

JANUARY, 1925

25 CENTS

Wireless Age

The Radio Magazine



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**Hear Him
by RADIO**
in your home

Funny? He's a Riot, a Laugh Factory, A Fifth Alarm!!! The whole nation knows his name and fame.

But how few can actually see him in person!!!

Radio leaps the Barriers of Time and Distance. Listen-in when next he's on the air. Cunningham Radio Tubes make Clear Reception a Certainty. Why gamble on sub-standard equipment for the nerve-center of your set? More than ever — Quality Counts.



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Standard for all Sets

Types C-301A, C-299, C-300, C-11 and C-12. In the Orange and Blue. Carton. Price, \$4.00 each

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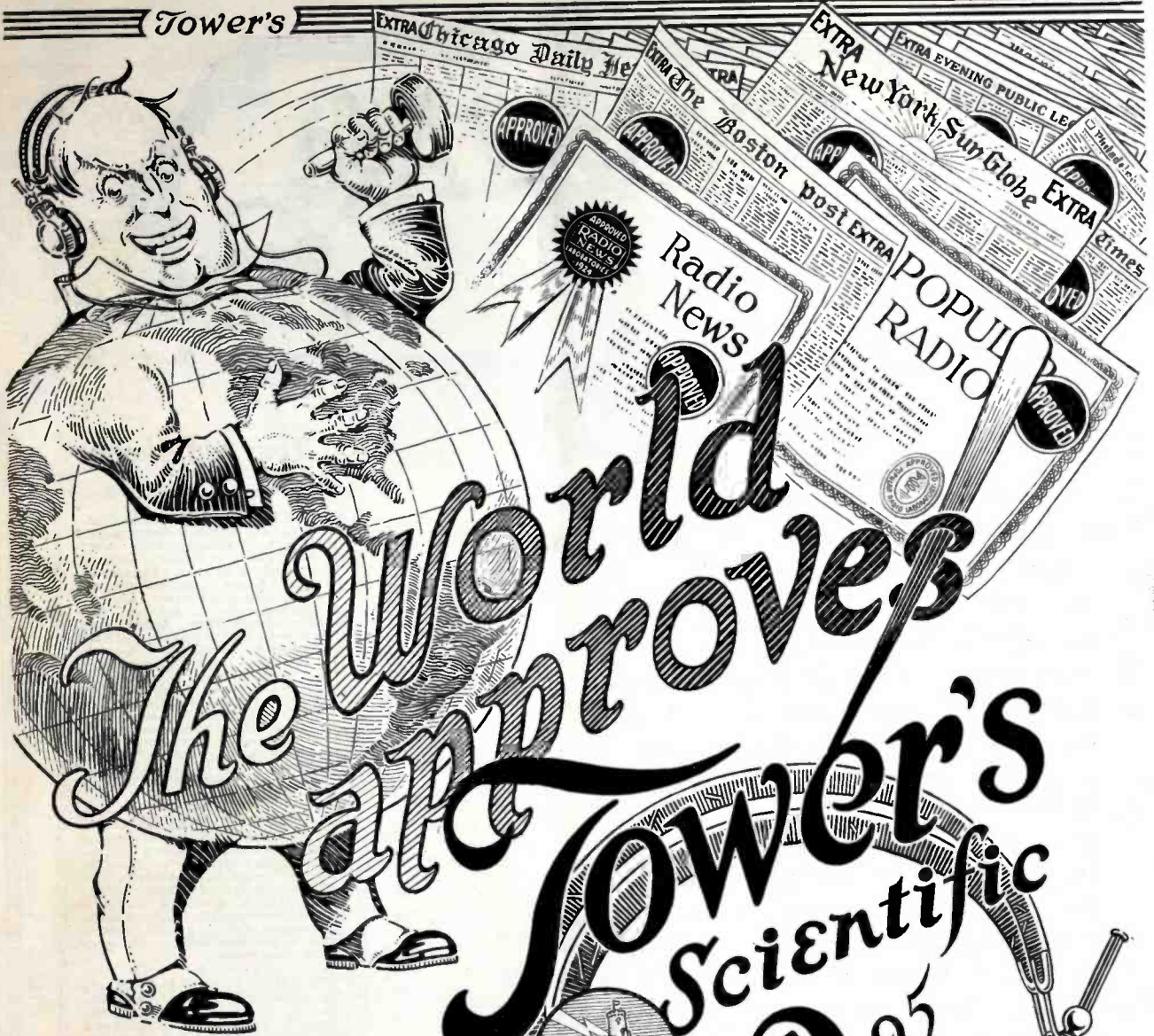
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CHICAGO

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The World approves
Towers Scientific

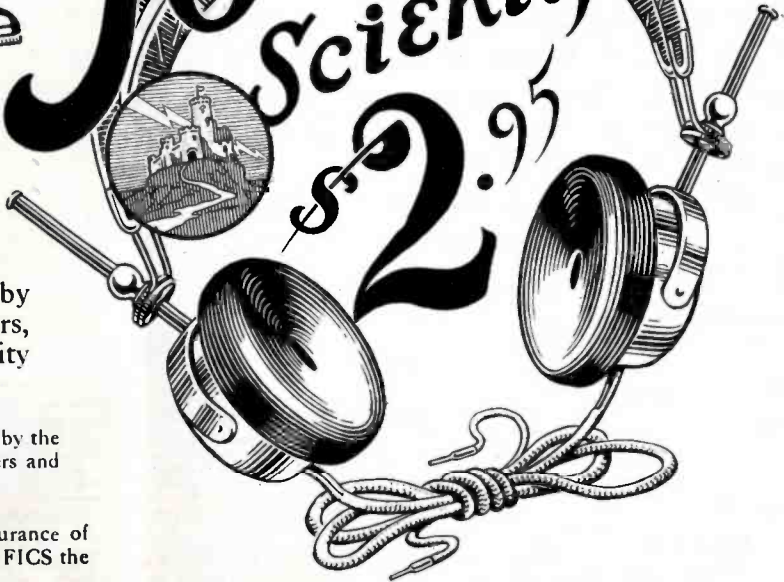
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Every Set Tested and approved by Government licensed Radio operators, thus guaranteeing uniform tone quality and accuracy.

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Scientific

"Quality Goods for Quality Readers"

Wireless Age

The Radio Magazine

Vol. XII

No. 4

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Your Authors

Alice Mary Kimball (Radio Troops of the Girl Scouts) was born on a farm in Woodbury, a hilly, thinly-settled township in Northern Vermont. Neighbors lived far apart, with stretches of upland forests, rugged pastures, and timbered mountains between. The nearest railroad station—a jerkwater line—was several miles away. So she is qualified to write of what the radio will mean to lonely girls. At the age of twenty she got a job on a small-town newspaper. Later she worked her way across the United States, paying railway tickets and board bills by newspaper jobs. She lives in New York City now and contributes to magazines. Her articles or short stories have appeared in "Scribner's," "The World's Work," "Outlook," "The Literary Review," "New American Mercury," "Smart Set," "Ainslee's," "Designer" and "Country Gentleman."

Austin C. Lescarbours (At the Flip of the Dial) is well known as a writer on scientific subjects. He was for some years the editor of "Scientific American" where he established a reputation of clear literary style in articles of advanced scientific thought. His present contribution to Wireless Age is a complete resume of the art of radio reception which should prove exceptionally interesting to our readers.

Kenneth Perkins (When the Monsoon Broke) was born in British India, in the Palnai Hills, in 1890. His early schooling was acquired at a Hill station in the Madras Presidency and his college training was completed at the University of California in 1915 where he received a degree of M. A. He has been an instructor of English at Pomona College, southern California; obtained a commission in the Field Artillery, U. S. A., 1918, and after the war, began his literary career with such novels as "The Beloved Brute," "Ride Him Cowboy," "The Gunfanner," and "The Queen of the Night." The first two have been brought out in England and the screen production of "The Gunfanner" was made by Fox and "The Beloved Brute" by Vitagraph.

PUBLISHED MONTHLY AT WIRELESS PRESS, INC., 326 BROADWAY, NEW YORK

Los Angeles, Calif., 1116 Chapman St., Coast Publishers Co. Chicago, Ill., Wrigley Bldg., Wheeler & Northrup. Boston, 18 Stewart St., Charles M. White.
 San Francisco, 821 Market St., Coast Publishers Co. Great Britain, 12-13 Henrietta St., London. Australia, 97 Clarence St., Sydney, N. S. W.
 Yearly subscription in U. S. A., \$2.50—Outside U. S. A., \$3.00; Single Copies, 25 cents Entered as second class matter Oct. 9, 1913, Post Office, New York, N. Y., under the Act of March 3, 1879. Copyright, 1925, Wireless Press, Inc. When subscription expires you will find a renewal blank enclosed. Return with remittance promptly.

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Because certain statements and expressions of opinion from correspondents and others, appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts either now or in the future and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any priority or responsibility for any statements of opinion or partisan expression if such should at any time appear herein. Printed in U. S. A.

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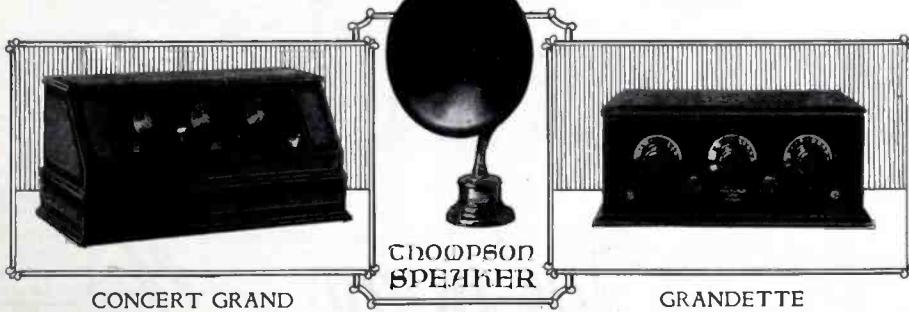
The 5-tube GRANDETTE is \$125. The 5-tube PARLOR GRAND, (shown above) is \$145. The 6-tube CONCERT GRAND is \$180. Prices are without tubes or batteries. The Thompson Speaker, with conical diaphragm and other special features, is now \$28.

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Matched Tone
 Headset
 \$9 in Canada

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This book makes it easy to build a

FADA

5-tube Neutrodyne

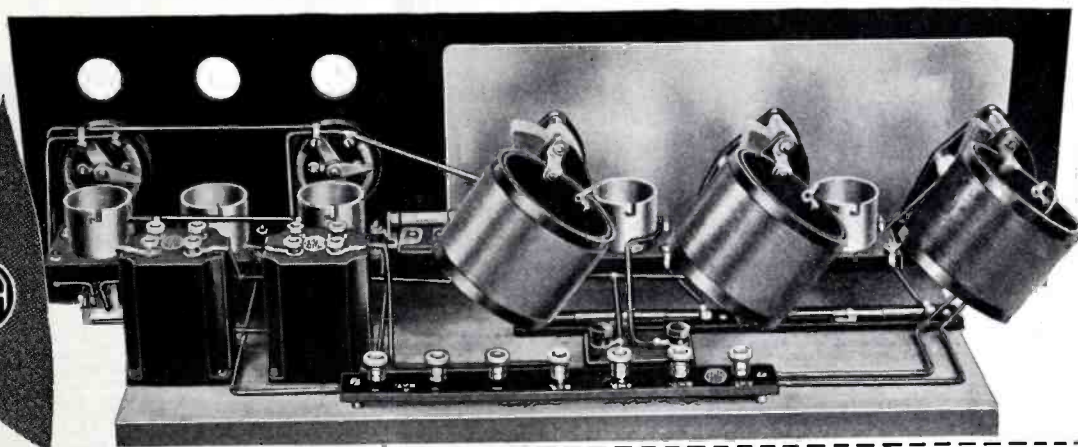
MORE Neutrodyne receivers are being bought and made today than any other type of radio receiver. You couldn't build a set that will give you as much real radio enjoyment and results as you can get on a five-tube FADA Neutrodyne. You can assemble one yourself in a few hours that will enable you to tune in stations all over the country with loud speaker volume. Get the new FADA outfit of Neutrodyne parts (No. 169-A), which sells at \$72, and you have the most complete Neutrodyne outfit to be had. Everything needed is included and every part is guaranteed to be of the finest quality, low-loss type. Buy the FADA Neutrodyne outfit and

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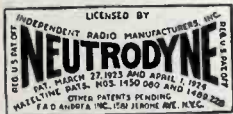
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TYPE T

Mahogany cabinet, 10 1/2" high, 14" wide, 13 1/2" deep. Dry-cell "A" and "B" batteries enclosed in cabinet. Reflex Neutrodyne circuit. Three dry cell tubes, one reflexed; equivalent to four tube circuit; one stage tuned radio frequency amplification, detector, two stages audio. Operates loud speaker. Outside antenna

\$65.00 without accessories



TYPE X

Walnut cabinet, 8 1/2" high, 21 1/2" wide, 10 1/2" deep. Dry cell "A" and "B" batteries enclosed in cabinet. Reflex Neutrodyne circuit. Four dry cell tubes, one reflexed; two stages tuned radio frequency amplification, detector, two stages audio, equivalent to five tube circuit. Double-scaled voltmeter indicates voltages of "A" and "B" batteries. Indoor or outdoor antenna.

\$150.00 without accessories



TYPE W

Walnut cabinet, 8 1/2" high, 21 1/2" wide, 10 1/2" deep. Neutrodyne, not reflexed, using five vacuum tubes—two radio, detector, two audio—and storage battery. "B" batteries enclosed in cabinet. Double-scaled voltmeter indicates voltages of "A" and "B" batteries. Indoor or outdoor antenna.

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The illustrations will give you an idea of what the various models are like, but really to know just what they will do, you must hear them. You can then form your own conclusions as to appearance, quality of tone, range and any other characteristics that you feel your radio set ought to have.

Be sure to ask your dealer for a demonstration of Ware Neutrodyne receivers. They are their own best salesmen.

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TYPE XU

(See WU for cabinet open)
Brown mahogany or walnut cabinet, with panels of contrasting shades. Embodies Type X circuit. Loud speaker concealed behind grille at top, below which a desk leaf turns down, exposing the panel. Dry cell "A" and "B" batteries enclosed in cabinet. Dimensions: 44" high, 27 1/4" wide, 18 1/2" deep.

\$275.00 without accessories



TYPE WU

(See XU for cabinet closed)
Brown mahogany or walnut cabinet, with panels of contrasting shades. Embodies Type W circuit. Loud speaker concealed behind grille at top, below which a desk leaf turns down, exposing the panel. Storage and dry cell batteries enclosed in cabinet. Dimensions: 44" high, 27 1/4" wide, 18 1/2" deep.

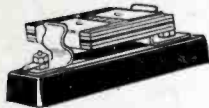
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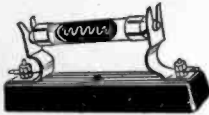
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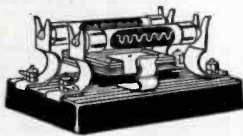
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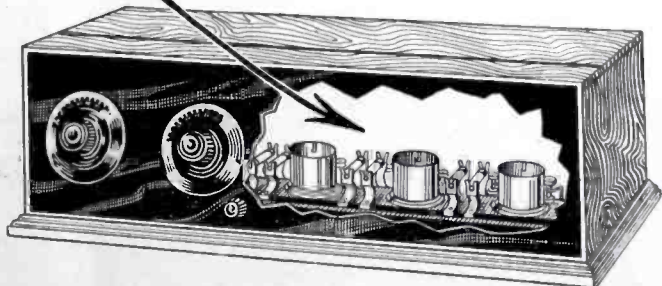
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DAVEN AMPLIFIER KITS (without sockets and condensers) for those who build their own.

3-Stages	\$8.00
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Modulation *plus* Regeneration

Gazette

RADIO SECTION

VOL. XIV - NO. 132 - 16 PAGES ★★

MODULATION PLUS REGENERATION IN NEW MODEL L-2 ULTRADYNE

20 DX Stations logged on August 25th on Loud Speaker using loop aerial at Covington, Ky

Modulation plus regeneration is the keynote of the new Model L-2 Ultradyne Receiver. Regeneration as applied to this new method of radio reception produces greater rectification than ordinary methods of detection—a vital step in radio engineering. This combination produces tremendous amplification when receiving weak signals. Allows the Ultradyne to respond to a very small amount of energy. Signals are amplified thousands of times before they are detected and made audible.

Mr. R. H. Thomas, 509 Coppin Building, Covington, Ky., writes: "The Ultradyne far surpasses any idea that I previously had as to what a radio receiver could be. On the night of August 25th, 1924, I tuned in on my Ultradyne, the following stations:

- WBZ Springfield, Mass.
- WOR Newark, N. J.
- WGY Schenectady, N. Y.
- WHN New York, N. Y.
- WCAP Washington, D. C.
- WEAF New York, N. Y.
- WOO Philadelphia, Pa.
- KDKA Pittsburgh, Pa.
- WCBZ Zion, Ill.
- WJAR Providence, R. I.
- WGR Buffalo, N. Y.
- WTAS Elgin, Ill.
- WAAM Newark, N. J.
- WABM Saginaw, Mich.
- WNAC Boston, Mass.
- WEAN Providence, R. I.
- WLW Cincinnati, O.
- KSD St. Louis, Mo.
- WWI Detroit, Mich.
- WHO Des Moines, Ia.
- WTAM Cleveland, O.
- WHAZ Troy, N. Y.
- WOS Jefferson City, Mo.

- WSB Atlanta, Ga.
- WMC Memphis, Tenn.
- WOC Davenport, Ia.
- WBAP Ft. Worth, Tex.
- WNYC New York, N. Y.
- WOAW Omaha, Nebr.
- WFAA Dallas, Tex.
- WSAI Cincinnati, O.
- KFKX Hastings, Nebr.
- WCK St. Louis, Mo.
- WBT Charlotte, N. C.
- KFKB Milford, Kan.
- WGAQ Shreveport, La.
- KGO Oakland, Calif.
- KFIM Grand Forks, N. D.
- KFI Los Angeles, Calif.
- WDAF Kansas City, Mo.

"I consider the above reception remarkable as it stands, but considering it was all accomplished on a 24-inch loop, and all but WGAQ, KFIM and KFI were heard on the loud speaker, it far surpasses anything that I have heretofore experienced.

"As regards selectivity, will say that I am only four or five miles from the powerful WLW station at Cincinnati, operating on 423 meters, and his wave is so powerful that I can receive him on the loud speaker, with one stage of audio, loud enough to be heard a block away, without using antenna, ground or loop. When WLW is on the air, I can tune him out completely, and receive WSB on 429 meters, WHB and WDAF on 411 meters, and PWX, but nominally on 400 meters, but usually somewhat above that wave.

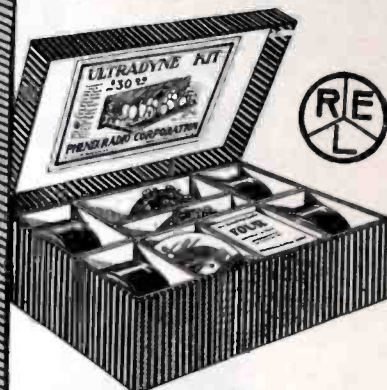
"I know of no other receiver that will even approach this performance for extreme selectivity, volume and distance."

ULTRADYNE

MODEL L-2

This application of regeneration is the most recent development of R. E. Lacault, E.E., A.M.I.R.E. since his perfection of the "Modulation System" used exclusively in the Ultradyne and which has so revolutionized all conception of selectivity, sensitivity, volume and range.

This Model L-2 Ultradyne, without a doubt, represents the peak of present day super-radio engineering skill.



Ultradyne Kit

Consists of one low loss Tuning Coil, one low loss Oscillator Coil, one special low loss Coupler, one type "A" Ultraformer, three type "B" Ultraformers, four matched fixed Condensers. The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, Consulting Engineer of this Company and inventor of the Ultradyne.

To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers. Ultraformers are guaranteed so long as this seal remains unbroken.

\$30.00

Send for the 32 page illustrated book giving latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver.

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Clear, distinct, complete



Blurred, indistinct, hazy

Clearness vs. Indistinctness

NO matter how loud the music may be, unless each delicate high tone and each soft low one is heard *distinctly*, it is not *the true music*, the music the composer and the musician intend you to enjoy.

There is no reason why the wonderful music now being broadcast everywhere should not come to you clear, distinct, and mellow—instead of hazy, indistinct, blurred.

N & K gives you a means of hearing broadcast music and speeches just as the musician and speaker deliver them. Nothing lost. Every tone clear and natural. No exaggeration, no over-loudness. Instead, it is as though you were in the room with the musician or speaker.

The Reason for This New Clearness

N & K Imported Phones, Loudspeaker, and Phono Unit were designed by a group of

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That is why *N & K Phones* are so decidedly different from the head sets designed in the days when radio reception meant little more than recording the sputter of a spark.

That is why the *N & K Loudspeaker* is different in shape, appearance and acoustic construction, and is made of a new material, *burtex*, which eliminates counter vibrations.

That is why the *N & K Phono Unit*, utilizing the amplifying qualities of any

good phonograph, makes a loudspeaker of the highest type.

The N & K products are sold everywhere on a strictly money-back guarantee of satisfaction. If your regular radio dealer is not now carrying the N & K line, write us for name of nearby N & K dealer.

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"The Phones The Fans Are All Talking About" tells in detail the reasons why N & K Imported Phones give such surprisingly clear results.

"The Loudspeaker You Have Waited For" tells about a revolutionary invention in radio speakers.

"How to Use Your Phonograph as a Clear, Rich-toned Radio Loudspeaker" gives full information about the N & K Imported Phono Unit.

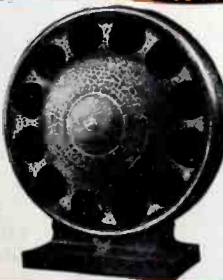
We will be glad to send you copies of any or all of these. Send a postcard telling which you are most interested in—Phones, Loudspeaker, or Phonograph Attachment.



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Dept. WI, 15 William St., New York
41 Common St., Montreal, P. Q.



N & K Imported Phones, Model D, 4000 ohms. Larger in size. Sanitary leather covered head bands. Six foot cord. Your money back if the tone is not clearer, richer, and if they do not fit more comfortably than any phones you may compare them with. Price \$8.50.



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"Quality Goods for Quality Readers"

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No matter how modest the ideas of the radio beginner, he soon begins to search for distant stations.

Then is when he appreciates an AIR-WAY Receiver.

All distant signals come to any set, but they will not fight their way in through unnecessary losses and high resistances.

AIR-WAY Receivers are the last word in LOW LOSS construction and tuned radio frequency amplification and build up the weakest signals to pleasing audibility.

Oscillation is perfectly controlled and all extraneous noises eliminated without neutralizers or complicated adjustments.

AIR-WAY No. 41, Four Tube

We claim without reservation that AIR-WAY Model 41 is superior in every quality of radio reception to any other four-tube set ever built, and unequaled by any set at less than nearly twice the price.

The selective qualities are unexcelled in any set, operating on an outside aerial.

The dignified design of the solid walnut case and the workmanship and finish of the panel equipment give it an outward appearance in keeping with the operative quality.

A set that meets all market conditions and all individual requirements; one that the Dealer may sell to the inexperienced user or the most discriminating expert and be sure that either will attain results satisfactory in every way.

Price, \$65.00.



AIR-WAY No. 51

The latest development in tuned radio frequency with two stages of radio frequency amplification, detector and two stages transformer coupled audio frequency amplification.

Offered without reservation as a set that will give general satisfaction to all broadcast listeners, regardless of previous radio experience.

Price, as illustrated, \$125.00.



AIR-WAY No. 52

A receiving set of practically the same design and construction as No. 51, but modified to fit a handsome black walnut Console, with built-in Thorola Loud Speaker and ample space for all batteries and other accessories. No more attractive radio outfit on the market at any price. Price, \$375.00.

AIR-WAY Apparatus is the result of several years study and development by skilled radio engineers and is strictly up to the minute in radio design.

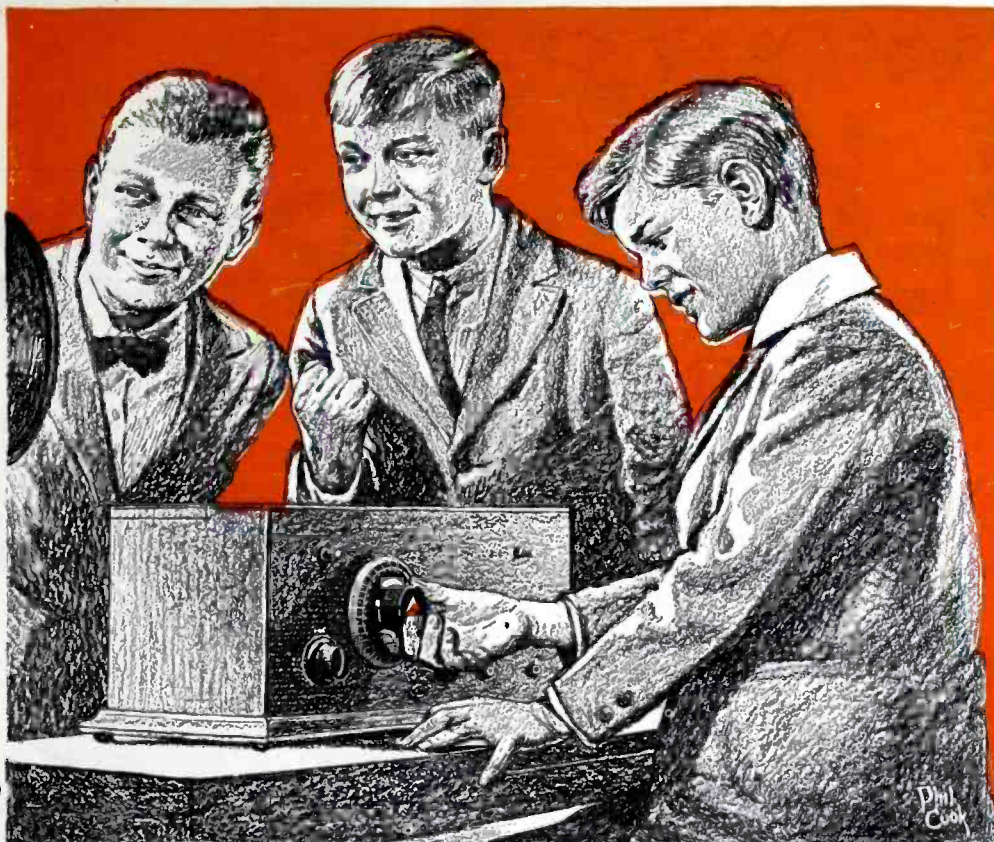
Operation is simplified to the limits of the radio novice, and quality throughout is developed to meet the demands of the most discriminating of radio experts.

AIR-WAY apparatus is distributed through established jobbers and dealers only.

Write our Sales Department today for literature covering our complete line. It is the dealer's assurance of profitable and satisfactory business.

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FOUR \$65

Easy to tune—Easy to own

THE new Paragon line of Radio Receivers is making radio history for fans of all ages and purses—the new Paragon Four, especially.

A four-tube set that is getting everything that's in the air. Getting it clear and strong on the speaker. And tuning in sharply and distinctly at a twist of the single tuning dial.

As fine a set as Paragon ever made—doing all that you expect of far costlier sets that use more tubes—yet costing only \$65. No greater value in radio today!

Write for "Station Please!", a folder picturing and describing the new set in detail.

ADAMS MORGAN COMPANY, Inc.

Originators since 1915 of Record-holding Radio Receivers
8 Alvin Ave., Upper Montclair, N. J.



NEW PARAGON FOUR \$65

Four tubes. Handsome mahogany case 21 inches long. New Paradyne non-radiating circuit. Almost unlimited range for clear, strong speaker reception.

NEW PARAGON THREE \$48.50

Three tubes. Mahogany case 17 inches long. Clear speaker reception over range that amazes you.



NEW PARAGON TWO \$27.50

Two tubes. Mahogany finish case, 11 inches long. Excellent speaker tone and volume from local stations. Almost unlimited phone range.

"Quality Goods for Quality Readers"

www.americanradiohistory.com

NEW GENERAL RADIO PRODUCTS



\$1.00
to
\$2.85

New Low Loss Coils



\$5.00

A New Variometer

Radio Builders and Experimenters—here are the newest additions to the well known *General Radio* line of Quality Parts!

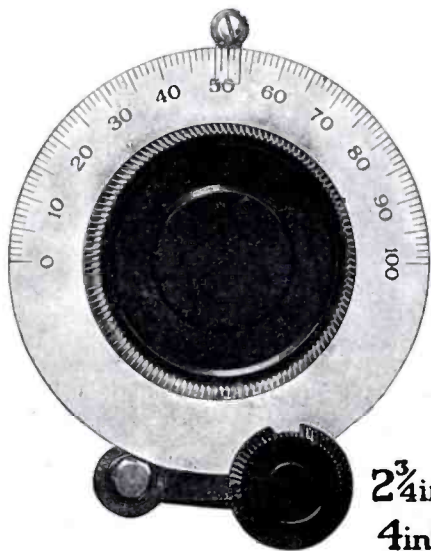
A Variometer unusually compact in size and efficient in operation.

Low Loss Coils that mount as easily as a vacuum tube—ideal for oscillator and antenna coupling coils for super-heterodyne circuits.

The New Geared Vernier Dial—an improvement in the appearance and operation of any well planned set.

They are all popular instruments selling at popular prices.

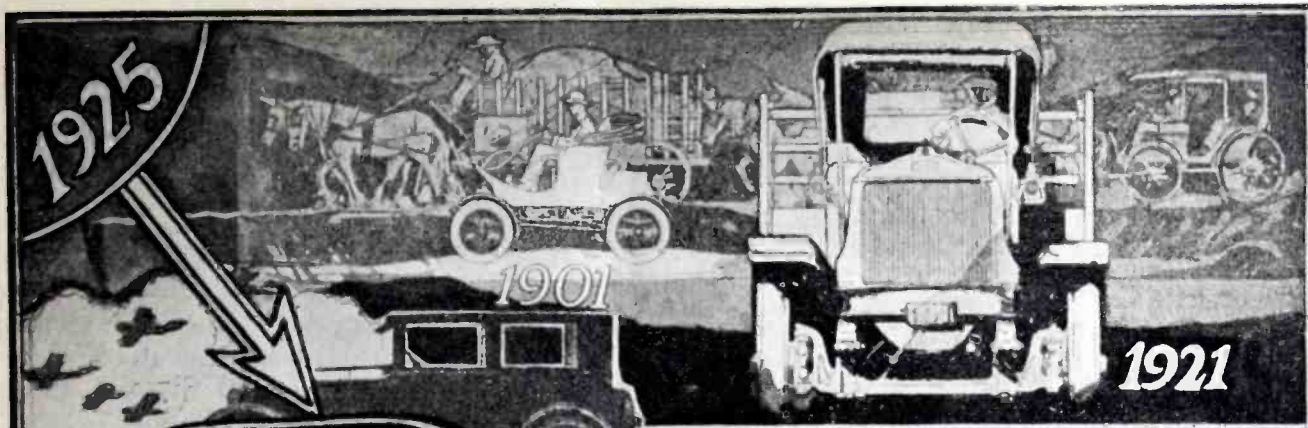
See them at your dealers or write for our new radio catalog 919 - W.



2³/₄ in. \$1.50
4 in. \$2.50

New Geared Vernier Dials

GENERAL RADIO CO.
Cambridge, Mass.



Aristocrat Model

The Bestone V-60 Five-Tube Receiver in beautiful, distinctive, antique poly-chrome cabinet, with built-in high-grade loud speaker and battery compartment. New Popular Price..... **\$150.00**

“Just as good” means nothing. We call the Bestone V-60 the “Aristocrat of Radio.” One look at it and the pride of ownership is yours without apology.

We lay particular emphasis on the tone qualities. Sublimity of perfect tone, entirely free from distractive noises and distortion.

Volume—distance and selectivity—so simple.

We welcome comparison. In justice to your taste and purse see and hear the new BESTONE V-60.

Write for Particulars
 Manufactured and Guaranteed by
HENRY HYMAN & COMPANY, INC.
 476 Broadway 212 W. Austin Ave.,
 NEW YORK CHICAGO



TRADE MARK

The Aristocrat of Radio

There is prestige in owning a Bestone V-60. The inside is mechanically perfect. The outside is a superb piece of furniture.

There is philosophy in buying the best. Henry Hyman & Co. have been in business long enough to know the value of manufacturing superior goods.



Imperial Model

Imperial Model—Bestone V-60 Five-Tube Receiver in beautiful mahogany cabinet. New Popular Price..... **\$100.00**

Editorial Chat

THE new ever strikes an inspirational note—be it clothes, books, or the modern acrostics which we term cross-word puzzles. Likewise New Year's Day also inspires, and bearing this in mind WIRELESS AGE comes to you this month with its story of the New Art—Radio—in its most recent developments.

The Art of Radio Reception

"At the Flip of the Dial" by Austin C. Lescarboursa, former editor of "Scientific American," reviews the past, presents the present and envisages the future developments in the art of radio reception so that you may have a complete and comprehensive picture of what is happening in this new field of human activity.

And women's influence in adapting radio to the refinements of the well appointed home, and adding to its comforts, is discussed from the viewpoint of experience by Mrs. Christine Frederick. You will find "Home Comforts" rich in suggestions.

A Radio Tale of the Orient

Travel to the Orient with Kenneth Perkins in "When the Monsoon Broke!" and learn how the mystics of the Orient were mystified by a nonchalant radio fan during some dramatic incidents.

Then turn to "The True Story of Heinrich Hertz" for a glimpse of the genius who first demonstrated physically the existence of electromagnetic waves, and reflect on the reach his work has had in the every-day-world.

Of Broadcast Interest

Regular feature programs on the Pacific Coast are presented in this number so that you may tune in to what you want, when you will—look for the programs of big station features in future issues.

And the story of "Radio Troops of the Girl Scouts" illustrates in a practical manner the valuable work that radio is doing to make life more livable for a great number of people.

To the Technically Inclined—

This issue of WIRELESS AGE presents Dr. Minton's article on "Loud Speakers," Donald Gordon Ward's description of the functioning of the vacuum tube as a detector, and John R. Meagher's able treatise on potentiometers.

For the home-builder, further developments in the wonderful "WIRELESS AGE D-Coil Receiver" are noted by Mr. MacIlvain, the designer of the D-Coil, and in addition, the constructional article on the "One Control Regenerative Receiver," will appeal to DX fans because it contains a real low loss coupler that sharpens the tuning and increases the signal strength.

This issue will help you start the New Year right in the new art—Radio—and, as the year grows, so will your interest grow in WIRELESS AGE—THE RADIO MAGAZINE.

—THE EDITOR.



Reach Out!

Loud-Speaker reception from nearby stations will be only a small part of your enjoyment of a Superspeaker and a modern radio set.

The air is full of music and voice from far and near. Nearly 100 high powered stations are begging admission to your home theater.

Tune your set to the entertainment that suits you best. Through the graceful throat of the Superspeaker, reception will come in naturally, clearly, and with amazing volume.

For the Superspeaker is a true musical instrument. It is the work of experienced musical instrument builders. In design, materials, workmanship and performance, it differs notably from all other devices of its kind.

Regardless of the size or power of your set—regardless too, of your prior experience in amplified reception—Superspeaker performance will surprise and delight you. Just ask any of the thousands of Superspeaker users from coast to coast.

Enjoy your home theater to the full limit of its possibilities.

Install a Superspeaker and sweep the ether.

A big, substantial instrument, 26 inches high, with 14-inch bell, and weighing over 5 pounds—Handsomely finished in chony gloss—Needs no extra batteries or coils—Adjustable for volume—Wears forever—Built complete in our own plants at Detroit and Allegan, and backed by the guarantee of a million-dollar corporation.

JEWETT RADIO & PHONOGRAPH CO.
5678 TWELFTH STREET, DETROIT, MICHIGAN

The Superspeaker

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"Quality Goods for Quality Readers"

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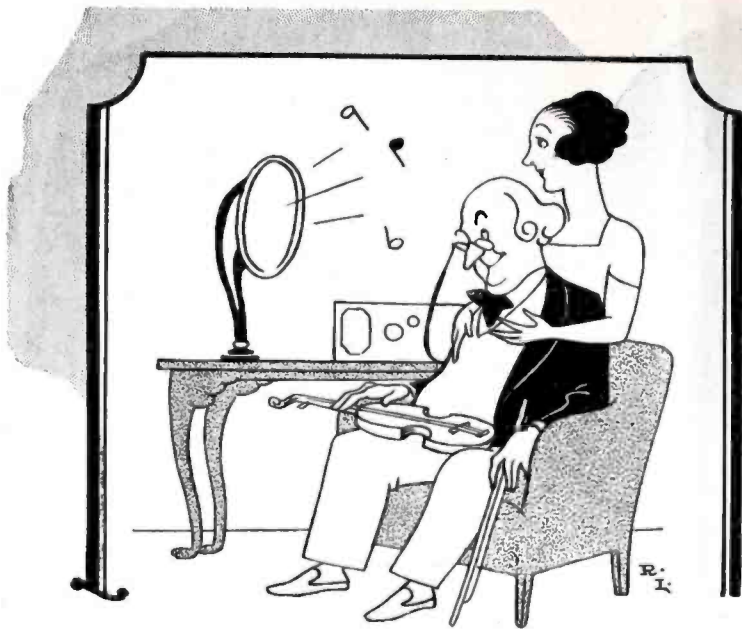


THE SUPERSPEAKER For Homes or Public Reception.

THE JEWETT PARKAY CABINET With Parquetry Top—All Standard Panel Sizes.

THE JEWETT ADAPTO CABINET Houses Any Set and Equipment—Superspeaker built-in.

THE JEWETT MICRO-DIAL Makes Tuning 50 Times as Accurate.



Radiola Loudspeaker

Type UZ-1325

Now \$25.00

Music for the critical

Time was when people were so impressed with the wonder of radio, and so entertained by the fun that came over, that they actually didn't mind the bluster of a noisy horn. But most of us aren't like that now. We want music that is music—we want speech that is really human speech—unclouded by horn sounds. And we can have it now—with a Radiola Loudspeaker.

You cannot blame every extraneous sound on the loudspeaker. But if your set is working perfectly, all it needs, to give you clear, faithful, undistorted reproduction, is a Radiola Loudspeaker. Hear one today, and if you really want to judge the difference, ask to hear it in competition with others.

Radiola

EQ. U. S. PAT. OFF.

LOUDSPEAKER



This symbol of quality  is your protection

RADIO CORPORATION
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233 Broadway, New York
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"Quality Goods for Quality Readers"



A display of period art cabinet radio receivers—the Colin B. Kennedy line

AT THE Flip of the Dial

The Gentle Art of Tuning-in on Radio Programs, and the Reception Problems and Their Solution of Yesterday, Today and Tomorrow

By *Austin C. Lescarboursa*

AMERICANS, according to the Man from Mars, are a unique race of automobile drivers and dial twist-ers. In their leisure moments they divide their precious time between driving their cars not so much with the object of getting from one place to another as for the sheer sensation of leaving mile after mile behind them, and twisting the dials of their radio receivers for the purpose of harvesting music and talks from one end of their country to another without so much as getting out of their comfortable arm chair.

Comes the Fall of the year, and these Americans are in a state of feverish expectancy. They scan the advertising pages of periodicals and newspapers. They search the windows of the shops. They probe the luckless engineers and salesmen who fall into their hands. All this they do. For, to them, it seems a matter of life-and-death whether the ABC automobile is coming out with nickel-plated hub caps and leather-covered bumper for its 1925 model, and whether the XYZ radio company is bringing out a sixteen-tube super-headortail or a five-tube reflexocluck.

All of which seems very strange to the Man from Mars, since the automobile of from one year to the next varies but little in its real essentials, while the radio sets seem to

be reaching that stage of standardization in which the yearly changes must soon simmer down to non-essentials which affect the general appearance rather than the performance. Stranger still, so muses our visitor from Mars, is the attitude of the man who loudly proclaims that automobiles and radio receivers are still in their infancy, and that he will buy his car and his receiving set when they are perfected!

PERFECTION is that goal which is never quite made. To say that present-day receiving sets are perfect is to rob that word of its full meaning. But in a practical sense it is true that radio sets have been perfected to a remarkable degree, and that from now on we must not expect startling changes. The receivers of reliable manufacture that are on the market today will function for some time.

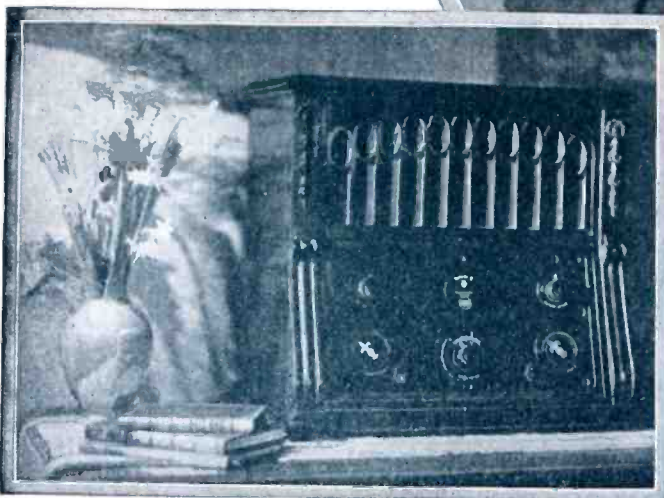
When radio broadcasting came down upon us without any warning, we turned to any receiving apparatus which we could lay our hands on. There was the simple tuning coil, consisting of many turns of wire on a cylinder, with a sliding contact serving to connect any desired number of turns into the circuit. There was the simple crystal detector, with its delicate cat-whisker wire touching the

clusive sensitive spot on the crystal. There was the vacuum tube of that time, drawing over an ampere of current for the filament and draining the storage battery in short order. There was the regenerative receiver, with its tricky, but amazingly sensitive "tickler" control, which enabled us to pull in the long-distance programs even if we did convert them into fog-horn reproductions through the forcing process of regeneration.

Those early receiving sets were radio instruments. They had all the ear marks of laboratory apparatus and, indeed, belonged there rather than in the living room of the American home. And they were true radio instruments in that their operation called for considerable skill, so that the lady of the house, as often as not, could get nothing more out of the receiver than a collection of squeals, groans and barks.

Radio broadcasting proved to be too big a force to be played with for a while and then set aside as a passing craze, as had been freely predicted. It grew and grew, and became a definite part of our daily life. With it was born the demand for simple listening-in devices to take the place of the former radio

A charming set in a charming setting—the Radiola X of the Radio Corporation of America



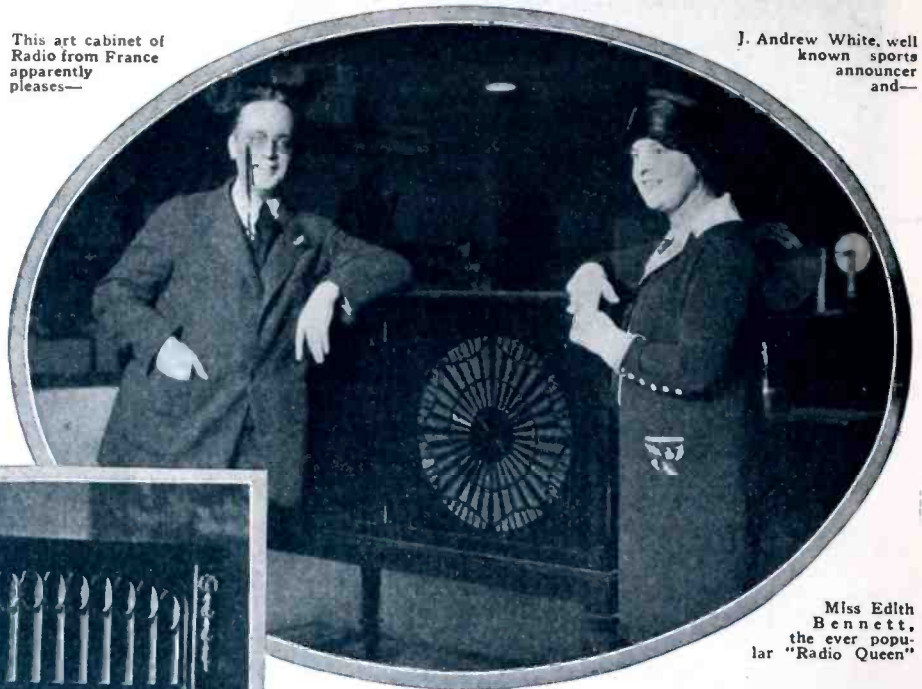
apparatus. While a large part of the American public took to radio as a hobby, and have found much fun in tearing apart and rebuilding their radio receiving sets as often as the radio writers can concoct new diagrams with enticing claims and high-sounding names, the major portion soon insisted on the minimum of radio complications and the maximum of simplicity in intercepting their radio entertainment. This major portion has become interested in radio broadcasting solely for the programs, and is interested in radio only as a means to an end, and not in radio itself.

The lady of the house has had no little influence on the development of what may be termed popular radio. Because the fair sex objected so much to the unsightly appearance of the early radio receiving sets, and especially the exposed batteries, the trend in radio receiving sets of late has been decidedly toward attractive cabinets and self-contained batteries. Even the loud-speaker horn has been disappearing, being taken into the cabinet along with the batteries.

So the radio receiving set has finally reached a state of near perfection. Changes, from now on, must be less spectacular and more in the nature of refinements and mechanical improvements. Of course, there is always a possibility of basically new developments which may alter our whole scheme of radio reception, but any such surprise seems rather remote for the time being, at least.

THE backbone of our present radio reception is in the circuits which we have available. Whether we dress up our radio receivers in Sheraton or Adam period cabinets, whether we gold-plate our control handles or put a piano

This art cabinet of Radio from France apparently pleases—



J. Andrew White, well known sports announcer and—

Miss Edith Bennett, the ever popular "Radio Queen"

finish on our bakelite panel, the main consideration is one of the circuit behind the dials.

The trend of popularized radio has been from the very beginning in the form of a search for a means of controlling radio-frequency amplifying tubes at a point where they are almost oscillating. To permit the tubes to oscillate is to distort the reproduction of the radio programs, while to keep the radio-frequency tubes far below the oscillating point is to render the receiving set relatively insensitive. In the regenerative circuit, which has been the pioneer circuit in broadcast reception, the feed-back action is confined to a single tube. Part of the outfit of this tube, which happens to be the detector, is fed back into the tube, thus amplifying the signals. However, the great drawback of the regenerative circuit is that the amplifying action is limited to a single tube, and, unlike other circuits, this arrangement cannot be expanded. For this reason the regenerative circuit has now been limited to the simpler types of receiving set, although the regenerative principle is to be found in conjunction with other arrangements in some of the elaborate receivers.

Then there is the neutrodyne, in which the radio-frequency amplifying tubes are prevented from oscillating by neutralizing the capacity coupling within the tube, between the plate and grid circuits. In this manner we prevent the interplay of energy from one circuit to the other, and therefore stop the radio-frequency tubes from oscillating. This arrangement produces an excellent receiving set, which is as simple to operate as it is efficient. The standard neutrodyne receiver uses five tubes, two of which are radio-frequency amplifiers, one a detector, and

two for audio-frequency amplification. Of late the various neutrodyne manufacturers have been introducing three-tube receivers, with two controls instead of the usual three.

Next, we come to the superdyne circuit, in which the output and the input circuits of the detector are so coupled as to transfer output energy to a maximum degree while opposing this transferred energy to the initial energy, in order that the two will balance at the point where there is an excess of initial energy to operate the tube at its highest efficiency. The four-tube superdyne receiver is remarkably efficient, although its manipulation is somewhat complicated for the layman in the initial stages of operation.

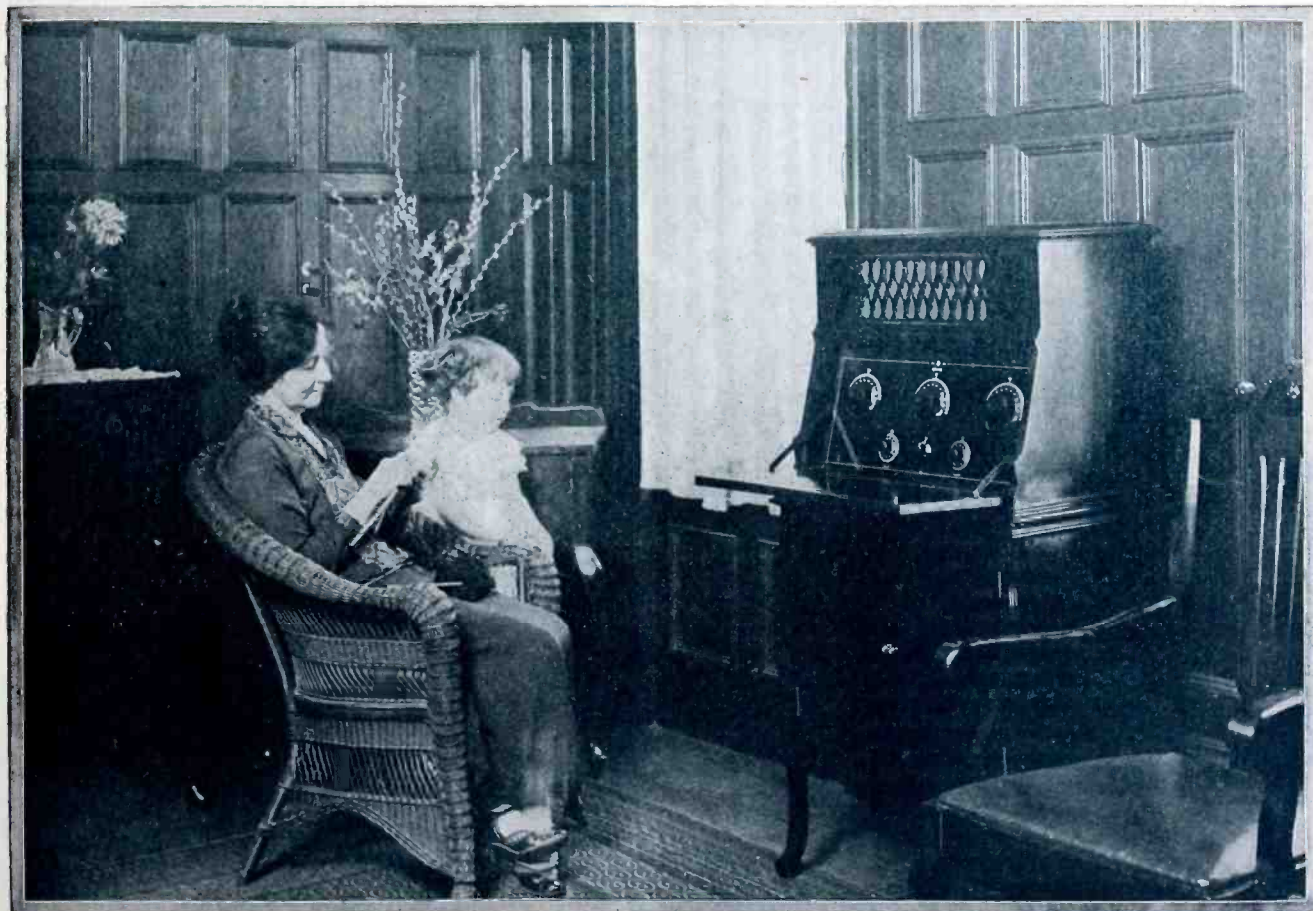
Then there is the reflex circuit, in which the plate energy from the radio-frequency amplifying tubes is rectified by means of a crystal detector or detector tube, as the case may be, and fed back to the grid circuit of the radio-frequency tubes at audio frequency, so that these same tubes now perform as audio-frequency amplifiers. Generally the amplifier tubes are controlled by means of a stabilizing potentiometer in the grid circuit. The reflex circuit has the advantage of accomplishing the utmost with the least number of tubes. It is essentially a loop receiver,

operating with a loop instead of the usual antenna and ground connection. The reflex circuit, making use of a loop, is simple to operate. It has the decided advantage of being self-contained. The receiver of this type may be moved from place to place, without installation of any kind. It is ready to operate anywhere, at any time, by anyone.

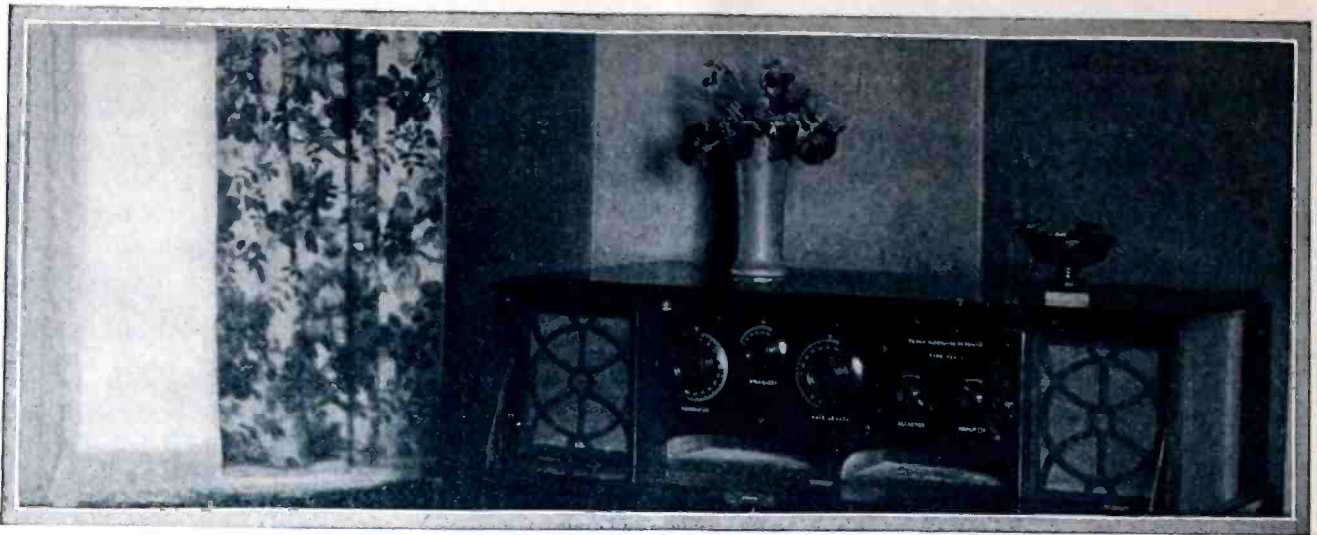
Again, we have the superheterodyne circuit, which, we are assured by radio experts, is the last word. The problems of radio-frequency amplification have been cleverly solved by the simple expedient of dodging them. The frequency of the signal to be amplified is changed to such a low frequency that the capacity of the tubes is minimized. At the low frequency, known as intermediate frequency, the capacity coupling between the circuits is practically nil. The superheterodyne, like the reflex circuit, operates on a loop. Thus it may be used anywhere. It has two tuning controls, one for tuning the loop wave-intercepting system, and the other for controlling the oscillator, which generates a frequency that is thrown into interference with the incoming signal, so that the resultant "beat" note, or difference in the two frequencies, may be of the desired frequency for the intermediate frequency amplifier.



The well known Wireless Age D-Coil receiver in artistic dress



Meeting all the requirements of refined surroundings, the FADA Neutroceiver finds a place in the best homes



Ornamental and efficient, the Tuska Superdyne "fits" the well appointed living room

And then there are all manner of radio-frequency circuits now in use, making use of transformer-coupled amplifiers and tuned radio-frequency amplifiers. The transformer-coupled amplifiers have the advantage of simplicity of operation, since they will handle the signals without additional adjustments over the usual tuning. However, transformer-coupled amplifiers, having to cover a more or less broad band of wave lengths, cannot prove as efficient as the tuned radio-frequency amplifiers which are adjusted for maximum efficiency in handling any given signal. The latter, on the other hand, have the disadvantage of additional tuning controls to offset their increased efficiency. Thus each stage of tuned radio-frequency amplification must be tuned for a given signal, and this complicates the manipulation of such an arrangement not a little.

IRRESPECTIVE of the circuit employed, the trend in radio receivers is distinctly towards stable circuits. The greatest demand today is for radio receivers that may be logged—that is to say, receivers which will bring in the same stations with the same dial settings day after day, in sharp contradistinction to the early regenerative re-

ceivers the control handles of which were seldom twice in the same positions for given signals. The neutrodyne receiver won its first spurs on that score: with its three tuning dials which could be set time and again to the same numbers, just like the combination numbers of a safe, it appealed to the laity as no other set had done up till that time. Today there are numerous receiving sets which can be logged much after the fashion of the neutrodyne. Indeed, the bulk of the present-day receiving sets have three tuning dials which are logged for the various stations.

The Radiola superheterodyne receiver charts the position of the tuning controls right on the dials themselves, which in this instance consist of paper disks which are renewed whenever desired. The call letters of the various stations are indicated on the paper disks, so that the lay operator merely sets the two control handles to the call letters of the desired stations.

More and more this charting or logging is coming into favor. The radio receiver of today is essentially a listening-in device. Anyone must be able to operate it without months of experience. Just how far this simplicity of

(Turn to page 64)



And the well known Radiola Super-VIII proves a companion to the business man in the office as well as at home

Artists on the Air



Betty Bronson, movie star, in "Peter Pan" and Herbert Brenon, producer, telling broadcast listeners all about it from KNX



Broadcast listeners enjoyed a real treat when Paula Ayers, contralto opera star, broadcast her songs from WOR



Helen Taylor, coloratura soprano, favored WJZ listeners with an exceptionally fine program recently

When the Monsoon Broke!

A Radio Fan Invades the Heart of India With a Radio Set and the Gods of Krishnu and Kaali and Brahma Become Powerless to Stop the Consternation—Ay! the Monsoon—That Breaks Forth

By Kenneth Perkins

THERE was a clatter and a bang; a smashing of tubes, of tables, of mahogany. The Director of Central Intelligence, with a swing of his arm, sent the wireless set crashing to the chunammed floor. Never had he been in such a temper. He had fumed and stamped about the Residency bungalow all day, kicking the soft skinned natives around, precisely like a bull in a china shop. Everything went wrong at the worst time of the year—that is to say when the Monsoon was about to break. The punkah-wallah kept going to sleep, the ice-making machine would not work; the "English water" was lukewarm; the obese Director himself broke out like a pink baby with prickly heat; and worst of all the nap before tiffin was lost because an agent had been demonstrating a wireless to a bazaar keeper across the compound gate. And now the same agent had the nerve to call on the Director himself!

Now there are certain things toward which the Southeast Monsoon shows no mercy whatsoever: One is a fat melting giant of a man like the Director of Central Intelligence; and the other is a wireless. No wireless set has ever been invented—so it was said at Madras, which could work during the steaming days before the breaking of the Monsoon.

The Director reclined in one of those long "grasshopper" chairs with his feet elevated on the long, extended arms, one hand fanning himself, the other holding his glass of arrac which he exchanged intermittently with a puff from his cigar. The punkah overhead squeaked and flapped—for he had posted his housekeeper to keep the old punkah-wallah awake. But it was all to no avail.

The energetic business of fanning himself, of puffing at that cheroot, of lifting his glass, of wiping his brow, of scratching his flabby neck, made him hotter than ever. He fumed and itched and swore. Mosquitoes and flying ants hummed about him; the pens of the writer-babus at



their desks on the verandah irritated him; the parrots and crows tormented him; and that wireless beyond the compound had made him hysterical.

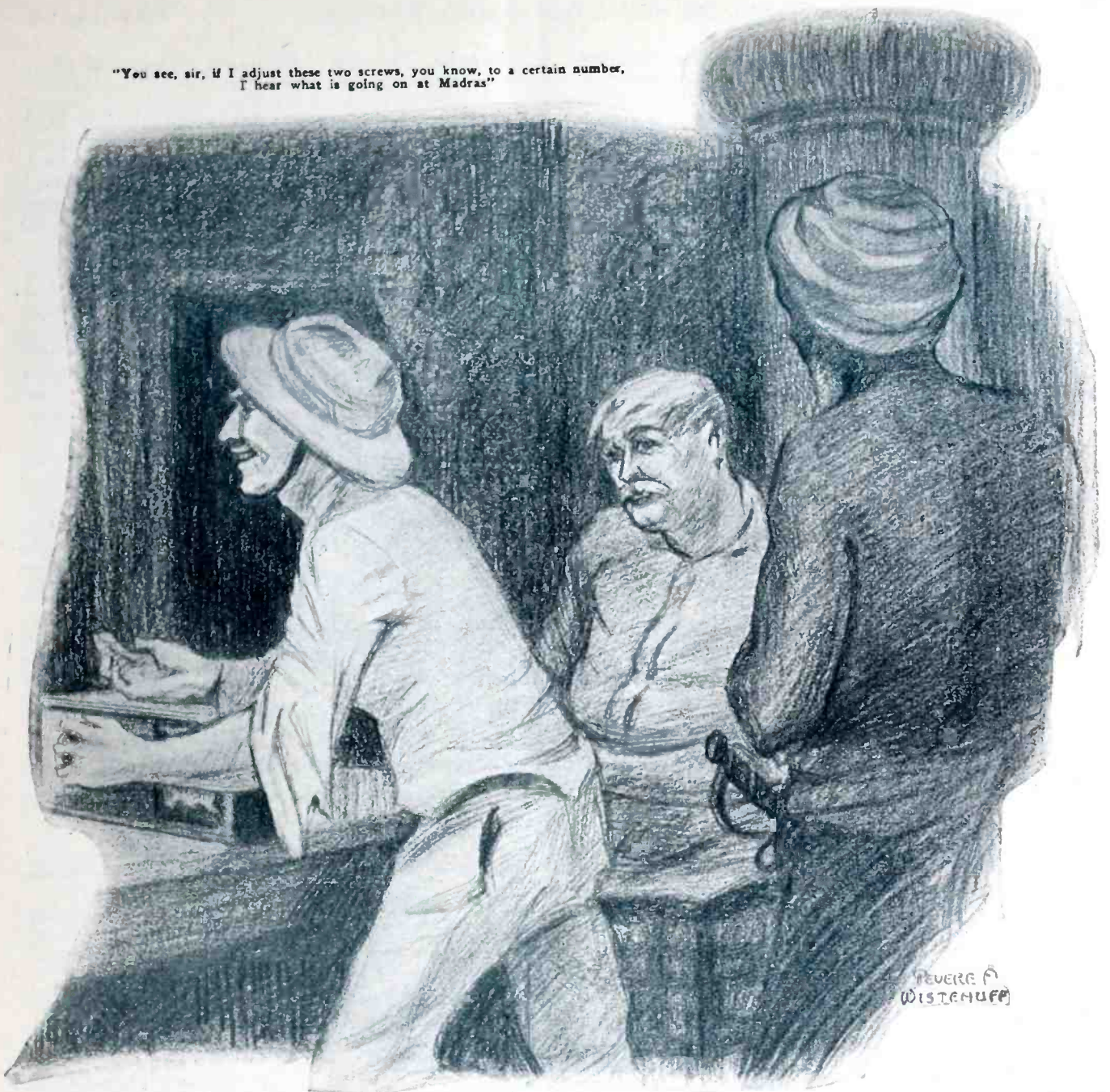
It was at this most unfortunate moment that a salesman had come in and tried to sell him a wireless set!

"HERE I've been slowly going crazy waiting for the Monsoon and cooler weather—and you come in trying to sell me that confounded ballyhoo! And you actually start it screeching in my ears!" He called to his chupprassi—"Sweep up this mess, and throw the gentleman out!"

The salesman, Mr. Wemble, a complacent but shabbily clothed youth, stooped to gather up the remains of his demonstration outfit.

"Who let you in anyway, I'd like to know?" the pompous Director fumed on. He turned his crimson perspiring face to his office force of gaping natives, writer-babus, punkah boys. "Out with the bally swine! White man or no white man—take him by the scruff of the neck and throw him into the street! Where's my hostler—get me

"You see, sir, if I adjust these two screws, you know, to a certain number, I hear what is going on at Madras"



my horsewhip, you! I'll show him! And you half-caste idiots who let this codger in—I'll teach you a lesson! A good fine for each of you—that's jolly well what you get! And as for you—"

The unlucky Mr. Wemble was hurriedly bundling his wares into his bag. In the process his pith hat fell to the floor. And the Director gave it such a kick that it spiraled like a football through a tatti curtain and down the long verandah.

Two native constables pulled at their black, forked beards, bowed, begged Mr. Wemble's pardon for the indignity they were about to commit on his person. The salesman was too much engaged in gathering up the wreckage of his wireless to resist them. The two giant blacks with continued and abject apologies took him by the arms and threw him into the street as they might throw out a boy who has stolen an armful of coconuts.

The Director, tortured by the prickly heat, gasping for air, turned to his terror-stricken office force—

"It is the last straw, confound you all!" he fairly screamed. "It is the end! My nerves are broken—snap-

ping. I'm going amok and I admit it! You are looking on a crazy man!" The office came fearfully to a military attention, each man quaking and praying as the enraged master tore up and down like a snorting rhinoceros. "To hell with the whole Department! I'm through until the Monsoon breaks! Saddle my horse. Get out the elephants and shikaris. I'm off for the hills. At least there I'll find quiet from these beggars and hawkers—and infernal machines. If another man plays a wireless in my hearing I'll tear him to pieces with my bare hands! I'll mash him to such a pulp that the dogs will smell his rotting carcass!"

THE night came with a suffocating blanket of jungle mists. Far up in the mountain khors the Director found little relief from the heat. It was a heavily timbered tract where he periodically went for a few days' hunting and a complete escape from the affairs of state. But now everything was wrong. The khors were dry. Deer and sambhur had fled to other water-holes. The jheels sent up a fetid smell from their beds of ooze, which choked

anyone who tried for a gasp of air. The wind had died down. The picket-line for the pack elephants had been chosen in a bad place where there were too many anthills. The Director had knocked down his mahout with a blow and the miserable black had fled into the jungle. As a result the picket-line was in a turmoil—as was the whole camp.

The Director sat in the midst of this misery, tortured with prickly heat, with night moths, with the lack of mosquito netting, or ice for his English water, or quinine which the matey had forgotten. Utter torment. The squawk of a parrot made him howl oaths. Before the hour was up—so the elephant keepers, the shikari, the cook and the matey affirmed—the Director Sahib would kill some one.

And he was of the same opinion. The person he decided upon as the first and most deserving to be killed was a stranger, a white man who had followed the hunting equipage up into the hills—riding on a tat-pony and leading by its halter another pony—his pack animal, which looked suspiciously like a cross between a bandicoot and a jackass.

"It is a white sahib, Heaven-born!" the matey announced to the Director, as the latter—after a miserable meal of soggy rice, sat fuming at the door of his tent. "A white sahib who purports to be your friend."

KENNETH PERKINS is the author of "The Beloved Brute," "Ride Him Cowboy," "The Gunfanner" and "The Queen of the Night." The first two have been brought out in England. Fox produced "The Gunfanner" and Vitagraph "The Beloved Brute." "The Discard," a story of India by Perkins running serially in Munsey's Magazine, has met with popular approval. "When the Monsoon Broke!" introduces this entertaining author to our radio readers and you will be glad we did after you have read the story.

"I don't want to see any friend!" the Director growled. "I came up here for my nerves!"

The matey sped off into the darkness of the jungle beyond the rim of the encampment, and returned scarcely a moment later.

"The white sahib, O Heaven-born, maintains that I gave his message wrongly. He is not a friend, but as he says a fellow-white man, who has lost his way."

"Bally ass, trying these elephant trails without a guide. Tell him I won't see him! My shikari can lead him back to the Pangarh highway."

Again the native merged into the blackness of the bamboos, and reappeared a moment later.

"Again I misunderstood him, O Son of Heaven! The white sahib said he did not want to see a shikari, but to see you. He feels these jheel mists in his bones and wants quinine."

"Ten thousand hells!" the sweating and itching Director cried. "You, yourself, forgot the quinine in my kit! Send him away. Let him stick his head in a swamp. Plenty of 'em around. That'll cool him."

A third petition a moment later:

"He says that you being a pillar of the Central Intelligence and a great magistrate of Government and the British Raj, can not refuse audience to a fellow countryman lost in the wilderness." The matey added in his own flowery English: "It is a matter, O Heaven-born, of life and death!"

"Send the confounded nuisance here! And warn him

to be quiet. The pack elephants are milling—and one of them is in musth. Serve him right if they trample him!"

IT was less than a moment now, when out of the black vertical lines of the bamboo glen there emerged into the moonlight two shabby snub-nosed, calf-kneed horses, on one of which was a man in wrinkled and torn whites, a crushed pith helmet, and soiled tennis shoes. On the pack horse which he led was a kit of provisions, and a satchel of rusty buckles and torn leather.

The Director's eyes bulged until they turned red. He withheld the smoke in his gaping mouth; his nostrils widened. His heart—if that were possible—had practically stopped beating. And so had the hearts of the matey, the elephant homos, the cook and the guide. It would hardly be stretching a point to say that the elephants—a few yards away—stopped milling and watched this newcomer with little twinkling eyes which were as red as the Director's.

But there was one heart that beat heroically. The visitor, who was none other than Mr. Wemble, alighted from his horse, and unstrapped the satchel from the other.

"I have here, sir, something that will make your Department of Central Intelligence ninety per cent. more efficient."

The Director choked: "The Department doesn't want

to be ninety per cent. more efficient. Who said it wanted to be ninety per cent. more efficient? I'd like to know. Damn you for an infernal nuisance! The Department is efficient enough!"

"Very well then, sir," said the resourceful Mr. Wemble. "It's something that no hunter in the jungle can afford to be without. In the desperate loneliness of these sal-forests you can have brought to your very tent-flap, all the entertainment of the world! You can listen to His Majesty's Band at the Government Dock Yard in Bombay. You can listen to the orchestra of the Royal Hotel in Madras. The dancing Nautch girls in Madura will sing their temple songs. While you are brooding and lonely, you will hear the jingle of their anklets as if they were dancing in there under that banyan. Instead of the roar of the tiger you will hear the speeches of the Legislative Council in Calcutta! Or tune in anywhere you please: to Colombo; to a French song sung in Pondicherry; to the temple bells of Mandalay!"

The rash intruder had actually set his satchel on the canvas-top hunting table at the Director's right hand, and during his oration was adjusting connections, uncoiling wires, turning the dials, lighting dim lights.

For a moment the jungle held its breath. The servants, elephant keepers, beaters, stood around in a circle, ghastly eyes, confident in the expectation that the first game to be bagged in that hunting expedition was to be a man—and a white man at that.

The Director lumbered out of his chair, sniffing like a wild beast that has caught the scent of prey.

The luckless Mr. Wemble went on:

"You don't even have to get out of that grasshopper chair of yours when you hear the Royal Indian Marines playing 'God Save the King.' There's luxury for you! 'God Save the King' listened, but not stood up to! A jolly good one—eh? And look here. A fine set for your Intelligence Department! Quite reasonable you know and all that sort of thing. Four dry cell tubes, reflex mute-so-fine circuit, don't you know, two stages audio. Double scaled voltmeter. Indoor or outdoor antenna—rather sort of neat I'd say! And the price—why mention it? Two hundred rupees to bring 'God Save the King' into this jungle!"

Mr. Wemble looked up, breathless but otherwise calm, from his labor. He found himself facing that favorite gun of the British tropics—the 9 mm. Luger pistol. Something that the Director customarily used against elephants, but now contemplated another use.

MR. Wemble seemed miraculously possessed of the conviction that the trigger would not be pulled. Of course he was right—except for the fact that his suaveness was like a red flag. The magistrate was not in his right mind.

"Pray, sir, do not be hasty until you have heard me tune in on—let us say—the broadcasting station at Madras. Now you see—"

He began twisting one of the dials.

The Director exploded in a roar of oaths. A parrot screamed. The pistol

was lowered. "If you so much as dare to start that infernal machine spluttering I'll—"

A brown hand was laid lightly upon the Director's up-lifted arm. It was the shikari, terror-stricken at the possible outcome of this situation.

"The Heaven-born must not fire!" he cautioned. "One of the elephants is in musth and the noise will start them all bolting. They are all irritable and nervous. May Brahma forbid that some mouse does not scurry up to the elephant lines and start a stampede!"

The magistrate paused. And a moment later he regretted it with all his heart.

From out of the box on the table came a wail, a whistle, a squawking as of twenty parrots and a banyan tree of monkeys.

"I'll have it working in a moment, sir," Mr. Wemble said cheerfully. "You see—this atmosphere before the Monsoon isn't propitious. Static, you know, and that sort of thing."

He fiddled with screws, dials, wires. The squawking

stopped. And then suddenly a long-drawn-out squeak—as of a mouse torn by a cat. "I believe I'm getting Madras, sir!"

The squeak which Mr. Wemble attributed to Madras was followed by a terrific trumpeting, a roar, a thunderous crashing of bamboos that came from the direction of the elephants.

"The gundas! The gundas!" the shikari howled. "The elephants have bolted! May Vishnu preserve us! *The sound of the mouse—for which they have been waiting!* They have heard it!" He pointed frantically at the squawking wireless. Mr. Wemble was fumbling madly with the dials. The squeaking grew excruciating.

The elephant keepers ran to and fro, howling to their gods; the shikari took up his goad and yelled orders. The elephants lifted their trunks, trumpeted wild calls, and went galloping off down the dry khor in a mad stampede. The Director sent a well aimed shot into the very middle of the object of his hysteria—that mahogany case. It splintered the wood, put out the lights, and in fact made the whole contraption jump as if possessed of an acrobatic devil.

And then in the midst of all this maelstrom of turmoil—it began to rain! The Monsoon had broken.

"Thank God, sir!" the delighted Mr. Wemble cried. "The air will clear by morning. Don't blame you, sir, for getting into such a funk over the squeak. Merely static, sir, I assure you. Air is too damp and hot, you know. When the air clears—I assure you I'll have the temple bells at Mandalay!"

UNFORTUNATELY before morning a very grave mishap overtook the Director Sahib. If it had not been for the demolishing effect of the Monsoon, the pouring rains, the freshets in all the trails, everything might have turned out all right. But the Director was left practically alone in this mêlée of storm and lashing trees and floods; while his beaters and servants spent the whole stormy night herding the routed elephants together again.

It was during this adverse combination of circumstances that the great magistrate was attacked by a band of murderous dacoits who had long planned to take his life. He found himself gagged, bound and thrown into a dhoolie packed by four men. When the gag and blindfold were removed, he looked about and realized that he was in the mountain stronghold of the dacoit leader, a tall slim, brown skinned gentleman by the name of Bukri Dhinn.

Although Bukri Dhinn was a savage, with fierce look-

(Turn to page 79)



"—threw him into the street as they might throw out a boy who has stolen an armful of coconuts"

the true Story of Heinrich Hertz

Who found that waves produced by the spark of an electrical machine could be received by a circular loop of wire and was able to show the reflection, refraction, diffraction and polarization of the waves

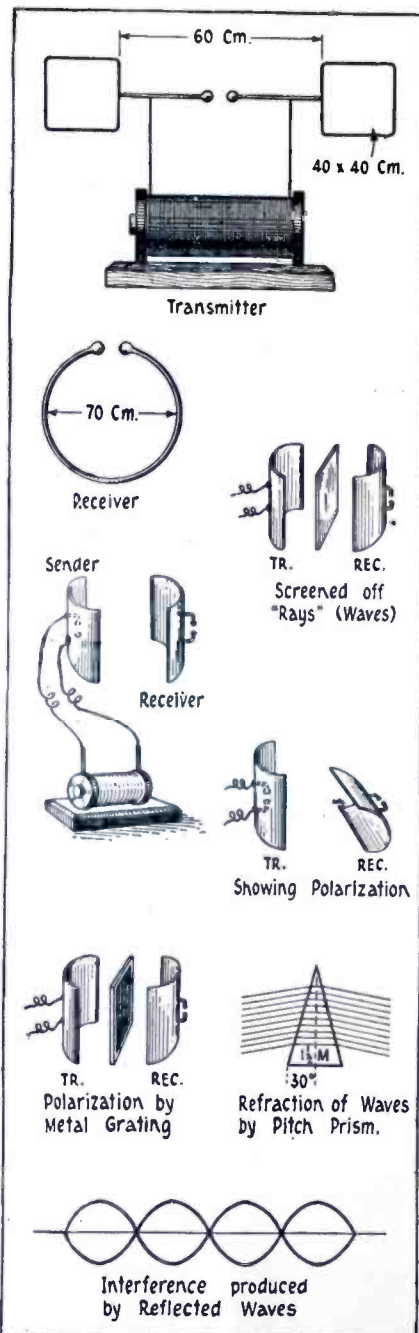
By Raymond Francis Yates

THE German physicist, Heinrich Hertz, was born at Hamburg in 1857. He studied to become a civil engineer, but forsook this profession for the study of mathematics and pure science, which he pursued at Munich and Berlin, becoming Helmholtz's assistant at the latter university in 1880. His earlier experiments with electromagnetic waves were performed during his professorship of physics at the Polytechnic Institute at Karlsruhe, and made for Hertz such a reputation that he was in 1889 called to the important chair of physics at Bonn, previously occupied by Clausius. To Hertz is due the realization and detection of the electromagnetic waves which Maxwell had discovered in his theoretical consideration of the nature of electricity.

The first paper describing these wonderful discoveries was published in 1887 and the series continued for several years in Wiedemann's *Annalen*. In 1890 was published *Ueber die Beziehungen zwischen Licht und Electricitat*, while his *Gesammelte Werke* were published in Leipzig the year after his death. English translations entitled *Electric Waves*, by D. E. Jones, with a preface by Lord Kelvin (1893), and *Miscellaneous Papers*, by D. E. Jones and G. A. Schott, with an introduction by Philipp Lenard (1896) have been published.

That Hertz's classical experiments were inspired by our own Thomas Edison is not generally known. It was during one of the industrial exhibitions in Paris in the early eighties that Edison displayed for the first time a very mysterious black box. It was arranged at one side of the booth and he placed within it a tiny spark gap. A peep hole allowed the curious visitors to observe the gap.

On the opposite side of the booth there was a heavy induction coil connected to another spark gap. When this coil was operated a tiny spark was seen to pass across the gap located in the little black box. From the



Experimental apparatus used by Hertz

standpoint of pure science, this experiment was one of the features of the whole exposition. Many of the great scientists of Europe were awed at the remarkable demonstration. The best of them could not quite understand what was taking place. In fact, Edison himself was quite at sea.

One day a gaunt young man with a long, thin face smoothly shaven wandered through the exhibit and stopped at Edison's booth. He casually stepped up to the little box and peeped into it. That was an important moment in the history of radio, for it marked the birth of the inspiration that later gave the world a new art of communication. When this young man saw the mysterious spark, the thought of James Clark Maxwell and his electromagnetic theory of light flashed through his mind. This, he argued to himself, is no doubt caused by some of the electromagnetic waves that Maxwell had accounted for in his mathematics.

The young man mentioned was none other than Prof. Heinrich Hertz of the University of Bonn, Germany. Hertz was twenty-eight years old at the time and bubbling over with the ambition to make his mark in the world of science. Indeed, his mind was restless and his fingers twitched until he had arrived back at the laboratory of the university where he later not only proved the correctness of Maxwell's wonderful reasoning, but placed in the hands of the world a new and powerful instrumentality.

That Hertz's commercial vision was by no means as keen as his experimental vision is proven by the part of his paper where he says, "We have applied the term rays of electric force to the phenomena which we have investigated. We may perhaps further designate them as rays of light of very great wave length. The experiments described appear to me at any rate eminently adapted to remove any doubt as to the identity of light, radiant heat and electromagnetic wave motion. I

believe that from now on we shall have greater confidence in making use of the advantages which this identity enables us to derive both in the study of optics and electricity."

It is evident that Hertz's interest in pure science was in no way dimmed by commercialism. He was essentially an investigator and cared little or nothing for invention. He formed a part of that preciously small army of experimenters who prepared the fertile soil in which many of our great inventions of the day took root.

Immediately Hertz got back to the laboratory he set up a crude form of oscillator and from the results of his first experiments with it it is pretty certain that he was sure of just what he was doing. The brass balls of his oscillator were separated by a spark gap about seven millimeters long. A Ruhmkorff coil supplied the oscillator with its high voltage discharge.

When this oscillator was operating, Hertz visualized electromagnetic waves spreading out from it, and to prove that they were present he built the simplest radio receiver that could possibly be produced. It was formed by a loop of wire 70 centimeters in diameter. This loop was broken so that a tiny spark gap would be formed between its ends. The total length of the wire forming the loop corresponded with the length of the oscillator, for it was evident to Hertz that his transmitter and receiver would have to be in tune with it.

Hertz took his small receptor and walked about the laboratory with it. At certain points he noticed a little spark passing between the tiny spark gap. It must have thrilled him for he then knew that there was an actual transference of energy between his oscillator and receptor. Furthermore he must have known that he was dealing with a wave motion, for he could easily knock his receptor out of tune with the transmitter.

Inspired by this success, Hertz enthusiastically jumped in to a series of experiments that have since marked him as one of the world's greatest minds. He put these newly discovered waves through all the experimental antics that could be imagined. He played with them as a child plays with a new toy.

His next experiment was performed to demonstrate that these waves had all the properties of light

waves. To do this he made use of the phenomenon known as interference and in this he was probably guided by Young's classical experiment in light made a number of years previous. Hertz set up a metal reflector and interposed between it and the oscillator his simple receiver. By changing the position of the receiver he reached points where he found that no spark



The originator of "Hertzian Waves"

occurred between the balls of the receptor. This, he reasoned, was due to the interference caused between the reflected waves and the waves from the oscillator that were on their way to the reflector. In doing so he demonstrated that there was a unit of electric force at the reflector. By moving his simple receptor to various positions he easily picked out the points at which the waves interfered with each other. This was of course at their crossing points as will be understood from the illustration.

Searching further into the mysteries of electromagnetic wave phenomena, Hertz set up and used a transmitter and receptor capable of dealing with shorter wave lengths. The apparatus used was not unlike that first employed, save that it was connected to

cylindrically shaped reflectors. The wave generated had about 1/10th the length of the one originally employed.

The first experiment made with the new equipment demonstrated the fact that radio waves, like light waves, are capable of casting a shadow. To demonstrate this Hertz simply interposed a metal screen in a direct line between his oscillator and receptor. The effect produced was exactly as he anticipated; the waves were entirely screened off and prevented from reaching the receptor.

The simple expedient of turning his receptor to a point where it would be at right angles to the transmitter showed polarization.

Here again Hertz showed the great similarity between light waves and electric waves. Not satisfied with this proof, he made further experiments in polarization by interposing between the receptor and transmitter a grating of wires and he anticipated that this simple apparatus would act in the same way as tourmaline crystals when applied to light. Still again he found his assumption was correct, for the simple wire grating was capable of controlling the passage of the waves. When the wires were in a horizontal position the waves passed freely, but turning the grating ninety degrees caused it to become opaque.

If these electric waves follow so obediently the law of reflection and polarization, one should be able to cause them to demonstrate the property of refraction. So argued Hertz and forthwith he constructed a huge prism of pitch. This prism was 1½ meters high and had a total weight of 1,200 pounds with a refracting angle of 30 degrees. Setting his receiver and transmitter up as illustrated, Hertz shot his newly discovered waves through the pitch. Again his action and forethought were vindicated for the waves were bent to an appreciable extent upon passing through the huge pitch prism. Calculations of Hertz placed the index of refraction of the pitch at 1.69.

Briefly, this is the story of Hertz and his history-making experimentation. The simplicity of the apparatus that he employed and the positiveness of its operation when in the hands of even the most rank experimenter make it possible for any novice to reproduce the original experiments in all their beauty and accuracy. There is nothing intricate or difficult about them.

Pacific Coast Stations

Tune in on the Hoot Owls, the Little Symphony Orchestra, the Sandman and Queen Titania, Uncle John, Hollywood, Creatore and the Wampas Programs

By Dr. Ralph L. Power

AS the DX hound goes romping around the dials probably there is nothing that gives him greater pleasure or more genuine thrills than to bring in Pacific Coast stations. Of course the Pacific Coast radio stations always have worth while programs, but there are some features that stamp the various stations in the minds of radio fans elsewhere. The average radio enthusiast can hear music and other entertainment from his home town or nearby stations, but when tuning in for long distance, he usually wants something different. And he nearly always gets it.

Let's take an imaginary trip down the Coast and visit the stations that are most frequently heard in the middle west and on the Pacific Coast. There's the Morning *Oregonian* station of KGW in Portland, Oregon, on 492 meters. Wait until Friday nights and tune in sharply at 10.30. Pacific time, and the Hoot Owls, one of the most famous of the early radio organizations, will come to you right in your home. Listen to their initiations, the various splurges of horseplay, even the intermission when they take the goat out for water, and you will become part of the regular audience each week as are thousands of others scattered in all parts of the country.

Then perhaps we'd better drop down the Coast a bit to Oakland where the gigantic KGO of the General Electric Company on 312 meters, is famous for the Sunday afternoon concerts by the KGO Little Symphony Orchestra, under the leadership of Carl Rhodenhamel, which is a regular feature beginning at 3.30 o'clock.

The evening program hour from 8 until 10 o'clock on Monday, Tuesday, Thursday and Saturday brings a splendid array of talent to radioland not the least of which is the radio dramatic offerings under the direction of Wilda Wilson Churchill. The same evenings from 10 to 1



CREATORE
The director of the Metropolitan Theatre Orchestra which broadcasts its classic programs every Sunday night direct from the stage of the theatre through Station KFI

o'clock Henry Halstead's Orchestra in the Hotel St. Francis, San Francisco, broadcasts its dance music through remote control to the Oakland station with the cable laid beneath the waters of San Francisco Bay for a distance of ten miles.

Right in the same city the Oakland *Tribune* on 509 meters celebrated the third birthday of its station KLX in November. Besides its regular fine program hours this station broadcasts a remote control line every Monday evening for two hours beginning at 8 o'clock from the University of California Associated Students on the University Campus at Berkeley. The program makes no attempt to inflict a serious lecture course on radioland, but rather a varied offering of instru-

mental and vocal numbers and occasionally a live, up-to-the-minute, snappy talk on some current event of world wide importance and interest.

Continuing our little radio journey along the Pacific Coast we next go across the bay to San Francisco where KFO of Hale Brothers, on 423 meters, makes a feature of the station organ recitals on Monday and Thursday of each week from 8 to 9 in the evening by Theodore J. Irwin, the official organist of the station. During the regular evening hours this station also broadcasts remote control lines featuring Rudy Seiger's concert orchestra and Art Weidner's dance orchestra, both from the Fairmont Hotel, and E. Max Bradfield's Versatile Band playing in the Palace Rose Room Bowl.

And now for the sunny clime of Los Angeles where five 500-watt stations almost continuously fill the air and a 1,000-watter is nearly ready for operation. KHJ, *The Times*, on 395 meters, has made a feature for nearly two years of the weekly visit of the Sandman and Queen Titania and the bedtime stories of Uncle John every Tuesday for an hour beginning at 6.30. Tune in on KHJ and give the kiddies a treat for the children's hour program always presents something unique and novel for the youngsters of radioland.

KFSG, the Angelus Temple on 278 meters, is extremely interesting for its water baptism service and music by the Temple Choir and Silver Band every Thursday for two hours starting at 7.30 P. M. At other times, except Mondays, there is an almost continuous program of religious services, testimonial meetings, divine healings and other broadcast features from KFSG. But the baptism services, with from 75 to 125 people being baptized each week, offers a unique program for listeners-in. KNX, the new Los Angeles *Express* station in Hollywood, on 337 meters, starts the

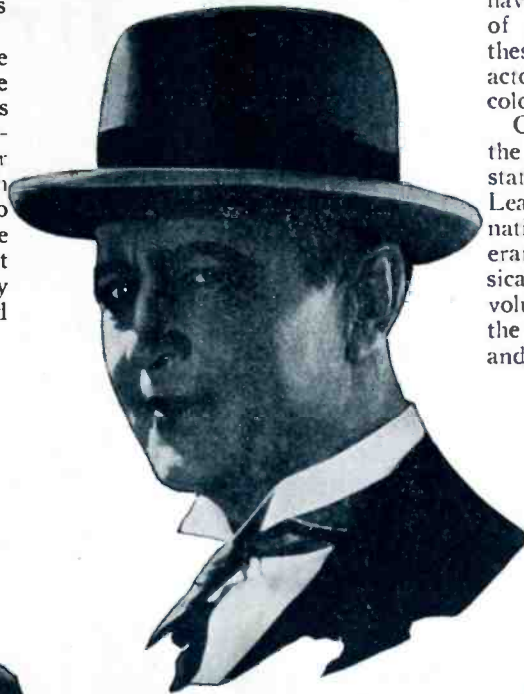
day—not with the alarm clock or the daily dozen like some eastern stations—but with the morning prayer by clergymen of all denominations every morning promptly at the hour of 8. Its dance music program from 10 o'clock until the hour of midnight on Wednesdays has become one of the most popular programs featuring the Hollywoodland dance orchestra—an organization composed of young college men who have been playing Wednesday night programs from Los Angeles radio studios during the past two years.

KFI, on 469 meters, known as the Radio Central Station, with five remote controls to various parts of Los Angeles, is well known for the Packard Ballad Hour, presenting popular songsters every Tuesday night from 10 to 11 as well as the Packard Radio Club on Saturdays during the same program hour. These are broadcast from the studio of Earle C. Anthony Inc., located on the roof of the Packard

P.M. the Wampas programs are broadcast to an audience that can hardly be estimated in numbers. Known as the Western Motion Picture Advertisers and Wampas for short, they present movieland programs on which have appeared Marion Davies, Elinor Glyn, Lew Cody, Monte Blue, Milton Sills and other celebrities. It is small wonder then that hundreds of thousands of radio and movie fans eagerly

These programs come to you twice a month on Wednesday at 9 o'clock for a full hour of enjoyment featuring vocal and instrumental music as well as talks by stage and screen luminaries. And don't forget, too, that many of these celebrities can entertain you in other ways than through the spoken word. Bill Desmond and his favorite harmonica; Ben Deely, with his own songs; Carmel Myers, singing popular selections—all these and many more have made tremendous successes out of their radio programs. Many of these famous people were musicians or actors before joining the talented movie colony.

On alternate Wednesday evenings at the same hour and from the same station, the Los Angeles Branch of the League of American Penwomen—a national organization—presents a literary program interspersed with musical numbers. Books of the day, volumes sparkling with wit and humor, the more serious kind, tomes of fiction and travel—everything, in fact, that



(Left) Lew Cody of Wampas fame, (center) Hobart Bosworth, movie star of ranch life in the great North country and (right) Monte Blue, all of whom present movieland programs through KFI

Motor Car Building. The 500-watt station is now in process of increasing its equipment to 1,000, which will be in operation by the New Year.

Sunday nights from 7 to 8 an unusually fine program composed mainly of classic selections comes to radioland from KFI direct from the stage of the Metropolitan Theatre where the great Creator directs the orchestra of 100 musicians and soloists. This has become one of the really big features of each week in radioland of the great Pacific Southwest where the air is full of religious services all day Sunday, and this hour of orchestra selections makes for variety.

Another remote control goes to the Los Angeles *Examiner* and twice a month on Wednesdays from 9 to 10

watch for these programs from Los Angeles and the colony of artists from Hollywood.

When Hobart Bosworth spoke recently for the Wampas a curious coincidence was brought to light. A large family on a Montana ranch had driven twenty miles away to see a movie—a privilege not often theirs—and they saw Hobart Bosworth in one of his thrilling and gripping film versions of the great North country. Returning to their lonely ranch home in the rugged fastnesses of the hills, without knowing what was on the air, they tuned in KFI, and lo and behold! Bosworth himself was speaking from the Los Angeles station. Truth is indeed getting more and more to be stranger than fiction.

is good reading is presented in a series of three-minute sketches for each book.

The information set forth herein offers the solution to a speedy trip down the Western coast line while seated comfortably right in your own home no matter where the location is. Tune in on the receiving set and visit all of these stations.

The time schedules given are, of course for Pacific standard time. These 500-watt stations and KGO's 1,000-watt set, all have fine programs and are on the air many hours each day. This little story, however, gives you the gist of the programs that are regular features during the long winter months. Tune in when you can and you will not be disappointed.

Radio Troops

of the

Girl Scouts



Hundreds of lonely girls in isolated parts become active members by means of radio

By *Alice Mary Kimball*

I KNOW a fifteen-year-old girl who lives on an isolated farm in the hills of northern Vermont. Lucy Williams isn't her real name, but it will do for the purposes of this article. A year ago, she used to go about as hungry for companionship and good times as young puppies are hungry for steak bones. Fifteen is a lonely age. Any grown woman who remembers her youth will tell you that. And rural Vermont is a silent, lonely country, especially in Winter when the Fords stop running and each tiny farmhouse is snow bound—shut away by mile upon mile of white, glittering wastes.

One day last December the voice of the Girl Scouts called Lucy to join a big sisterhood of girls of her own age. It was like a miracle—Cinderella's fairy godmother and Aladdin's lamp rolled into one. From Station KDKA of the Westinghouse Company of Pittsburgh the voice had traveled, over fields and farms and cities and mountains, until it reached the neat, stove-warmed kitchen in the Williams farmhouse. Lucy's brother, Tom, had installed a radio set two weeks before; and when he heard Miss Laura Holland, local director of the Pittsburgh Girl Scouts, organizing a radio troop of girls on lonely farms, he called to Lucy:

"Here, Sis, this is girl stuff. You

listen. It doesn't mean anything to me."

The voice was clear and strong. It was full of fun and friendliness. Miss Holland was making a word-picture of the Girl Scouts. Lucy gave breathless attention.

"A long time ago in England," Miss Holland said, "Sir Robert Baden-Powell, a British gentleman, decided that the boys of England ought to have a chance to learn to be better citizens of their country. That was the beginning of the Boy Scout program, and you all know how fast it grew. Today, it has spread to all civilized nations, and there are hundreds of thousands of Boy Scouts in the world. In those days—twenty-five years or so ago—nobody ever thought of girls as good citizens. It never oc-

curred to the men who started the Boy Scout movement that there were millions of girls who might like a chance to grow into women trained to take a real place in their homes and neighborhoods as citizens. It didn't take the girls of England long, however, to discover that they were being neglected. They began everywhere to ask, 'Why can't we be Boy Scouts, too?'

"Of course," Miss Holland continued, "the girls didn't really want to be Boy Scouts. There are too many differences between the things boys and girls like to do! But the more they thought about it, the more sure they were that it was not fair to give the boys all the chances for work and fun that the Boy Scouts have, and never to pay any attention to the girls what-

ever. It wasn't fair for the boys to have all the hikes and camps and the girls have none. It wasn't fair for the boys to have splendid opportunities for service to the homes and communities, with no girl ever being asked to help. So the men at the head of the Boy Scouts decided that the girls should have their chance, too. They called in their wives and sisters who worked up a program of scouting for girls. This was the start of the Girl Scouts. They were called Girl Guides in England, but when the work began to



Girl Scouts listening to the Radio Troop programs

grow in the United States, American girls wanted to be called Girl Scouts. So that is what we are called over here."

THE voice went on telling about the Girl Scouts of the United States. There are over 150,000 of them, it said, and within the last five years, nearly 500,000 girls have had Girl Scout training.

"The Girl Scouts include nearly every kind of girl you ever heard of," said Miss Holland. "There are white ones and black ones and yellow ones and red ones; little ones, big ones, fat ones and thin ones; Girl Scouts of all nationalities and all religions. Some of these Girl Scouts meet in schools, some in churches, some in playgrounds, settlement houses, or libraries. Any place will do for a meeting, if there is room for a group of peppy girls with a leader to get together for work or play. I feel sure that there are hundreds of lonely girls all over the country who cannot be Girl Scouts because they live too far from other girls to form a troop; and because there is no older woman in the neighborhood who has the time to be a leader. It is for such girls that we are starting a Radio Troop. How would you like to be a long-distance Girl Scout with your leader far off in Pittsburgh? I want



Mrs. Jane Deeter Rippin, National Director of the Girl Scouts

to organize a troop made up of girls from every corner of our country and to help them have a good time over the radio! Shall I tell you the way to start such a troop and what you have to do to join?"

Lucy clapped her hands in excitement. She had often longed to be a Girl Scout. She had seen in newspapers and magazines pictures of healthy, laughing girls in khaki outing suits, tramping over mountain trails, with packs on their backs. She had seen pictures of Girl Scouts in camp—swimming, diving, boating, studying birds and flowers, and setting up tents and "lean-tos" for sleeping out-of-doors. How she had longed to be in on this fun! But it had seemed impossible. In the first place, the girls of Girl Scout age—from ten to eighteen years—lived far apart, with miles of joggly, narrow hillside roads between. And life on the Vermont farms, for young, fun-hungry girls like Lucy, is to a great extent an all-work-and-no-play proposition.

I AM familiar with the country in which Lucy lives because I was born there and spent my girlhood there. It is a natural pleasure-ground, but only the city people who come as visitors in summer, really use it for pleasure. There are, within five miles of Lucy's



Girl Scouts broadcasting folk songs from WFI, Philadelphia. Mrs. Julia Williamson, local director of the Philadelphia Girl Scouts, is in uniform. Miss Edith Hale holds a silver cup won by the Girl Scouts in a folk song contest

home, a dozen clear, forested lakes for swimming, boating and camping.

Mount Mansfield, Camel's Hump, and Smuggler's Notch near by are real scenic wonders—magnificent for hikes or overnight camping. In summer, the trees are alive with birds, the clear brooks are full of queer caddis-worms and water-insects, and the roads are interesting with the tracks of furry animals. The spring and summer woods have their secrets—yellow lady's slippers, arbutus, Indian pipes, thousands of varieties of ferns and mushrooms. What a country for boys and girls to have fun in!

The boys do have a certain amount of out-of-door fun. Lucy's brother Tom and his companions, go as a matter of course to the lakes and learn to swim. Fishing trips keep them out-of-doors over night. In deer-hunting season, a group of boys sometimes hire a cabin in the woods and spend a week or ten days living in the open. But with the girls it is a different story.

"Nobody seems to think I need to have good times," Lucy used to complain to me. "When I was a little girl I had fun. I liked to play with Rover on the front lawn, and to give tea parties for my doll, and to play with the children at school. Now I'm fifteen these things aren't fun any more.

There just isn't a thing to do. The young folks around don't know how to have parties and Ma says I'm too young to have a beau. There isn't a thing for me to see but stupid granite boulders and hills and trees. There isn't a thing to do, but wash dishes and feed the chickens."

Imagine a little country girl in a gingham dress saying this. Her straw-colored hair hangs in two braids down her back. There is a sprinkle of freckles over her turn-up nose. She is rather homely—fifteen is an awkward gosling age—but she is attractive and likable just the same. Two big tears are crawling out of her hungry blue eyes and trickling down her cheeks!

It did seem to me that Lucy had a case. Not a girl in the country where she lived owned a swimming suit, or had ever learned to swim in the clear mountain lakes. Neither Lucy nor

her friends had ever taken a hike in the woods, with a leader who could call attention to the interesting secrets of the flowers and birds. Not one of them could row a boat, dance a folk-dance, set up a tent, or cook a meal out-of-doors over a campfire. The charades, games, stories, songs, and dramas which are the everyday life of the city Girl Scout are altogether lacking.

We all know what the result of the mental emotional poverty of country girls or women has been in the past. Thousands of little girls like Lucy, untrained and inexperienced, have run away to the cities because they could

live up to the laws of the Girl Scout organization. The Girl Scout laws give the teen-age girl a simple code of ethics which she can understand and put into practice in her daily living. The member pledges herself to be loyal and trustworthy, cheerful, courteous, kind to others, clean in word, thought and deed, a friend to animals and to people, and a sister to every other Girl Scout.

Lucy became a Radio Scout. She wrote to National Headquarters, 670 Lexington Avenue, New York City, for the Girl Scout handbook. She could hardly wait for the next meeting.

The second meeting of the Girl Scouts was even more thrilling than the first. Lucy was on hand at the appointed time, Monday night at 8:15 with her ears glued to the receiving set, and pencil and paper before her to take notes. Miss Holland had said that through the Radio talks the girls would learn of all sorts of Girl Scout activities: knot-tying, first aid, fire prevention, nature study, handwork, songs, and games. There was also to be singing by the troop of real Girl Scouts in Pittsburgh.

Sure enough! The meeting was opened by whistle signals and a pledge of allegiance to the flag, just like a regular Girl Scout gather-

ing in a club room. Miss Holland's voice came through distinctly as she greeted the Girl Scouts. Throughout the country, it seemed, the Radio Wizard had worked magic. Would-be Girl Scouts had come alive from Maine to California, from Minnesota to Florida. The postman came every day to Miss Holland's office in Pittsburgh with Radio Girl Scout letters. From little towns, from ranches, lumber camps, mines and farms, Girl Scouts had written in. From Sun Prairie, Wisconsin, to Palmetto, Georgia; from Iron River, Michigan, to Oak Lawn, Rhode Island; from Grey Eagle, West Virginia, to Corsica, South Dakota, girls just as lonesome as Lucy had awakened and found themselves Girl Scouts overnight. Girls also enrolled from Canada—from Quebec, Ontario, and Mon-

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Girl Scouts studying folk lore, folk dances and folk songs at Camp Hoffman, Kingston, R. I.

not stand the loneliness, and have lived precarious lives as factory workers. Others, driven into early marriage by the sheer dullness and tedium of their lives, have been swamped while too young with the responsibilities of motherhood and home-making. The insane asylums still take their toll of these lonely farmers' wives.

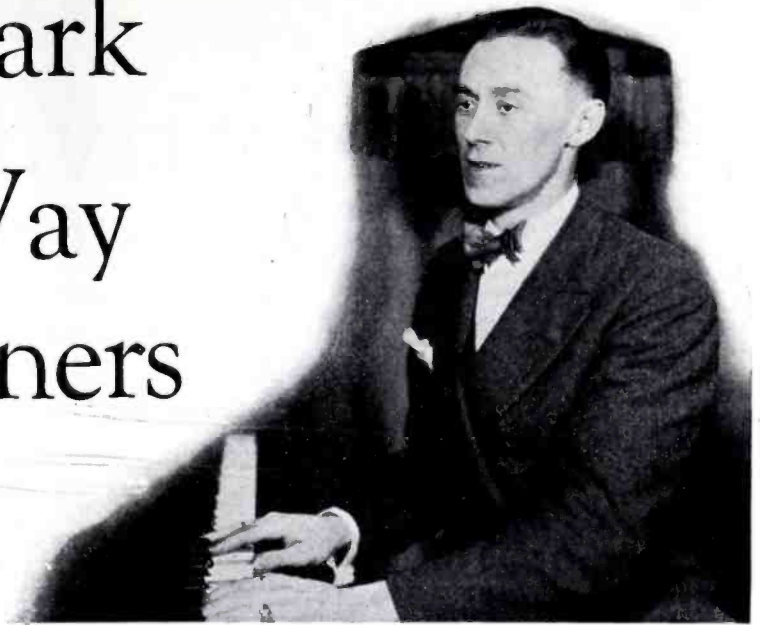
Rural free mail delivery, rural telephones, and the motor car have, of course been powerful factors in destroying the deadly vacuity of country women's lives; and now here is the radio, getting hold of girls on the threshold of life, bringing them into companionship with girls of their own age, telling them of books to read, games to play, and of ways to enjoy the out-of-doors.

IT wasn't difficult to join the Girl Scouts. A girl had to be at least ten years old. She had also to promise to

Jimmy Clark and his White Way Entertainers

Have Appeared at Most of the
New York Stations and
Proved Very Popular

By Mary Gray Reed



JIMMY CLARK has caused me to lose just a speck of my regard for one of the greatest of American authors, Mark Twain, because with all the latter's stories of the Mississippi in which I have reveled since I was knee-high to a grasshopper he never mentioned a colorful bit of river life which Jimmy Clark knows all about. When Jimmy was a kid his family moved westward to Chicago where at ten years of age the self-trained pianist began to play the songs he learned at school. This was a one-fingered performance on the piano, but

it developed into an engagement, at fifteen, on the steamer "Eastland," the excursion boat which had the fateful accident some time ago and which was then plying between Chicago and South Haven, Michigan. Here the excursion crowds must have felt that Jimmy added a decidedly festive touch to the daily trips as he played a steam calliope on deck. But this was only a stepping stone to what I shall always consider the high point of Jimmy's career, although he himself would consider that point to be his appearance at the Palace Theater in New York.

Down the river from Marietta, Ohio, to New Orleans, Eisenbarth Henderson's "Floating Palace" was wont to make its leisurely way. This was a boat with a theater built on a barge and pushed by a tug, and as it puffed along Jimmy Clark played his steam calliope on the deck and its raucous sounds drifted fifteen to eighteen miles on either side of the river. At night when they anchored, the farmers would flock to the shores and in the Barge Theater they would witness "Ten Nights in a Bar-room" or one of

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Jimmy Clark with some of his entertainers in action—and this is the picture you get over the air when you listen in

the Regenerative D-Coil

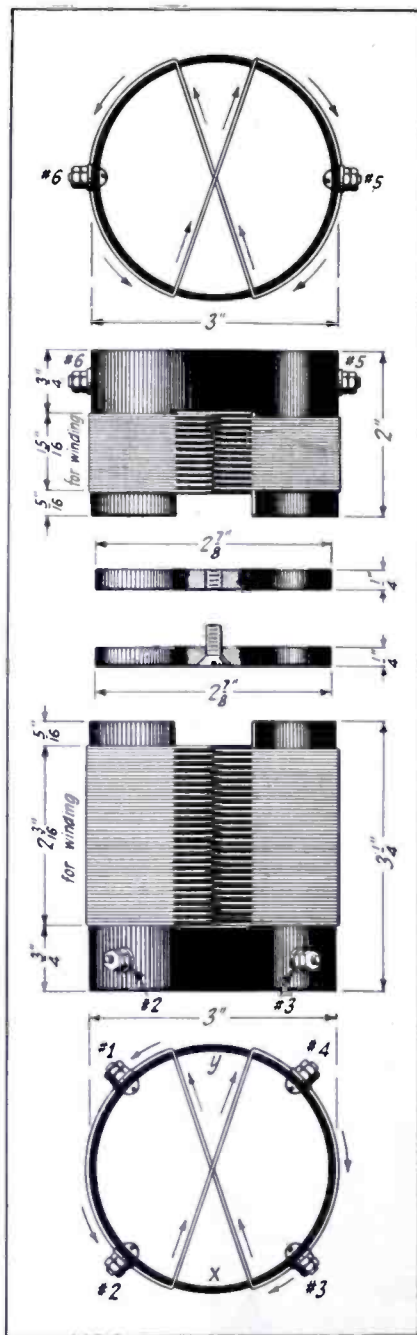
SOME NEW POINTERS

On transformer connections—application of 23-plate condensers to original circuit—use of regeneration—plate potential increase for r. f. tubes and proper biasing battery in r. f. circuit

By *K. M. MacIlvain*

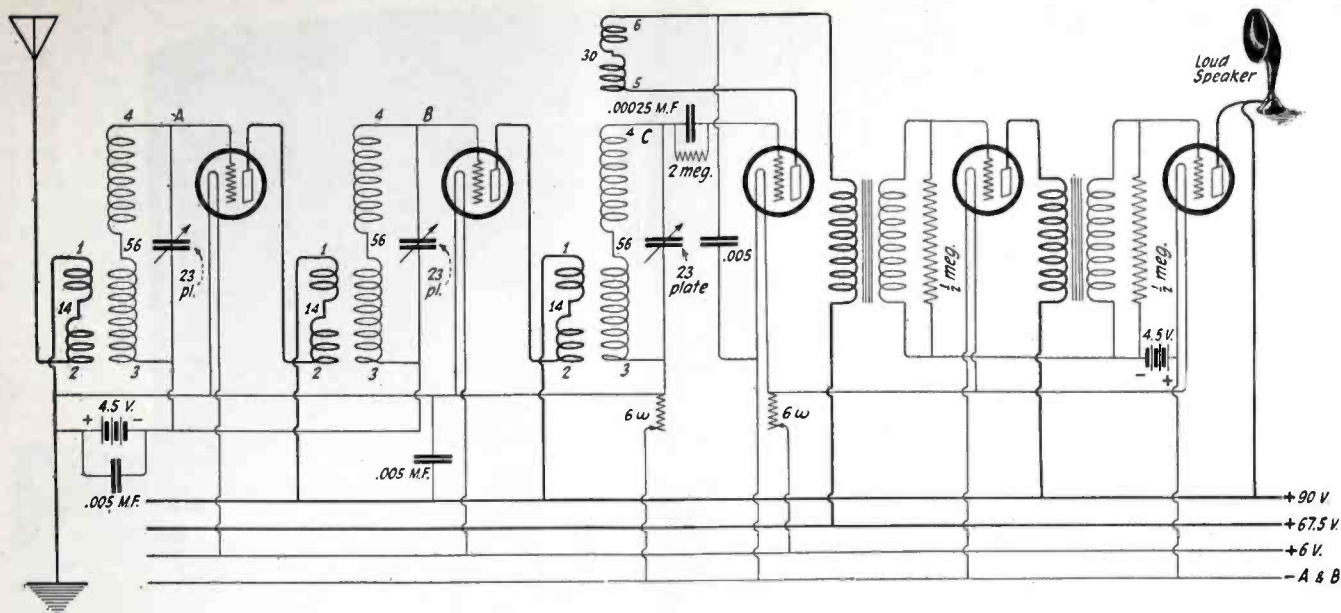
IN the June issue of WIRELESS AGE, I described "The D-Coil Receiver." This receiver had two stages of tuned radio-frequency amplification, a detector and two stages of audio-frequency amplification. The novel point of the circuit was the construction of the radio-frequency transformers which embodied an idea that was new for broadcast fans. These transformers were constructed on the plan of the "D-Coil" or "Figure 8" coil which has the property of possessing a very small stray field and hence its obvious adaptability to radio-frequency circuits. By the volume of mail that came in to the editor regarding this circuit it was evident that it had attracted widespread attention and by the number of congratulatory letters among them from fellows that had built the receiver and had met with success far beyond their expectations it was also evident that the circuit was popular and a success. Naturally, there were letters from fellows that had not started the construction of the set and wanted more detailed information before making the attempt and there were letters from others who had constructed the receiver and had experienced difficulties and wanted certain points made more clear. From a summary of this mail the author has picked out particular points that were not treated in sufficient detail in the previous article, and will attempt to clear them up for the benefit of those who probably experienced trouble, but failed to write in about it and gave up the work as a bad job, instead.

The circuit changes and additions are shown in the schematic diagram in figure (1) which is the latest model of the "D-Coil Receiver." The antenna-ground circuit is traced from the antenna, through the 14-turn primary of the first radio-frequency transformer and thence to ground. It is so noted that the primary in this case has 14 turns as compared with 10 turns in the previous case. This is due to the fact that the secondary turns have been increased to compensate for the decrease



Construction of the transformer and feed-back coil

in the capacity of the condensers used for tuning and since it is desirable to keep the same ratio of transformation (4 to 1) the primary turns had to be increased as well. The antenna-ground system is an untuned circuit and simply functions as an untuned pick-up of radio-frequency energy. The secondary winding of this transformer has 56 turns, as against 40 where the 43-plate condensers were used for tuning. A 23-plate condenser is used for tuning the secondary of this transformer and obviously should be as efficient as possible. If you are looking for good results it is well to spend a little more and get a better grade of apparatus and subsequently experience a proportionately greater increase in efficiency in the operation of the receiver. For instance, in the case of the tuning condensers, it is desirable to get condensers with as low a loss as possible. It is resistance in a tuned circuit that makes the tuning broad, therefore, the lower the loss in our condensers (the lower the resistance) the greater will be the selectivity of the set when it is in operation. The transformer between the first radio-frequency amplifier tube and the second, is similar to the one used to couple the antenna circuit to the first radio-frequency stage, but the third transformer, although identical to the first two, electrically, is somewhat different in mechanical construction due to the fact that it is mounted in conjunction with another coil which is also a "figure 8" coil and is used to feed back radio-frequency energy from the plate circuit of the detector tube to the grid circuit of the same tube and thus accomplish regeneration. Since regeneration is used it is essential and important to connect a radio-frequency by-pass condenser between the high side of the first audio-frequency transformer and the negative filament lead. In this case a .005 mfd. condenser was found to be a proper value to use, the point being to select a condenser of sufficiently large value to offer a comparatively low resistance path to the passage of currents of radio-frequency,



Circuit diagram of latest developments in the ever popular Wireless Age D-Coil Receiver

but not of large enough capacity to offer a low resistance path to the path of currents of audio-frequency, as, if the latter were the case, the audio-frequency currents in the plate circuit of the detector tube would be shunted around the primary of the first audio-frequency transformer and therefore we would not get efficient audio amplification. It might be well to add here for the benefit of those desiring the information, that, in the case of a capacity inserted in a circuit carrying alternating currents, for any particular frequency, the larger the value of the capacity the lower the capacity reactance and for any particular value of capacity, the lower the frequency the greater the capacity reactance. Care should be taken to see that this condenser is inserted in the circuit in the manner shown in the diagram and not from the plate terminal of the detector tube socket to negative filament, because in the latter case, much of the radio-frequency energy in the plate circuit of this tube would be shunted around the feed-back coil and the result would be that it would be impossible to obtain a very high degree of regeneration. Another .005 mfd. condenser is connected between the positive 90-volt "B" battery terminal and the negative filament lead to by-pass radio-frequency currents

around the "B" battery used to supply the plate potential for the radio-frequency amplifier tubes and thus increase the efficiency of operation. A potential of 90 volts is used on the plates of the first two tubes as compared with 45 volts used in the circuit that appeared in the June issue, since this increases the degree of radio-frequency amplification obtainable. In order to preserve the length of life of the "B" battery, it is advisable to insert a 4.5 volt "C" battery in the grid circuits of the two tubes in question and the point to insert this battery in the circuit is shown in the diagram in figure 1. Since this "C" battery is inserted directly in series in a circuit carrying radio-frequency currents it is well to shunt a radio-frequency by-pass condenser across the terminals of the battery. A .005 mfd. condenser will suffice at this point and the condenser leads made short. No jacks are shown in the audio-frequency amplifier circuit as this subject has been discussed quite thoroughly in all radio publications and is well understood by all radio fans who have reached the stage of building their own sets, hence, an explanation of that phase of the subject at this time would only occupy undue space and be a waste of time.

The mechanical and electrical con-

struction of the third transformer with the method of mounting the feed-back coil adjacent to it in such a manner that coupling between it and the secondary of the transformer may be effected and controlled, will be taken up first, since all the points involved in the construction of the first two transformers will be covered in the present discussion. The diagram in figure 2 shows the construction and method of winding the third transformer and the feed-back coil. The first thing to get is a piece of bakelite tubing 3 inches in diameter and 3 1/4 inches in length. The thickness of the walls of the tubing to be 1/16 of an inch. The end piece that is inserted in this piece of tubing is cut to the exact diameter to allow for its fitting on the inside of the tubing and the 1/16 inch walls forms the basis of the figuring. If the walls are thicker it will be necessary to cut the end piece to a smaller diameter. Starting at one end of the tubing, cut a slot down the side, with a hack saw, to within 3/4 of an inch of the other end. Make this slot 1 inch in width. Then cut a similar slot on the other side of the tubing and directly opposite the slot you have just completed. The manner in which these slots are cut are shown by the diagram in figure 2; (the two slots being marked

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I CALLED because I wanted you to know that my D-Coil receiver has re-discovered America. I have had loud speaker reception of WSB, WBAP, KFI, KGO, KFAE, CFAC, CFCA, CKAC, WBZ. This list bounds the United States, so I'm satisfied that I have the best home-made receiver." Such is the comment heard recently from one of our readers and such is the substance of letters on D-Coil.



Home Comforts

Radio sets can be utilized in the home without destroying harmony in decoration or occupying much space or being conspicuous—How you may add to your home comforts

By *Mrs. Christine Frederick*

FOR the first couple of years of radio, nobody seemed to think it strange to pile the library table with mechanical paraphernalia or to treat the radio set like a temporary novelty. Today this situation must now be completely changed, because radio is undeniably, as Secretary Hoover has expressed it in so many words—"a permanent part of the daily routine of the American home." The fact that the radio only recently began to be treated as a permanent part of home equipment in its design and its installation, is largely due to the fact that until this current year radio was the toy and the joy of men rather than women. It has been only since women

have taken a practical home making interest in radio that we have had the right attitude. This coming of woman's definite interest as a housekeeper in radio, has, perhaps, not been appreciated in its industrial significance.

The insistence of woman to make radio a fit home equipment has resulted in demand for higher class, more beautiful and more artistically designed sets.

I well remember that the same thing happened in other years when the phonograph first came on the scene. I remember a cousin of mine bringing in one of the old type wax cylinder phonograph machines, which was just about as ugly a home duckling as some

of the radio sets we have seen in recent years. He, too, stood it on the library table, the gawky wooden horn of it being quite as unsightly as some of the loud speakers of today. But, then, just as now, the miracle of a voice coming out of a mechanism, overshadowed all other considerations for the time being. Soon the phonograph was transformed to good-looking outfits. There are today 9,000,000 homes, I am told, which have phonographs, 4,000,000 more homes than have radio; and I venture to say that in not a single home of the 9,000,000 is there one of the unsightly old type phonographs which I remember.

It is amazing, to one who, as I do,

THE insistence of woman to make radio fit the home equipment has resulted in a demand for higher class, more beautiful and more artistically designed sets. Mrs. Christine Frederick in the present article describes how various homes have been embellished and made more comfortable through the installation of radio sets.

gets about all over the country into many classes of homes, how even the poorer classes have their cabinet phonographs in oak and mahogany bought at good prices. It is a well known fact that 75 per cent. of phonographs are sold on the installment plan, that these installment purchases are for cabinets.

I cite all this to indicate what we may expect with regard to radio. I am told that the demand for complete radio cabinets of good appearance is increasing more rapidly all the time, and that the home-built sets must make way for them.

Cherchez la femme! It is woman who is behind all this! She is thoroughly through with all the original radio messiness, the unprotected storage batteries which leak acid on her rugs, the unsightly technical tangles of wires and the dinky mechanism which has not the slightest relation to the general decorative scheme of her home.

What then is the development in this direction and what can the clever woman do, in collaboration with her men folk and the radio experts to increase the usefulness as well as the good looks of radio in the home? This, I find, is the question which is receiving most attention from women. It is no longer a question, as it used to be, whether or not to buy a radio. This is a foregone conclusion, which the remarkable test afforded by election night perhaps certified to in quite final fashion. Our old national habit with regard to election nights are changed by radio, as the *New York Times* editorially acknowledged the day after election. We sat around our radio sets in perfect comfort, hearing election returns far more rapidly at home than they ever were returned before. The whole ancient system of crowding in the street around the newspaper offices, in lodge rooms, clubs, etc., or before bulletin boards, blocking traffic and hugging one's overcoat in the cold, was rather done away

with to the benefit of all concerned.

We enjoyed this time all the privacy and comfort that the wealthy men used to enjoy who installed a private wire to their homes to receive election returns; and we beat them in speed even at that.

At my home on Long Island, half a dozen people who heretofore were obliged to wait until the following morning or walk several miles of country road, dropped in at my house, and around the fireplace listened comfortably to the returns; thus demonstrating how the country resident was not second behind his city cousin in point of time in knowing election results and

side of the practical electrician, who wants to simplify the wiring, and from the point of view of the family who want comfortable listening in. Of course, those who have a set with a loop antenna enjoy a greater portability, for their set can readily be moved from room to room. Undoubtedly the greater number, however, still use the outdoor aerial and the location of this aerial makes it sometimes necessary to place a set rather arbitrarily in some room. However, clever, careful installation in any house may be so calculated that wherever the housewife indicates it to be most useful, there it can be placed.

I realize that a city apartment is exceedingly different from a detached house and I shall not pay special attention to the apartment, because it always represents a special situation, but I will devote myself to the situation in the ordinary detached home.

After a great deal of experiment, I am of the opinion that the right place for the radio set is in the living room or the room where the family most frequently assembles. I know homes which have a radio set in the ill-frequented parlor or in a side room which is only occasionally used by the family. I do not believe this is the right place for a radio set.

In my home, we have a very large living room and there is a comfortable settle before the fireplace. At the head of this settle we have installed the radio set permanently as a fixture. Someone sitting

or reclining on this settle can tune in without the slightest alteration of his comfortable position and in this way we get the maximum comfort out of it. Prior to placing it here, we had experimented in several ways, all of which proved unsatisfactory.

We had it located in a corner of the room on a shelf about shoulder high. This meant standing up to tune in and we found that there was a strong disinclination to move away from a comfortable chair to change the dials.



The leisure hour in the den is made more enjoyable by radio

the incidents associated with them.

So we may say that this presidential election has certified to the value of radio in the home, and to raise the question is now simply *passé*. Every home needs and wants a radio set; that is no longer open to doubt.

The first question which the practical housewife faces when she considers the matter of radio in her home is *in what room shall she locate the set?* There is always divergence of opinion on this point, both from the

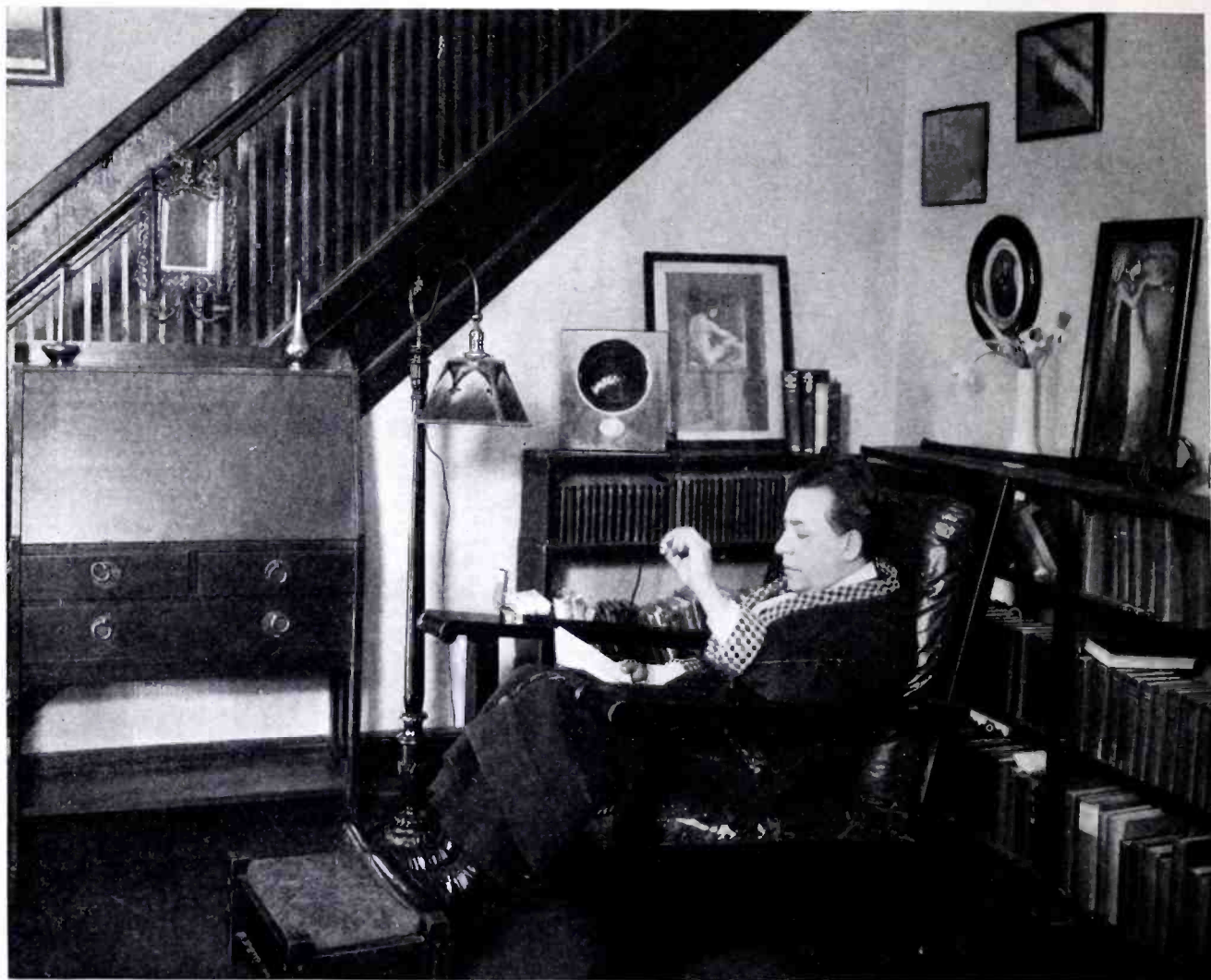
When we changed the set to another location and used our phonograph for a loud speaker, something of the same objection arose. There was the same feeling that we did not want to get up from a comfortable position and tune in or change the dials. I then realized that for its maximum value, the radio must be viewed as you view the library table or your table lamp itself. That is, you must regard it as a value and a service which is at its best only when it is immediately "to hand," and arranged to fit intimate convenience. One can put a telephone in a hallway,

desirable convenience of radio and phonograph in a single cabinet. We have, also, artistic combinations of cabinet and horn concealed in one cabinet structure. Then we also have more artistic loud speakers, even parlor lamps which are loud speakers; and I believe that by a little ingenuity radio can be utilized without loss of harmony in decoration or taking much space or being conspicuous.

For instance, take the manner in which I have installed my set. At one end of the settle, I have stood a neat upright bookshelf and had a car-

wires was led inconspicuously along the leg of the settle to the floor, through the floor, and into the basement, where the storage battery is much more fittingly kept, and connections made with the "aerial" and the "ground." This keeps our set in the living room free from protruding wires, awkward connections, and the dangers of harm from the "A" battery acids and grime.

Bear in mind, however, that this is only an individual instance, and that various other handy methods of dealing with a radio set are possible. Some



Reading the best seller in one's library to the tune of broadcast music is the modern style of enjoying good literature

but not a radio set, it must be right where the family gathers.

Many housewives have hesitated to place a radio equipment conspicuously in the living room, and I think rightly so. They have felt strong antagonism to the ungainly horns and instruments constituting the average radio set. This disadvantage must first be done away with before radio is thoroughly harmonized with the home. There are now three or four methods of achieving this result. We have now the very

penter fit a slot for the horn in among the shelves so that its full length was sunk below the arm of the settle and not visible. Over the arm of the settle, therefore, appears only the mouth of the horn and the neat dials of the set, the taper of the horn as well as the "B" batteries being entirely hidden from view. I have also eliminated a further element of awkwardness of the radio outfit by discarding altogether the presence in the living room of the storage battery. A cable of

friends of mine who recently built a house had the plan arranged while the house was being built. Their set is in a recess of the wall with hidden wires leading to the basement. Even the horn is set in a built-in closet, with the mouth of the horn flush with the wall. This is all done in careful color combination, harmonized with the wood trim of the room. Another friend of ours has installed his set in a somewhat unused closet just behind his fireplace.

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Loud Speakers

AND RADIO RECEPTION

The bipolar and balanced armature permanent magnet types described

By *Dr. John P. Minton*



Dr. Minton testing high quality loud speakers

ALL of us are familiar with the performance of some loud speakers which have been placed on the market and advertised "to the sky." Few persons have much regard for a human "loud speaker." He gets on our nerves; we avoid him, we close our eyes to avoid his gaze and we stop our ears to exclude his "noise." This is about the status of some loud speakers on the market today!

A group of capable acoustical engineers spend two years to develop an efficient and good loud speaker. Its performance is excellent. Another second rate company with an unpronounceable title spends two minutes to make a Chinese copy of this speaker, gives it a fancy name, such perhaps as "Aulettehwohlophone" and puts it on the market. It is worth about two shekels, from the viewpoint of efficient and faithful reproduction. The public buys it, tries it, and calls it "unbear-

ably rotten." This designation is soon applied by the indiscriminating public to the original loud speaker itself, which happens to be a very excellent device. Those people desiring to purchase loud speakers and other radio devices, therefore, should set down as the first and primary requisite to purchase from reliable concerns of long standing and experience. Such concerns have engineers of wide technical knowledge and experience, without which apparatus of high grade performance cannot be turned out.

These remarks apply particularly to loud speakers. There are on the market various makes of these devices and they give, with very few exceptions, poor and unsatisfactory performance and reproduction. The main object of this group of articles, beginning this month, on loud speakers, is to make it possible for the public to know a good one from a poor one

and to see the significance and importance of developments which have been carried through to completion recently by those of us who have given much thought and time to this important field of radio.

To the expert, a goodly number of loud speakers are not worthy of serious thought. He knows they are far from being even slightly satisfactory, and fall hopelessly short of doing what is claimed for them.

For example, in a recent issue of a radio magazine we find no less than twenty-five or thirty different types or makes of loud speakers illustrated. In some cases it is claimed by the makers that their loud speakers will reproduce perfectly and give plenty of volume. This is rather questionable to say the least, of any loud speaker on the market. Few give plenty of volume and less reproduce perfectly. If we had obtained perfect reproduction, our job

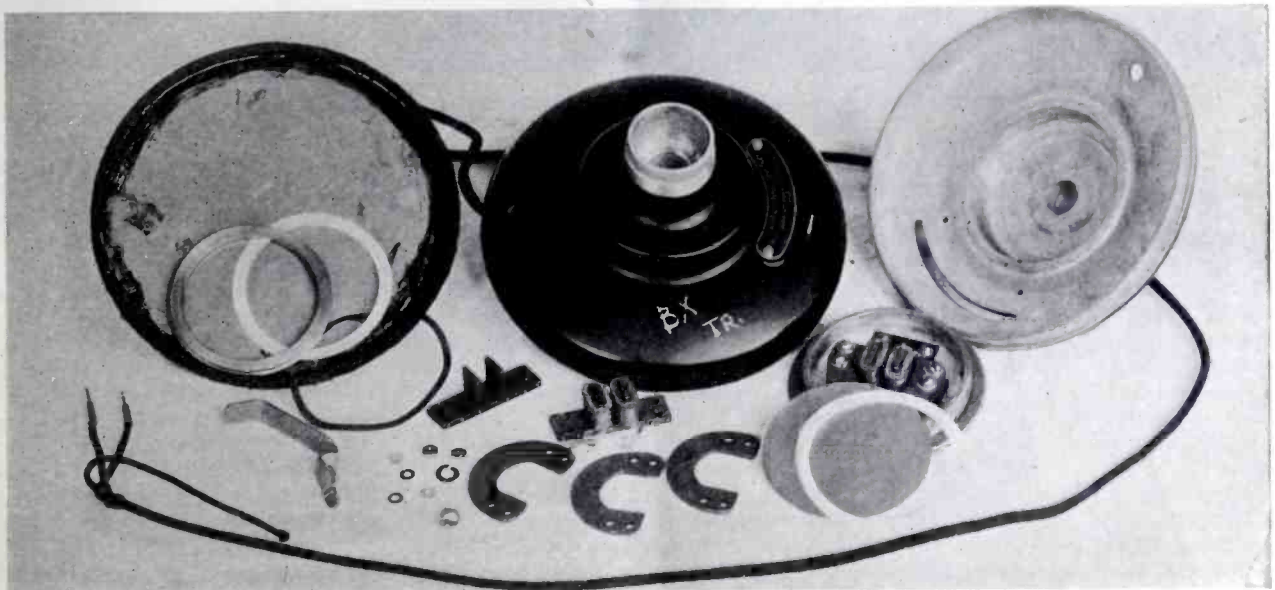


Figure 3—A Radiola Loud Speaker unit of the bipolar permanent magnet form

would be finished from the development standpoint. I think the public cannot be fooled quite so easily as this. One needs but listen to the piano over an average loud speaker and then compare it immediately with the piano in his own home. One does not need a pair of "million dollar ears" to observe the difference when the first chord is struck.

After a careful review of loud speaker literature in which the origin of loud speaker nomenclature has been traced back to its inception, it seems appropriate to begin this series of articles first by describing some of the existing makes of loud speakers and pointing out their likenesses and differences.

In figure 1 is shown the writer in his office examining an experimental model of a 10-tube superheterodyne receiver which he built for testing high quality loud speakers. In figure 2 is shown a photograph of a number of loud speakers made by different manufacturers.

type UZ 1325, of the ordinary bipolar permanent magnet form. Both the assembly and dismantled views are shown. Figure 4 gives a familiar type of the ordinary balanced armature, permanent magnet, unit. Here again both the assembled and dismantled units are shown for purpose of clearness. In a photograph to be given in the next article will be shown one make of the moving coil type of unit with the coil placed in the magnetic field set up by an electromagnet instead of a permanent magnet. The electromagnetic type here referred to requires an external source of electric power to set up the strong magnetic field. To avoid the use of an external source of electric power to produce the magnetic field, a permanent magnet, such as is

this type of loud speaker also will be shown later. The one to be shown, of course, is an experimental model and does not represent a commercial sample. As will be shown in the picture, there is a large aluminum diaphragm, thin and very light, clamped between two large "pan-cake" coils, so to speak. This type of loud speaker requires an external source of electric power to supply the coil and, therefore, set up a radio magnetic field. The diaphragm is forced to move back and forth by the currents induced in the diaphragm by the signals, as will be explained more fully later. This explains briefly why this loud speaker has been called the induction type.

Having described these various types of loud speaker units briefly and shown views of some of them assembled and dismantled, let us see what causes them to respond as they do to the radio

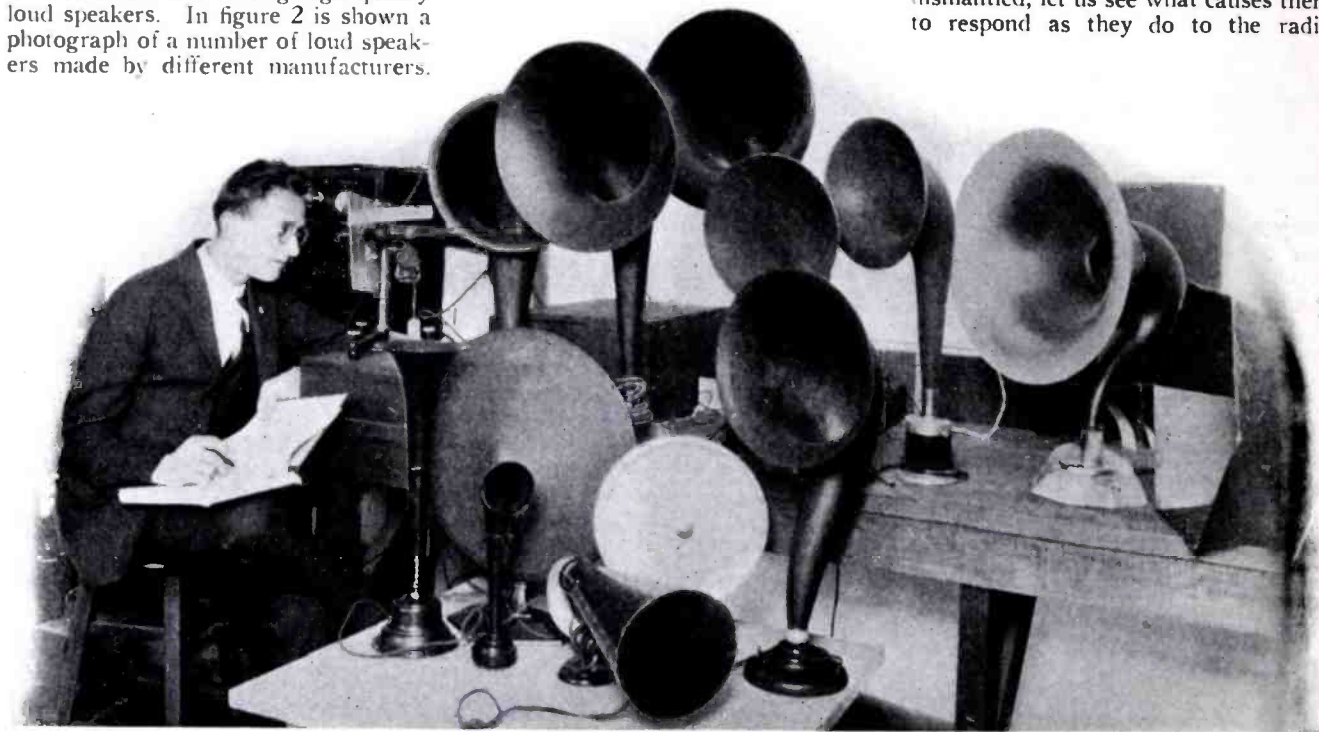


Figure 2—Various makes of loud speakers being tested for their operating characteristics

These have been arranged by Mr. Ringel in a group, so that he can observe their comparative performance very quickly by connecting them successively to a receiving set of superior quality and selectivity designed especially for just such comparison or by connecting them to a tube oscillator to measure their performance with very great precision.

The source of sound of a loud speaker is the unit itself, attached to the small end of the horn. There are many different makes of loud speaker units, but there are comparatively few different types. In the photographs shown in figures 3 and 4, are given some of the main types of units. Figure 3 shows the Radiola loud speaker unit,

used in the bipolar and balanced armature types, is frequently used. Manufacturers make much of this point in advertising their product by stating that no external source of power is required.

Another form of this moving coil type of loud speaker has been produced in Germany rather recently. We have no photograph of it, however, and will give only a sketch of it in the next paper. In this type the moving coil happens to be not a coil at all, but a wrinkled or corrugated piece of aluminum strip, very thin, very light, about three inches long and placed between the poles of a strong magnet.

There is still another type of unit, called the induction type. A picture of

signals. Let us also see what the relative merits of each type are and what kind of performance we should expect from each.

The most common form of loud speaker unit is the so-called bipolar, permanent magnet type shown in figure 3. Referring to the sketch in figure 5 we get a schematic view of this type of unit. The different parts are indicated in the sketch. The output wires of the radio receiver are connected to the terminals leading to the coils surrounding the pole pieces of the permanent magnet. The electric currents, therefore, corresponding to the musical and vocal sounds, cause a strengthening and weakening of the magnetic pull on the diaphragm placed in close prox-



Figure 4—The ordinary balanced armature permanent magnet loud speaker unit

imity to the pole pieces as shown in the sketch. This increase and decrease in the pull or force on the diaphragm is in unison with these currents and causes the diaphragm to vibrate accordingly. The diaphragm, of course, has to be iron or one of its alloys, because it has to be made of magnetic material. If this were not so, there would be no pull or force on the diaphragm and hence no mechanical vibrations of it to set up the sound waves. We have seen in one of our earlier papers of this series why it is necessary to have mechanical vibrations in order to produce the sound.

All of us know that an electric current flowing around a coil sets up magnetism in the region of the coil. If a piece of iron is placed within the coil as illustrated by the pole pieces in the sketch shown in figure 5, the magnetic field, so called, is strengthened greatly. This is one of the important proper-

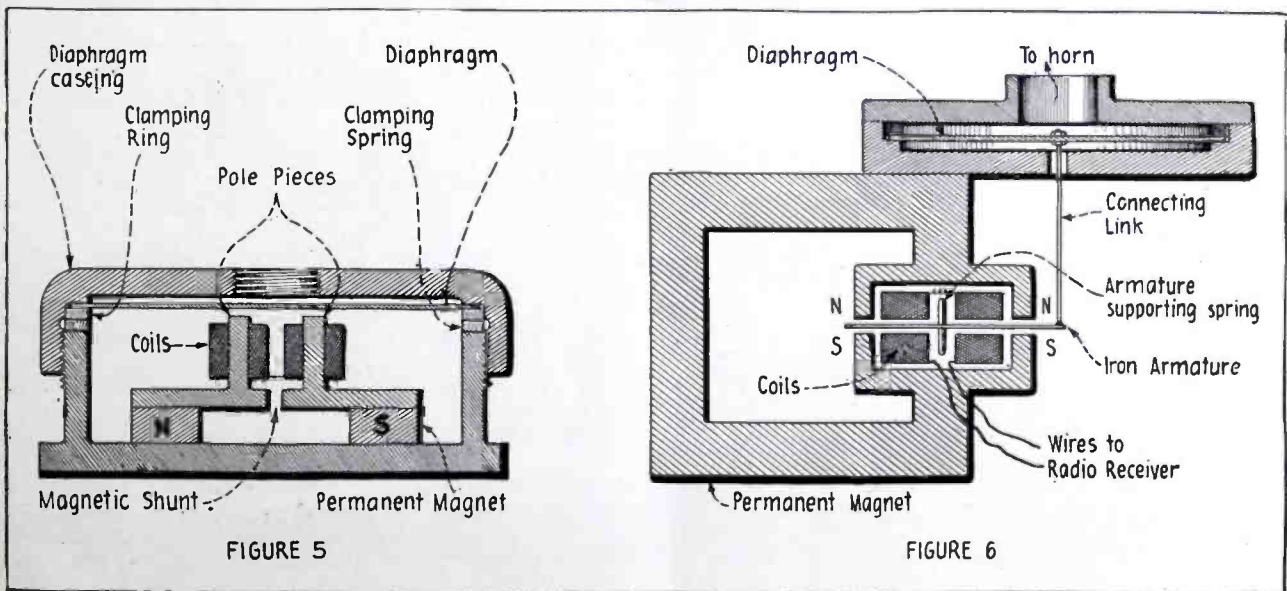
ties of iron—and therefore called a magnetic substance.

We know how to calculate the force on the diaphragm. We shall not bother with this calculation, but we shall, however, show by simple arithmetic, how important the permanent magnet is. The magnetic pull on the diaphragm depends upon the magnetism "squared." That is, if the force of pull on the diaphragm were a given amount, say 10 ounces, and the magnetism made just twice as much, then the force or pull would be $10 \times 10 = 100$ ounces and not $2 \times 10 = 20$ ounces. Suppose, then, the pull on the diaphragm caused by the permanent magnetic was 10 ounces and the pull caused by the signal current from the radio receiver was 2 ounces additional. The total pull will be $(10+2) \times (10+2) = 100+20 \times 2+4=144$ ounces. Of this 144 ounces, 100 represent the steady, unvariable pull of the permanent magnet, and the

other 44 represent the pull caused by connecting the radio signal to the loud speaker unit. Of this 44 ounces, 40 of it represent true undistorted signals and 4 ounces represent the amount of distortion of these signals, and it is quite an appreciable percentage in this case.

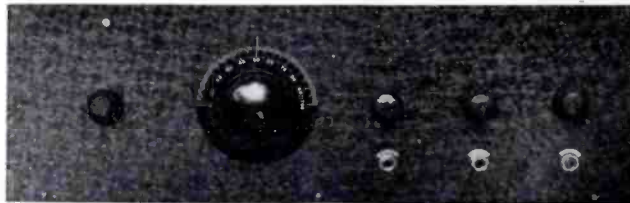
The important thing, however, is that if there were no permanent magnet in this unit then the pull on the diaphragm would be only $2 \times 2 = 4$ ounces in the cases cited. All this would be that caused by the signals. But, what is more important, is that all of it would represent distortion. That is, there would be none of the original musical or speech sounds present and the resulting sound would not be understandable. So, the use of the permanent magnet performs two very important functions. First, it makes possible the reproduction of the

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Schematic diagrams of the bipolar and balanced armature loud speaker units

How to Build the



The frieze finish insuline panel forms a stunning background for the single dial and the rheostats and nickled jacks

One-Control Regenerative Receiver

By R. A. Bradley

THE simplest form of a regenerative type of tuner is found in the "fixed untuned primary, tuned secondary, rotatable tickler coil." This unit is made up in many forms today and most of them are advertised as being "low-loss," or of low loss construction. The adjective "low" permits a wide and varied scope and does not confine itself to any upward or downward limit with respect to these losses. In other words low-loss may mean, from some manufacturers' standpoint, anything from sort of low to so low that the losses cannot be measured. Some of these coils are no more low loss than our old two-variometer-variocoupler combination which we were so proud of three or four years ago. In fact some of them present greater obstacles to the poor little signal than did ever our three-honeycomb-coil outfits.

The radio fans for the past few months have been literally swamped with various types of coil windings which have been more or less efficient. But in presenting the low loss coupler in the "pickle bottle" form of winding we believe that a superior development of low loss winding has been achieved. In the first place one criticism to be found with some types of regenerative tuners is the fact that the rotor and stator windings are of different design. For instance—the rotor winding of spiderweb form and the stator winding

- LIST OF MATERIALS**
- One Eastern Low Loss Tuner
 - One National Velvet Vernier Condenser .0005 mfd.
 - Three Garod Pyrex Sockets
 - Two Federal Audio frequency transformers No. 65 and 65A
 - Three Bradleystats
 - Three Carter Single Closed Circuit Jacks
 - Nine Eby Binding Posts
 - One .001 mfd. Dubilier Micadon
 - One .00025 mfd. Dubilier Micadon
 - One Bradleyleak
 - One Small Knob for 1/4" shaft
 - One 7"x21" Insuline Panel Frieze Finish
 - One 10"x3/4" binding post strip
 - Two small Angle brackets to support terminal strip.
 - One 6 1/2"x20 1/2" soft pine baseboard

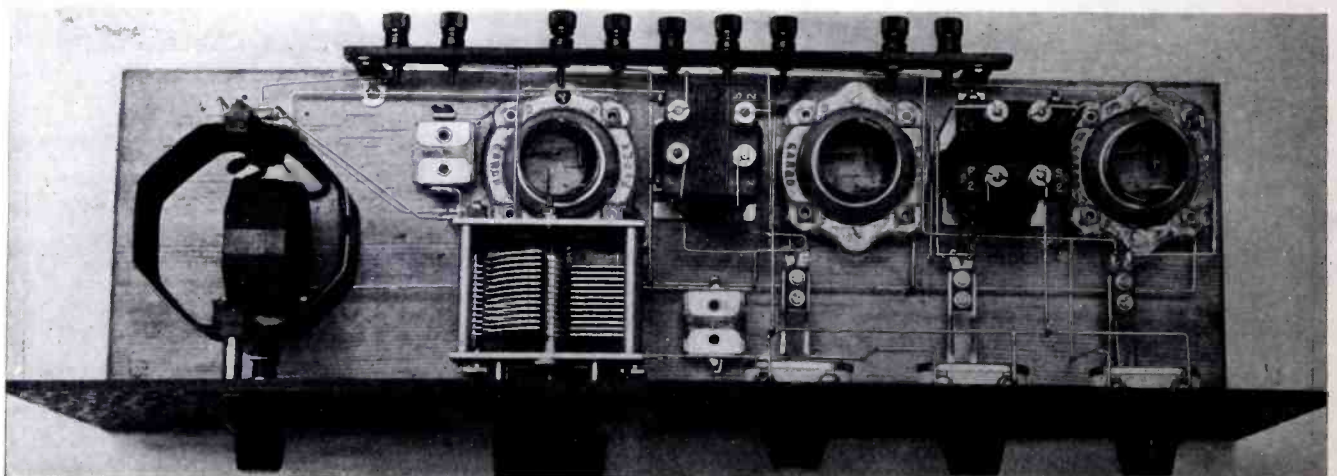
of basket-weave form. It is at once apparent that high inductance cannot be obtained from this combination because the magnetic lines of force do not coincide.

In the low loss coupler used in this receiver all three windings are the same form although the diameters differ. The greatest source of loss in an inductance coil is the capacity and energy absorption in the tubing which supports the coil. If this can be removed as it is in the low loss coupler used in this receiver the direct result

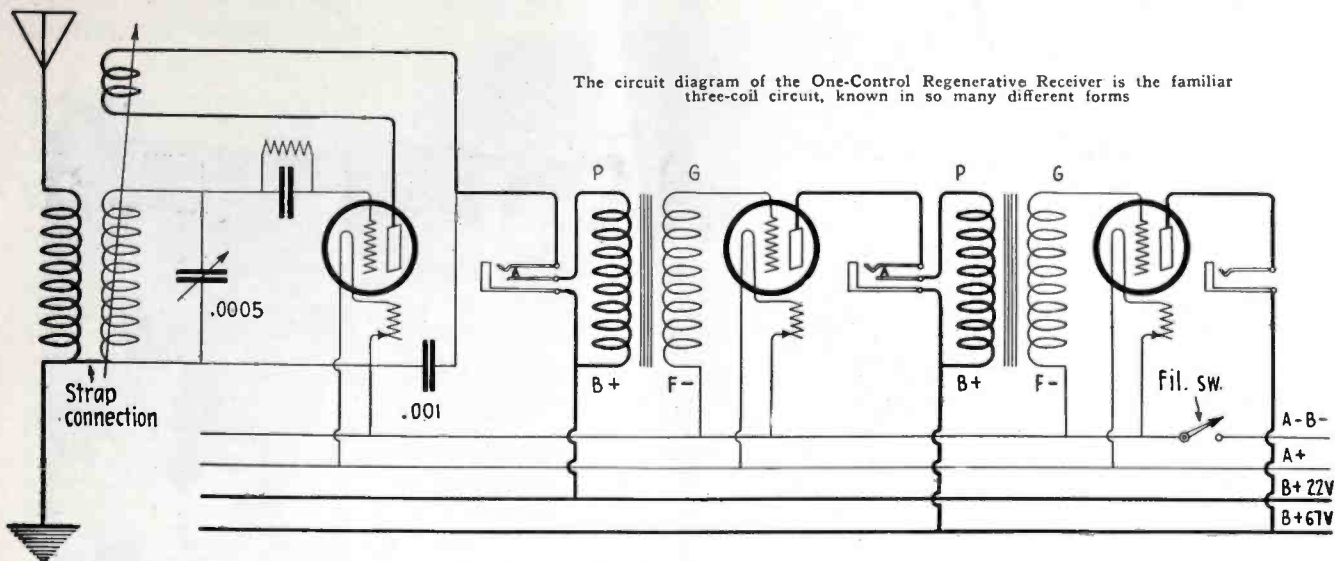
is sharper tuning and greater signal strength, which are of course the essential features for DX reception. The only dielectric in the field of this coil is the insulated strip for mounting purposes and the one for the binding post connections. The coil form is self-supporting because of the nature of its formation and good large sized wire is used in its makeup.

In connecting up the instrument, as will be shown later, it is possible to ground the main shaft which turns the rotor coil. This places the framework of the unit at ground potential and helps to prevent any capacity effect from the end of the dial. For anyone wishing to construct the standard three-circuit regenerative set, which still maintains its popularity due to its economy of parts and ease and simplicity of construction, we know of nothing to compare with the results obtained with low loss coils and low loss condensers. The receiver as shown employs various little conveniences which may be eliminated if desired to simplify the set further. Among these are the detector jack, the filament switch, the complicated binding post strip.

You will note that we have omitted the dial on the shaft of the low loss coupler. We have often wondered why a dial is used in this connection. The tickler action is not critical, and besides, nine times out of ten the home



The connections to the Pyrex tube sockets may be made either to a screw at the terminal or as we have it here, soldered to the socket prong contacts, themselves



The circuit diagram of the One-Control Regenerative Receiver is the familiar three-coil circuit, known in so many different forms

builder is not concerned how to place the dial when the coupling between the tickler coil and secondary coil is maximum or zero. The dial should be set so that as you turn the dial from zero to one hundred you should approach the regeneration point and pass it before 100 is reached. If you have your instrument adjusted in this manner then your dial reading may mean something to you, but personally we prefer to use simply a knob with which the fingers can fit closely around and adjust our tickler action in that manner. The condenser dial is an entirely different matter. Here your dial reading essentially means something and it is very important that the plates should be entirely "in" when the dial is set at one hundred and completely "out" when the dial is set at zero.

The numbers themselves on the dial mean nothing at all. However, they should be used to draw comparisons.

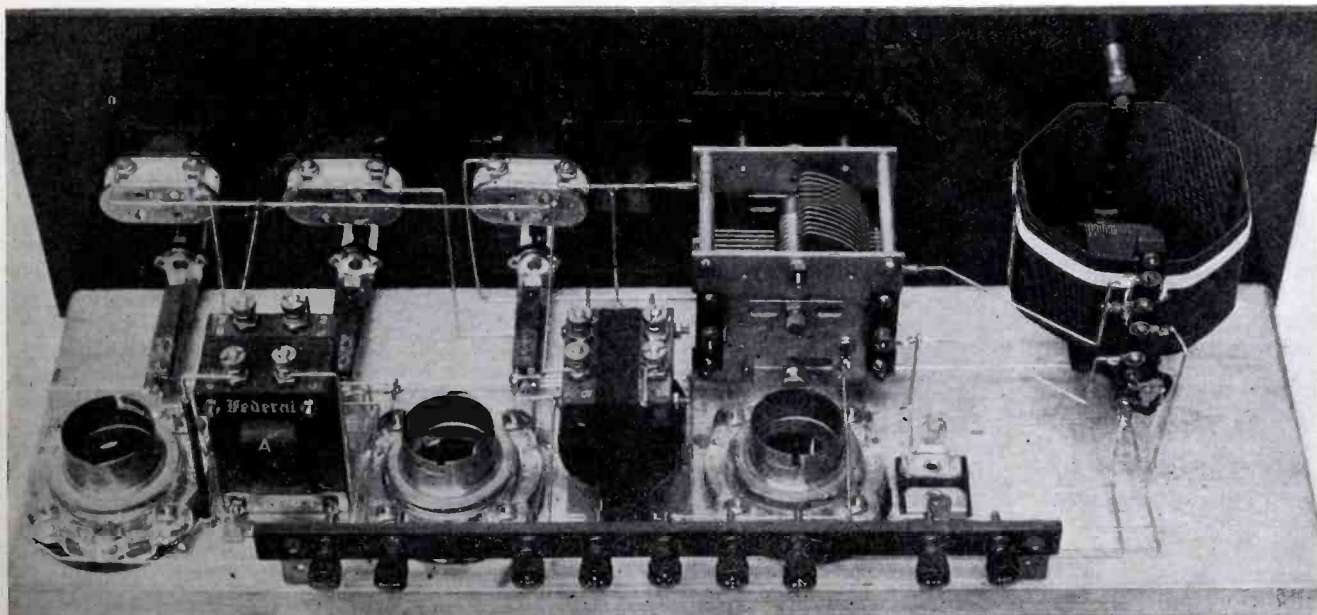
We have said this many times before, but there are still those who do not see the reason for it. Let us take the dial readings for this particular tuner as an example. WEA F was tuned in at 66 on the condenser dial and WJZ at 45½. The former's wave was 492 and the latter, 455. Now if we are looking for a station whose wavelength is between 455 and 492 then we will know that on the dial this station should be received between the other two and the comparison of wavelength made with the dial readings. The curve for the National Condenser shunted across the tuner is unusually good. The stations are well separated and the tuning very sharp. The wavelength range of this receiver ran from below 200 meters to 575 covering, all possible broadcasting requirements with the exception of the few stations below 100 meters, for which special apparatus is necessary. The arrange-

ment of the condenser and coupler with respect to the detector tube is the most satisfactory arrangement. By so placing your instruments your grid leads as well as your other leads are made especially short. The wire runs from the stator plates of the variable condenser to the coil and from the other side of the tuning condenser to the grid condenser.

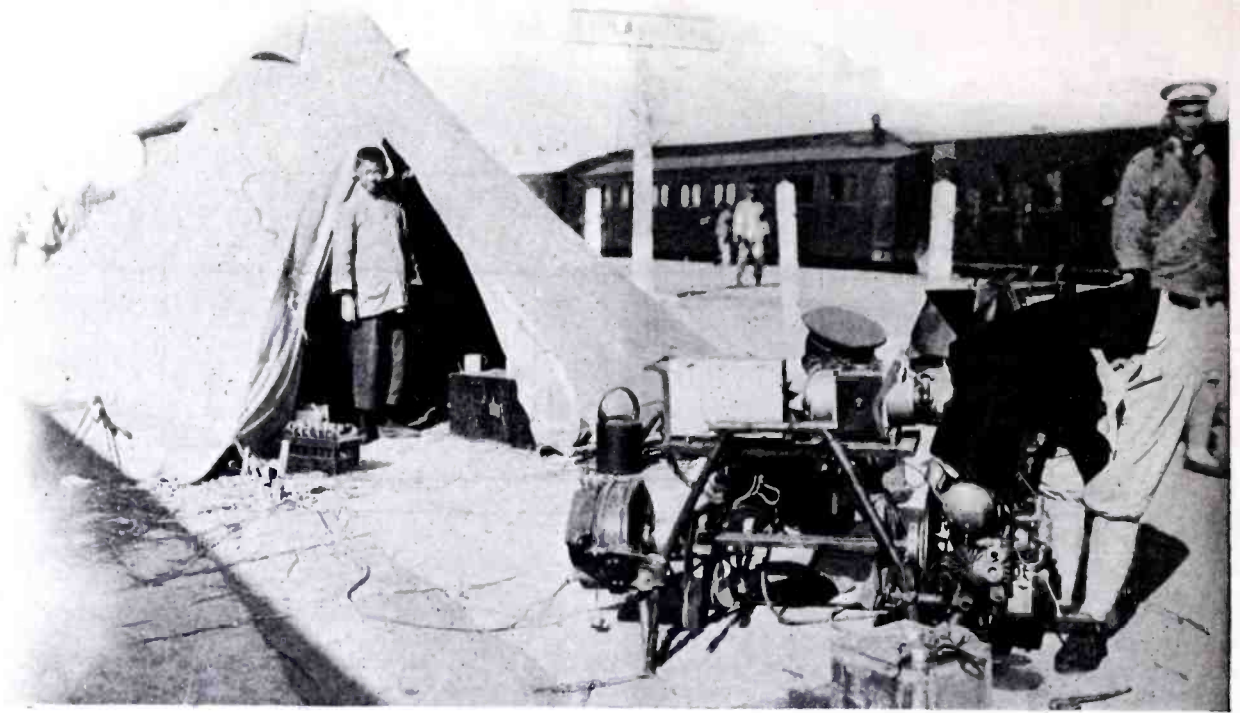
CONSTRUCTION OF THE LOW LOSS RECEIVER

SECURE for your baseboard for this receiver a piece of straight grained white pine and place your transformers and tube sockets on it temporarily so that you may make in your own mind a tentative lay-out for the placing of the instruments. A glance at the illustrations, particularly the one of the top view of the set will be helpful in this matter. The detector tube socket is directly behind the variable con-

(Turn to page 87)



By closely following this illustration, the wiring of the receiver will be easily accomplished. Note the short straight connections of bare bus-wire



WORLD WIDE NEWS

Photos by Radio—Turkish Government Admits Radio Sets—France, West Africa, and Madagascar Service—Island of Yap Station—Belgrade to Beirut Service

By *C. S. Anderson*

Managing Editor of Wireless Age

Photos by Radio

THE Radio Corporation of America has successfully demonstrated a new and practical method of transmitting photographs across the Atlantic by wireless.

More than a dozen pictures were sent from London to the offices of the Radio Corporation at No. 66 Broad Street, including photographs of Queen Alexandra and Ellen Terry, on November 30.

The transmission time was from twenty to twenty-five minutes for each picture. The pictures generally were recognizably good and it is understood the system can easily be refined to produce perfect results.

It will meet wide commercial application in the transmission of pictures, in the belief of the men who developed it.

General James G. Harbord, President of the Radio Corporation of America, said:

"It is not too much to say that we are on the eve of

developments whereby it will be within the realm of possibility to transmit a complete newspaper page from London to New York by means of radio and in a fraction of the time it would take to transmit the entire text of the page

either by radio or cable telegraph signals."

According to Mr. Ranger, the engineer who is in charge of the work, the new system rests on a "time element," or varying lengths of life of electrical impulses, rather than on the varying intensity of a continuous electric current.

This is an inherent advantage, making trans-oceanic transmission of pictures possible for the first time and minimizing the effect of static and all interference.

The necessary apparatus is the result not only of the co-operative work of the company's engineers but of the General Electric Company, whose recently developed photo-electric cell is the "eye" of the transmitter.

It is compact, inexpensive apparatus which is simply superimposed on existing radio facilities. The chief expense of transmitting a photograph, therefore, lies in the time required and further development already contemplated will reduce this to a minimum.



President Kalenin of Russia using radio to broadcast his address to the all-Russian Council of Soviets

Station on Island of Yap

THE Japanese Government is planning to erect a large wireless station on the island of Yap in the Pacific Ocean at a cost estimated at 1,500,000 yen. Construction work on the new station is expected to be started early this year. It was stated in official circles that the plan of the Japanese Government is in accordance with the treaty between the United States and Japan concerning Yap and other mandated islands in the Pacific Ocean, which was signed at Washington at the time of the Disarmament Conference.

While Japan will be in possession of the wireless station, all other interested nations will be able to share the communication facilities and may make use of the station for relaying purposes.

Turkish Authorities Admit Radio Receivers

THE Turkish Government has admitted on principle the installing of private radio receivers all over Turkey, but radio transmitters for private use are strictly forbidden.



Winston Churchill using the radio public loudspeaker system in an address to the British electorate

France, West Africa and Madagascar Service

ON November 27, the Minister of Colonies and the Assistant-Secretary of State of P. T. T., inaugurated the official opening of radiotelegraphic communications between France and Madagascar (Tananarive) and between France and West Africa (Bamako). The ceremony was held at 9 a. m. at the Ministry for Public Works. Wireless messages can now be sent from the colonies to France.

Barkhauser of Dresden, Germany. A piece of soft iron is inserted in a coil of 17,000 turns of 3-m. wire. The coil is attached to an amplification set, which in turn is connected to headphones or a loud speaker.

Belgrade to Beirut Service

A RADIOTELEPHONIC service is being actually carried out on a regular schedule between Belgrade (Jugoslavia) and Beirut (Asia Minor) by the French Radio-Orient Company.



Broadcasting in Cuba has met with popular approval, as evidenced by this street scene at San Jose de las Lajas, Station PWX is broadcasting the program

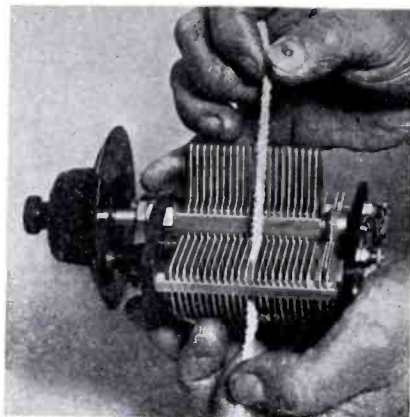
Trouble Shooting

Learn the proper care of your set and accessories—
Clean apparatus in the receiver means clear and
better reception

By *Robert Alan*

THE suggestions embodied in this article record the advice given during six months' work in answering phone calls and letters inquiring into the difficulties that the owners of radio sets are beset with in the course of time. After all there are not so many awfully wrongs that can happen to a receiver, and most of them can be obviated by proper observance of the meaning of the one word "CARE." This is, of course, presuming that your set at one time did behave as a well designed radio set should behave. For those that have never reached that state we refer you to past issues of *WIRELESS AGE* and to articles entitled "How to Re-animate a Dead Receiver."

The worst enemy of a radio set is dust. A pinch of dust can cause more trouble in a superlopadyne than anything we know of. The queer part about this is that the dust may be removed easier, and the trouble relieved with less labor, than one would suppose after gazing at five blown out tubes, or a shorted B battery, or a condenser with plates which touch. The simple application of a soft paint brush and very little elbow grease removes this item, and we recommend that you take this prescription in doses varying from once a month to once every five minutes, depending upon the volume of dust in your parlor. Variable condenser plates are the chief hiding place of dust. This may not seem so important since the area of one molecule of dust is incredibly small, but two units of dust and a few more can be measured in thousandths of an inch, and the spacing of the plates in a variable condenser is only a few thousandths of an inch. So you see if you have a good dusty condenser it soon becomes a very good grid leak which of course gives very nice broad tuning—all the local stations all the time—BUT it has a great tendency to keep out the outside stations and your DX soon becomes nil. Now instead of



The "pipe cleaner" method of removing dust particles from between the condenser plates. Be very careful not to disturb the alignment of the plates

dashing wildly to the dealer and trying to convince him that your radio set is no longer functioning, get a simple pipe cleaner and run it between the plates of the condenser. Don't do this as if you were cleaning your teeth, because the condenser plates can be damaged even if your teeth cannot be. This cleaning performed on a good variable condenser will keep your set in operation, all other parts being in order.

Next comes that \$21.00 storage bat-



Removing collected dust and copper sulphate from the top of your batteries insures a longer life for the battery and less noise in your receiver

tery that you had to work two weeks to earn the money to buy. A storage battery is a very wonderful device, but it should be treated like a watch, only more so. In the first place, your connections from your set to your storage battery should be made with rubber covered wires with clips on the ends. If the wires are fastened to the battery directly the action of the acid fumes on the copper will shortly leave you no connection at all. The acid eats the copper connections and the copper sulphate which is left collects around the terminals of the battery. This gathers in a film across the top of the individual cells and produces more or less of a short circuit. This is not relieved by opening the switch to your set, for you still have more or less of a closed circuit. The best remedy for this is a piece of paper or a cloth with which you can clean the top of the battery. This should be done each time the battery is charged. Keep dust away from the vent caps of the cells. This will prevent a possibility of dust getting into the electrolyte. A quantity of sediment or foreign matter in the electrolyte will very shortly ruin it.

Another favorite form of trouble is the lightning arrestor, and remember this right now, that the Flim Flam Special Lightning Arrestor will never arrest lightning in this world and does not pass the Fire Underwriters' Regulations even though it may ease your misguided conscience. If you have been operating a set without an arrestor, satisfied with the idea that the Fire Underwriters and your insurance man have not caught you yet, but you now feel that you really ought to have one so that you may mingle in the best society, be sure that you get a good one, and before you hook it up, put it on a closed battery circuit—that is one dry cell, one pair of phones and the lightning arrestor. If you get a click through the lightning arrestor the instrument is shorted and

should be returned. If you do not get the click you can be sure that it will not affect the operation of the set. Now in connecting up your lightning arrester observe that there are two posts. One of these should go to the aerial and to the aerial binding post on the set; the other should go to the ground and the ground binding post of the set.

About 50 per cent. of the noise in a radio set comes from the tube socket. The tube socket is one of the best little dust collectors that can be had. We are supposing that you bought a good socket in the first place, or at least had good sockets in your receiver; if you didn't the alternative is to put them in. The end of a tube prong is a drop of solder which is a lead composition. You have seen this when it was shiny, and also when it was dull with perhaps seven shades of green copper sulphate decorating it. A little piece of emery paper or your wife's nail file will shine up these prongs and insure that millionth of a microwatt signal energy from the station on the other side of the world reaching your tube, not greatly diminished in strength.

However, this will not do it alone. The socket contacts must be clean too. Now in cleaning these be careful not to bend the prongs down so that they lose their shape or their elasticity. They should make very firm contact with the terminals of the tube. If you get that combination of hash and clicks in your set and you can't attribute it to anything else you can be pretty sure that the trouble is in your tube sockets or your tube contacts. The paint brush, with which we removed the dust from the rest of the set, comes in very handy here.

Now even though this has taken us a long time to tell you, it does not follow that the entire operation of house cleaning in your pet regenerative receiver will take anywhere near that long. About five minutes' work will see the job done well, and we again recommend that you perform the house cleaning frequently and a good time to remember when "frequently" is, is when you charge your storage battery.

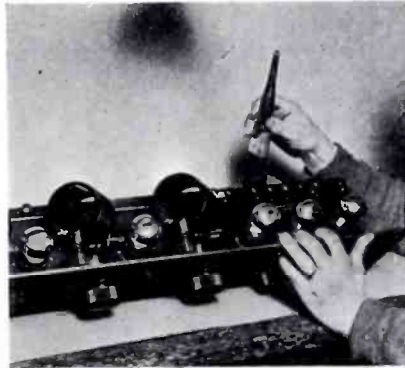
EVERY radio fan has heard of "body capacity" until he is tired of it, and it is safe to say that nearly every fan has had his own troubles with it. Most of them would have better luck if they had a better understanding of what it really is. What is this mysterious force that often upsets the finest tuning with unruly squeals, and what is the best way to prevent its effects?



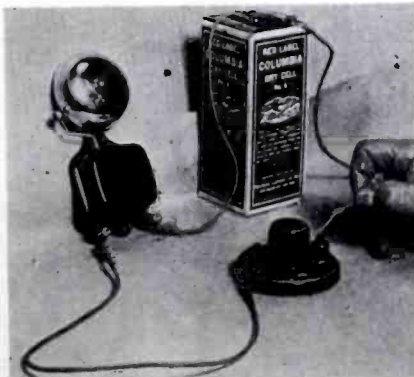
Bending up the tube socket contact prongs is good practice provided the prongs are made of elastic springy metal



The application of a fine file or emery paper to the tube contacts makes for better contact and a quieter set



In the hard-to-get-at nooks and corners of a radio receiver where you cannot remove dust with a cloth, a soft bristle paint brush does the trick



The right way and the quickest way of finding out whether or not your lightning arrester is arresting lightning or DX signals

Body capacity, or hand capacity, is the term applied to the property of the human body which makes it act as an electric condenser. Your body is not a good condenser. Compared to the variable condensers in a receiving set it has an extremely small capacity. The trouble is that even an extremely small variation in either capacity or inductance of a set can throw fine tuning out of adjustment.

Each time the operator's hand takes hold or lets go of a knob in the process of tuning, the capacity of the set varies by a small amount, because some of the body capacity is communicated to the set while the hand is in contact with it. Then you know too well what happens.

A very fine adjustment of the total capacity of a set can be obtained with modern vernier knobs for rotating the parts of the condensers, which supply practically all of the capacity of the circuit. In the same way a very fine adjustment of the total inductance is obtained by rotating the parts of the coils which supply nearly all of the inductance in the circuit. Thus these two elements in the set itself can be very closely controlled. Body capacity, while small enough in itself, is quite beyond control. That is why, if it is allowed to act on the set at all, it is likely to upset the whole apple cart.

Some radio enthusiasts who can build anything from a pocket crystal set to a super-heterodyne do not know just why this adjustment of capacity and inductance values is so important in its effect on reception. The reason, technically, is that when these values are properly related to each other for any given wave length the equivalent resistivity, or total equivalent resistance, of the circuit is reduced to the minimum. As the voltage supplied to the set by batteries or lighting circuit is constant, minimum resistance means maximum current. With the maximum current flowing through the set, you have reached the point of resonance—the point at which signals are strongest.

Attempts have been made to eliminate body capacity by various methods, but the most effective has been the protection of the panel, or in some cases of individual parts of the set, with a metallic shield. The shield, until recently, had to be applied either by the user or by the dealer, but an "anti-capacity" panel of hard rubber is now being made with a shield vulcanized in place. Shielding, while decreasing the effects of body capacity, does not detract in any way from the quality or volume of the tone.

In order to make shielding thoroughly effective, care must be used in making connections in the cir-

(Turn to page 90)

The Vacuum Tube as a Detector

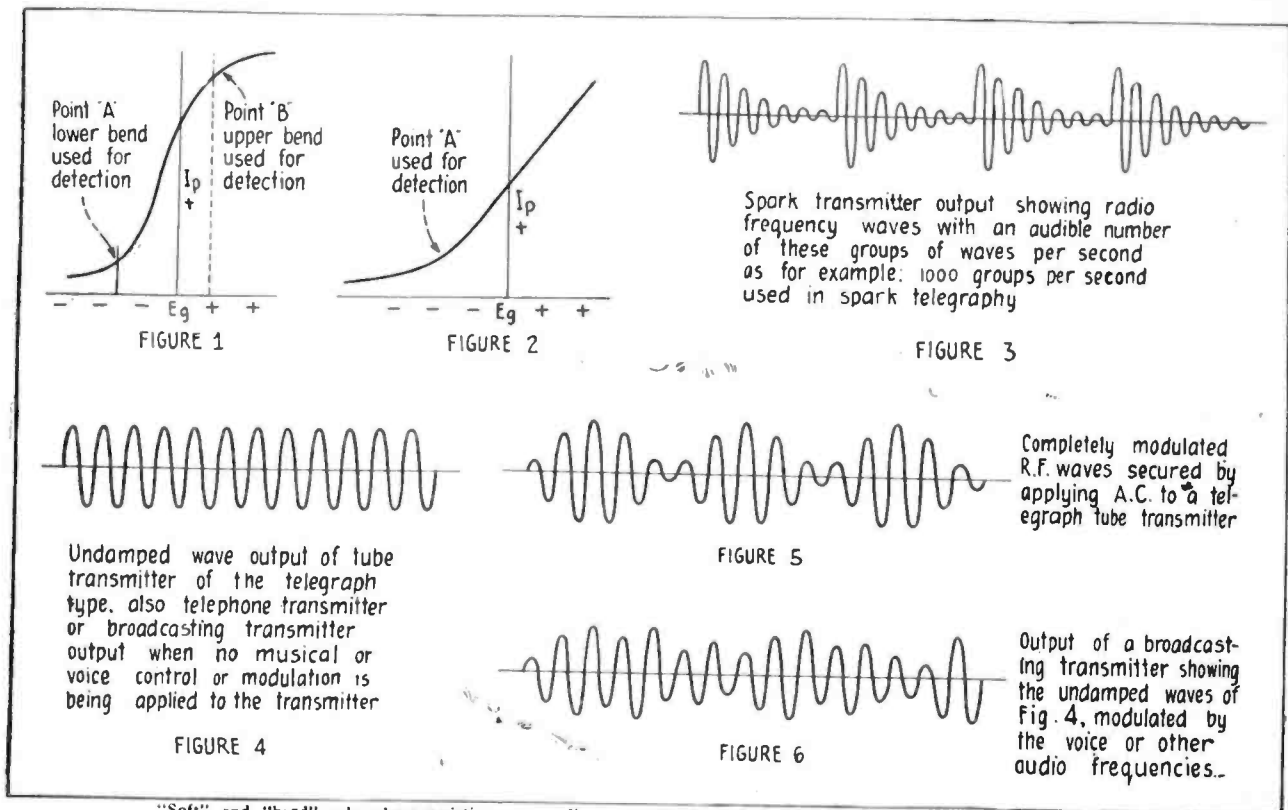
Reception of damped and undamped r. f. waves, and modulated c. w.—Grid-potential plate-current characteristic curves—Hard and soft detectors

By Donald Gordon Wade

IN the first of this series of articles concerning the operation of the vacuum tube we were concerned with the experimentation and mathematical interpretation in connection with the development of the character-

tubes, in fact, which may contain some small trace of a gas which has either been allowed to remain in the tube when it was evacuated or else which may have been deliberately introduced during the process of evacuation.

curve of the "soft" tube having very pronounced bends in its characteristic curve as illustrated in figure 1 at points A and B while the "hard" tube has a characteristic curve similar to figure 2 with a much slighter bend as illustrated



"Soft" and "hard" tube characteristic curves—diagrammatic figures of spark waves, and undamped and modulated continuous waves

istic curves of these tubes and with a general interpretation of these curves, while in this article we will deal with the specific application of these curves to an interpretation of their actions in receiving circuits; especially treating in this article the vacuum tube employed as a detector of radio frequency energy.

Generally speaking, there are two classes of vacuum tubes with respect to the degree of vacuum within the tube; namely, "hard" or high vacuum tubes, i. e., tubes which have had the air exhausted to the highest possible degree, or as it has been aptly stated, the most perfect "nothing," and "soft" or low vacuum tubes, i. e., tubes which have not been so highly evacuated or

"Hard" or high vacuum tubes are used as amplifiers of various sorts, such as radio frequency amplifiers, audio frequency amplifiers, direct current amplifiers, and as oscillators or generators of radio frequency or audio frequency energy; for the tube in its function as a generator actually functions as an amplifier. "Soft" or low vacuum tubes are to be found in use as detectors in receivers and as modulator or control tubes in transmitters. That they are not always used as detectors, for good and sufficient reasons, will be noted later.

"Hard" tubes and "soft" tubes are to be distinguished from each other by the shape of their grid-potential plate-current characteristic curves, the

by the bend at point A. In the curves usually given of "hard" tubes it is not common to include the upper bend of the curve, though it is always present, for this is a point on the characteristic curve which is avoided in normal operating practice, and if it is found advisable to use it for some special experimentation it is common for the experimenter to take his own curves of the particular tube which he is using, as general curves are not to be compared with specific curves for accuracy. It, however, is unnecessary to do this with the tube as used in the receiver, as laboratory methods and practice call for entirely different standards of accuracy, and the average man who operates a receiver is not

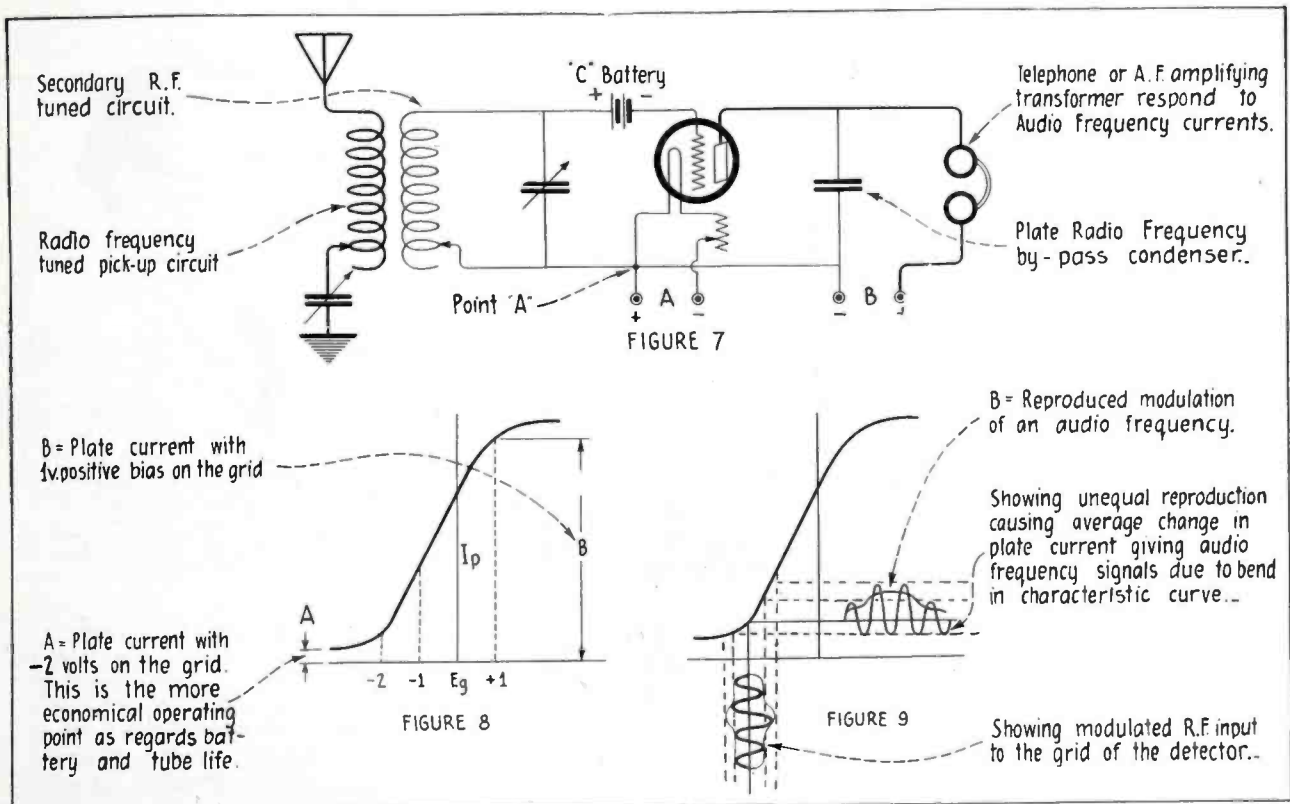
interested in obtaining the accuracy of the experimenter for even if he could attain this degree of accuracy, it would be impossible to maintain it in practice. The above statement is included for the benefit of those who might be inclined to criticize this article for not dealing with accuracies to the *n*th degree, which it does not do for the reason that they are of no interest to the majority of those who will read this article.

There are several types of radio frequency energy with which the detector must deal. They are: damped radio frequency waves such as come from a spark transmitter, as illustrated in figure 3; undamped radio frequency waves, which are the output of a tube transmitter which is used for telegraph

In fact any source of audible sound may be used to modulate the signals from the transmitter. We are going to deal with all of these various wave forms in order to answer the question that has been asked many times as to the reason for a broadcast receiver picking up telegraph signals, for if we are able to show the similarity of reception of these various forms of signal energy, the reason for the broadcast receiver picking them up will be self-evident.

Another question often asked in connection with the functioning of the vacuum tube is as to the reason for the same tube acting as a detector in one circuit, but functioning as an amplifier of either radio or audio frequency currents when placed in

by simply adjusting our output circuit to the audio frequency currents and neglecting the radio-frequency currents we may use the latter and have no difficulty in doing away with the former. If for example we consider the figure 7, which is a simple tuning and detecting circuit, the energy is taken from the air by the first tuned radio frequency circuit by virtue of the fact that is tuned to oscillate or vibrate, electrically, at the same speed as that of the wave which it is to pick up. This wave coming to the antenna sets this circuit oscillating. This first tuned radio frequency circuit then passes on the energy to the second radio frequency tuned circuit by the same means as was employed by the first circuit to pick the energy out



Receiving circuit diagram and grid-potential plate-current characteristic curves

purposes when used with a direct current input to the tubes, as shown in figure 4; completely modulated continuous waves which are the result of applying alternating current to the tube transmitter, as illustrated in figure 5; and voice modulated continuous waves which result from modulating, that is moulding or shaping the continuous waves as illustrated in figure 4, by means of the human voice, which results in a wave having a shape similar to figure 6. It is with this last form of wave that the broadcast listener is most particularly concerned, as it is this form of wave which comes into his detector to be employed in giving him entertainment through musical instruments.

another or perhaps in another position in the same circuit. The reason for this is that the incoming radio frequency energy in the detector tube is also present in the output circuit of the tube. In fact, it is this so-called radio frequency component of the plate current which is used to make regeneration possible. However, in the tube which is employed merely as a detector it is our wish to put radio frequency currents into the tube and to get audio frequency currents out of the tube and therefore even if we do have radio frequency currents in the plate or output circuit of our tube in addition to the desired audio frequency currents,

of the air, that is, it is tuned to the same frequency as that of the first oscillating circuit. During all of this time the radio frequency energy, if it is coming from a broadcasting transmitter is of the general form of the wave as illustrated in figure 6. The tube which we are going to use as a detector has a characteristic curve of the shape shown in figure 1, that is, one with a sharp bend in the curve. We will take this curve and note that the two bends on the curve occur at the points where the grid is 2 volts negative and 1 volt positive with respect to the filament. This operating point is regulated by the "C" battery

(Turn to page 88)

ON THE AIR

THIS MONTH

HERE AND THERE WITH THE BROADCASTERS



And this—little dears—is "Uncle Bob" Wilson telling another one from KYW. Bedtime stories is his specialty on the air, but we'll wager he knows a few. . . . for that matter just gaze at him and then tell us you don't believe it!



Wendell Hall, broadcast artist at large, impersonating Santa Claus to the accompaniment of his "Uke." And we are not abusing any confidences when we say that Wendell knows what he is doing



Grinning from left to right: Ernest Hare, Larry Briars and Billy Jones; the Happiness Boys at WEA. Not that we care to insinuate—nor even to raise the question—BUT why the hands in the hip pockets and the fair weather mirth? Broadcasting is very serious nonsense



Edward H. Smith, director and leading man of the WGY Players. Look at him—just now he is thinking. And when Edward thinks—it's time to tune in on Schenectady



Dr. Ralph L. Power, telling the world all about it from KFI, the home-town station of Loz Angelaz. And when he gets through saying whatever is on his mind Dr. Power writes it down and has it published in various forms

A PHYSICAL CULTURE instructor, broadcasting from one of the large stations, received a letter thanking him for the fine exercises broadcast every morning at 7:30, the listener saying that he listened in bed. The physical-culture instructor replied that he was glad to hear from his lazy listener, and added, "I broadcast the exercises—lying in bed."



Josiah Zuro broadcasting from WNYC—He is the conductor of the Sunday Symphonic Society and Director of Music at the Rialto, Rivoli and Criterion theatres in New York

C HARLIE CHAPLIN successfully broadcast a neat bit of pantomime when he announced that he would play a violin solo, 'cello solo, flute solo, trombone, and drum, his audience marveling that Charlie could play even one of the instruments named. Then he announced that he would play them all at once! His orchestra, of course, obliged, and the B.C.L.'s still marveled.



BROADCASTING STATION DIRECTORY

The Most Authentic, Up-to-the-Minute List of Stations Broadcasting in the United States, Canada, England, France, Cuba and other countries.

KDKA	Westinghouse Electric & Mfg. Co., East, Pittsburgh, Pa.	326	KFNG	Women's Radio Shop.....Coldwater, Miss.	254	KWH	Los Angeles Examiner.....Los Angeles, Cal.	360
KDPM	Westinghouse Electric & Mfg. Co., Cleveland, O.	270	KFNJ	Central Mo. State Teachers College.....Warrensburg, Mo.	234	KYQ	Electric Shop.....Honolulu, Hawaii	270
KDPT	Southern Electrical Co., San Diego, Cal.	244	KFNK	Radio Broadcast Association.....Pasadena, Cal.	246	KYW	Westinghouse Elec. & Mfg. Co., Chicago, Ill.	336
KDYL	Newhouse Hotel.....Salt Lake City, Utah	280	KFNV	L. A. Drainie, 305 Third St.....Santa Rosa, Cal.	246	KZM	Preston D. Allen, 13th & Franklin Sts., Oakland, Cal.	360
KDYM	Savoy Theatre.....San Diego, Cal.	280	KFNY	Montana Phonograph Co.....Helena, Mont.	231	WAAB	Valdemar Jensen, 137 S. St. Patrick St., New Orleans, La.	268
KDYQ	Oregon Institute of Technology, Portland, Ore.	240	KFNF	Royal Radio Co.....Burlington, Cal.	231	WAAC	Tulane University.....New Orleans, La.	268
KDZB	Frank E. Siefert, Baker's Bldg., Bakersfield, Cal.	240	KFNG	Rhodes Dept. Store.....Seattle, Wash.	455	WAAD	Ohio Mechanics Institute.....Cincinnati, Ohio	360
KDZC	Rhodes Department Store.....Seattle, Wash.	270	KFOA	First Christian Church.....Whittier, Cal.	224	WAAF	Chicago Daily Driver's Journal.....Chicago, Ill.	286
KDZR	Bellingham Publishing Co., Bellingham, Wash.	261	KFOB	The Radio Shop.....Marshallfield, Ore.	240	WAAM	I. R. Nelson Co.....Newark, N. J.	263
KFAD	McArthur Bros. Mercantile Co., Phoenix, Ariz.	360	KFOR	Rhodes Electric Co.....Whittier, Cal.	224	WAAN	University of Missouri.....Columbia, Mo.	254
KFAE	State College of Washington, Pullman, Wash.	278	KFOS	Moberly High School Radio Club.....Moberly, Mo.	246	WAAW	Omaha Grain Exchange.....Omaha, Neb.	286
KFAF	Western Radio Corporation.....Denver, Colo.	360	KFOL	Lestlie M. Scharfuch, 502 W. Marion St., Marengo, Iowa	234	WABB	Harrisburg Sporting Goods Co., Harrisburg, Pa.	266
KFAJ	University of Colorado.....Boulder, Colo.	360	KFON	Echophone Radio Shop.....Long Beach, Cal.	234	WABD	Lake Shore Tire Co.....Sandusky, Ohio	240
KFAN	The Electric Shop.....Moscow, Idaho	360	KFOO	Latter Day Saints University, Salt Lake City, Utah	261	WABI	Bangor Railway & Electric Co., Bangor, Me.	240
KFAR	Studio Lighting Service Co. (O. K. Olsen), Hollywood, Cal.	280	KFOR	David City Tire & Electric Co., David City, Neb.	226	WABL	Connecticut Agricultural College.....Storrs, Conn.	283
KFAU	Independent School District of Boise City, Boise High School, Boise, Idaho	270	KFOT	Colosse Hill Radio Club.....Wichita, Kans.	231	WABM	F. E. Doherty Automobile & Radio Equipment Co., Columbus, Ohio	254
KFAW	The Radio Den.....Santa Ana, Cal.	280	KFOX	Hommel Manufacturing Co.....Richmond, Cal.	234	WABN	Off. Radio, Inc., 1627 State St., La Crosse, Wis.	244
KFAY	Virginia's Radio Service.....Medford, Ore.	283	KFOY	Technical High School.....Paul, Minn.	226	WABP	Lake Ave. Baptist Church, Rochester, N. Y.	283
KFBB	F. A. Buttery & Co.....Havre, Mont.	360	KFOZ	Beacon Radio School.....Fort Smith, Ark.	233	WABQ	Robert F. Weing, 522 Wooster Ave., Ioror, Ohio	266
KFCB	W. K. Azbill.....San Diego, Cal.	278	KFGA	Leon Hudson Real Estate Co., Fort Smith, Ark.	233	WABR	Haverford College Radio Club.....Haverford, Pa.	261
KFCB	Reuben H. Horn.....San Francisco, Cal.	278	KFGC	Gardner & Dennis.....Los Angeles, Cal.	238	WABS	Scott High School.....Toledo, Ohio	270
KFBE	First Presbyterian Church.....Tacoma, Wash.	360	KFGD	Howard C. Mallander, 992 Lake St., Salt Lake City, Utah	242	WABT	First Baptist Church.....Camden, N. J.	225
KFBG	Kimball-Union Co.....Sacramento, Cal.	283	KFGE	C. C. Baxter, 205 Grafton St., Austin, Texas	242	WABU	College of Wooster.....Wooster, Ohio	234
KFBK	Leslie Bros.....Everett, Wash.	224	KFGL	New Furniture Co.....Greenville, Texas	242	WABV	Henry B. Joy.....Mount Clemens, Mich.	270
KFBK	Trinidad Gas & Electric Supply Co., and Chronicle News, Trinidad, Colo.	280	KFPM	Missouri National Guard, 70th Infantry Brigade, Jefferson City, Mo.	242	WABY	John Magaldi, Jr., 815 Kimball St., Phila., Pa.	242
KFBU	The Cathedral.....Phoenix, Ariz.	238	KFPD	Colorado National Guard, Forty-fifth Division Tank Co., Denver, Colo.	231	WABZ	Coliseum Place Baptist Church, New Orleans, La.	263
KFCB	Niles Radio Supply Co.....Phoenix, Ariz.	238	KFPF	G. & G. Radio & Electric Shop, Olympia, Wash.	236	WABA	St. John's College, New York, N. Y.	270
KFCF	Frank A. Moore.....Walla Walla, Wash.	360	KFPG	Los Angeles County Forestry Department, Los Angeles, Cal.	231	WBAA	Purdue University.....West Lafayette, Ind.	283
KFCF	Leslie E. Rice, Los Angeles Union Stock Yards, Los Angeles, Cal.	236	KFPH	Cope & Johnson.....Salt Lake City, Utah	268	WBAB	Wireless Phone Corporation.....Paterson, N. J.	244
KFCP	Ralph W. Flyvare.....Houston, Texas	360	KFPJ	Heintz & Kohlmoos.....San Francisco, Cal.	236	WBAC	James Millikin University.....Decatur, Ill.	275
KFCV	Western Union College.....Le Mars, Iowa	252	KFPK	St. John's Church.....Pinole, Calif.	242	WBAP	Wortham-Carter Publishing Co. (Star-Telegram), Fort Worth, Texas	476
KFCZ	Omaha Central High School.....Omaha, Neb.	258	KFPQ	First Presbyterian Church.....Spokane, Wash.	283	WBAX	Ermer & Hopkins Co., Wilkes-Barre, Pa.	360
KFDD	St. Michael's Cathedral.....Boise, Idaho	252	KFQA	The Principia, 5539 Page Ave., St. Louis, Mo.	261	WBAY	The Western Electric Co., New York, N. Y.	492
KFDD	University of Arizona.....Tucson, Ariz.	360	KFQB	Searchlight Publishing Co., Fort Worth, Texas	254	WBBB	Barbey Battery Service.....Healding, Pa.	234
KFDF	Oregon Agricultural College.....Corvallis, Ore.	226	KFQC	Kidd Brothers Radio Shop.....Taft, Cal.	280	WBBF	Georgia School of Technology.....Atlanta, Ga.	248
KFDH	Knights-Campbell Music Co.....Denver, Colo.	226	KFQD	Chovin Supply Co., Radio Laboratories, Dickenson, Henry, Radio Laboratories, Colorado Springs, Colo.	224	WBBG	Irving Yerville, Mattapoisett, Mass.	248
KFDI	Magnolia Petroleum Co.....Beaumont, Texas	306	KFQE	Donald A. Bout, 254 Pleasant St., Minneapolis, Minn.	224	WBBH	J. Irving Bell, 1511 Gordon St., Port Huron, Mich.	246
KFDJ	First Baptist Church.....Shreveport, La.	360	KFQG	Southern California Radio Association, Exposition Park, Los Angeles, Cal.	226	WBBL	Grace Covenant Church.....Richmond, Va.	283
KFDK	South Dakota State College.....Brookings, S. D.	360	KFQH	Albert Sherman, Hillsborough Box 5, Burlingame, Cal.	231	WBBP	Petoseky High School.....Petoskey, Mich.	246
KFDZ	Harry O. Iverson.....Minneapolis, Minn.	248	KFQI	Thomas H. Inc Corp.....Culver City, Cal.	234	WBBQ	Peoples Pulp Association.....Brooklyn, Mich.	273
KFEC	Melzer & Frank.....Denver, Colo.	254	KFQJ	Harbour-Lonkmeir Co., Oklahoma City, Okla.	236	WBBR	First Baptist Church.....New Orleans, La.	252
KFED	Winger Radio Corp.....Bank Oak, Neb.	268	KFQK	Democrat Leader.....Berwyn, Mo.	236	WBBT	Lloyd Brothers.....Philadelphia, Pa.	234
KFER	Serogin & Co.....Bank Oak, Neb.	268	KFQL	Oklahoma Free State Fair Association, Muskogee, Okla.	252	WBBU	Jenks Motor Sales Co., Monmouth, Ill.	242
KFER	Auto Electric Service Co., Fort Dodge, Iowa	231	KFQM	Texas Highway Bulletin.....Austin, Texas	268	WBBV	Johnstown Radio Co., Johnstown, Pa.	246
KFEX	Augsburg Seminary.....Minneapolis, Minn.	261	KFQN	Third Baptist Church.....Portland, Oregon	283	WBBW	Ruffner Junior High School.....Folsom, Va.	222
KFEY	Bunker Hill & Sulphur Mining Co., Kellogg, Idaho	360	KFQR	Melzer Radio Shop.....Russell, Kansas	261	WBBX	North Light Infantry, Charleston, S. C.	268
KFFB	Jenkins Furniture Co., Boise, Idaho	240	KFQS	Walter L. Ellis, 625 East 6th St., Oklahoma City, Okla.	250	WBL	T & H Radio Co., Indianapolis, Ind.	227
KFFE	Eastern Oregon Radio Co., Pendleton, Ore.	360	KFQT	Texas National Guard, Thirty-sixth Signal Co., Denison, Texas	252	WBS	D. W. May (Inc.), Newark, N. J.	360
KFFP	First Baptist Church.....Moberly, Mo.	266	KFQU	W. Riker.....Holy City, Cal.	234	WBZ	Southern Radio Corp., Charlotte, N. C.	360
KFFR	Nevada State Journal.....Spice, Nev.	226	KFQV	Omaha Grain Exchange.....Omaha, Neb.	231	WCAH	Westinghouse Elec. & Mfg. Co., Springfield, Mass.	337
KFFV	Grace Land College, Grace, Kans.	280	KFQW	C. F. Krieger Photo, Radio, North Bend, Wash.	248	WCAD	St. Lawrence University.....Canton, N. Y.	280
KFFG	Louisiana College for Women, Baton Rouge, La.	275	KFQX	Alfred M. Hubbard, 310 Green Bldg., Seattle, Wash.	233	WCAE	Kaufmann & Baer Co., Pittsburgh, Pa.	462
KFFG	Louisiana State University.....Baton Rouge, La.	254	KFQY	Farmers State Bank.....Balden, Neb.	273	WCAG	Clyde R. Randall, 2813 Calhoun St., New Orleans, La.	268
KFFD	Oklahoma College for Women, Chickasha, Okla.	252	KFQZ	Taft Radio Co., 5653 De Longpre, Hollywood, Cal.	240	WCAJ	Entrekin Electric Co., Columbus, Ohio	286
KFFG	Oklahoma State University.....Stillwater, Okla.	273	KFRA	Marvin S. Olson.....Carver, Minn.	280	WCAK	University of Nebraska, Lincoln, Neb.	280
KFFH	Leland Stanford University, Stanford, Calif.	234	KFRB	Radioart Studio.....San Francisco, Cal.	280	WCAL	St. Olaf College.....Northfield, Minn.	360
KFFI	Craty Hardware Co., Ardmore, Okla.	226	KFRF	W. R. Brown.....Alexandria, La.	242	WCAP	Southern Radio Corp., Baltimore, Md.	275
KFFJ	University of North Dakota, Grand Forks, N. D.	280	KFRG	Cleveland High School.....St. Louis, Mo.	268	WCAR	Cheapeake & Potomac Telephone Co., Washington, D. C.	469
KFFK	Electric Construction Co., Valley Radio Division, Grand Forks, N. D.	280	KFRH	The Radio Shop.....Grafton, N. D.	268	WCAS	Southern Radio Corp. of Texas, San Antonio, Texas	360
KFFL	Ashley, C. Dixon & Son.....Stevensville, Mont.	258	KFRI	Reynolds Radio Co., 1534 Glenasm St., Denver, Colo.	224	WCAT	Wm. Hook Dunwoody Industrial Institute, Minneapolis, Minn.	280
KFFM	Iowa State Teachers College, Cedar Falls, Iowa	246	KFRJ	Guy Simmons, Jr., 515 Clifton St., Conway, Ark.	250	WCAT	South Dakota State School of Mines, Rapid City, S. D.	240
KFFJ	Tunwall Radio Co., Fort Dodge, Iowa	246	KFRK	Men's Club of First Presbyterian Church, Grand Forks, N. Dak.	240	WCAU	Durham & Co., Philadelphia, Pa.	286
KFFZ	Texas National Guard, 112th Cavalry, Fort Worth, Texas	254	KFRM	Lieut. James P. Boland, U. S. A., Fort Sill, Okla.	263	WCAV	J. C. Dice Electric Co., Little Rock, Ark.	360
KFKA	Colorado State Teachers College, Greeley, Colo.	273	KFRN	M. Laurence Short.....Hanford, Cal.	224	WCAY	Milwaukee Civic Broadcasting Station, Hotel Antlers, Milwaukee, Wis.	266
KFKB	Brinkley-Jones Hospital Association, Winifred, Kan.	286	KFRS	Curtis Printing Co., 1109 8th Ave., Fort Worth, Texas	246	WCBA	Charles W. Heimbach, 1015 Allen St., Allentown, Pa.	280
KFKC	Conway Radio Laboratories.....Conway, Ark.	283	KFRX	J. Gordon Klemgaurd.....Ft. Worth, Texas	246	WCBC	University of Michigan, Ann Arbor, Mich.	280
KFKV	F. F. Gray, 3200 Richardson St., Butte, Mont.	283	KFSG	Echo Park Evangelistic Association, Los Angeles, Cal.	278	WCBD	Willbur G. Voltra.....Zion, Ill.	356
KFKX	Westinghouse Electric & Mfg. Co., Hastings, Neb.	341	KFSY	Van Biarloom Co., 20 So. Main St., Helena, Mont.	261	WCBE	Uhart Radio Co., New Orleans, La.	263
KFKZ	Nassour Bros. Radio Co., Colorado Springs, Colo.	234	KGB	Tacoma Daily Ledger.....Tacoma, Wash.	252	WCBG	Howard S. Williams.....Pasadena, Mass.	268
KFLA	Abner R. Willson, 1321 W. Blatnum St., Fort Worth, Texas	254	KGG	Hallock & Watson Radio Service, Portland, Ore.	360	WCBI	University of Mississippi.....Oxford, Miss.	248
KFLB	Signal Electric Mfg. Co., Menominee, Mich.	283	KGO	General Electric Co., Oakland, Cal.	312	WCCK	Nicoll, Duncan & Rush.....Bemis, Tenn.	244
KFLC	National Educational Service.....Denver, Colo.	268	KGU	Marion A. Mulroy.....Honolulu, Hawaii	360	WCBL	E. Richard Hall, 2801 Central Ave., St. Petersburg, Fla.	266
KFLD	Bizzell Radio Shop.....Little Rock, Ark.	261	KGV	Portland Morning Oregonian.....Portland, Ore.	252	WCBM	Northern Radio Mfg. Co., Houlton, Me.	280
KFLR	University of New Mexico.....Albuquerque, N. M.	254	KGY	St. Martin's College.....Keokuk, Iowa	360	WCBN	Charles Schwarz, Charles and North Aves., Baltimore, Md.	228
KFLU	Rio Grande Radio Supply House, San Benito, Texas	236	KH	Times Mirror Co., Los Angeles, Cal.	395	WCBO	Radio Shop (Inc.).....Memphis, Tenn.	250
KFLV	Swedish Evangelical Mission Church, Rockford, Ill.	229	KHQ	Louis Wassmer.....Seattle, Wash.	360	WCBP	First Baptist Church.....Nashville, Tenn.	360
KFLW	Missoula Electric Supply Co., Missoula, Mont.	234	KHJ	C. O. Gould.....Stockton, Cal.	273	WCBS	Charles H. Messer.....Providence, R. I.	248
KFLX	George R. Clough, 1314 40th St., Galveston, Texas	270	KHR	Northwest Radio Service.....Seattle, Wash.	283	WCCT	Clark University.....Worcester, Mass.	239
KFLZ	Atlantic Atlantic Co., Atlantic, Iowa	241	KHS	Bible Institute of Los Angeles, Los Angeles, Cal.	360	WCBU	Arnold Wireless Supply Co., Arnold, Pa.	254
KFMB	Christian Churches of Little Rock, Little Rock, Ark.	254	KHT	Warner Bros Radio Service Co., Oakland, Cal.	360	WCBV	Tulahoma Radio Club.....Tulahoma, Tenn.	222
KFMC	Morningside College.....Fayetteville, Ark.	261	KIU	Reynolds Publishing Co., Oakland, Cal.	509	WCBY	George P. Rankin, Jr., and Maitland Solomon, Macon, Ga.	256
KFMD	Morningside College.....Sioux Falls, Iowa	261	KL	San Joaquin Lt. & Power Corp., Fresno, Cal.	248	WCCE	Forks Electrical Shop, Buck Hill Falls, Pa.	268
KFMW	George W. Young, 2219 W. 7th Ave., Minneapolis, Minn.	231	KLJ	Loe Joquin Co., Tacoma, Wash.	360	WCCD	Washburn Crosby Co., 200 Chamber of Commerce, Minneapolis, Minn.	248
KFMX	M. G. Sateren, 127 Blanche St., Houghton, Mich.	266	KLH	Walter Herrlich.....Eureka Bay, Alaska	337	WCCF	Stix Baer & Fuller Dry Goods Co., St. Louis, Mo.	360
KFMZ	Carleton College.....Northfield, Minn.	283	KLN	"Hollywood" Los Angeles Evening Express, New Mexico College of Agriculture and Mechanic Arts, State College, N. M.	360	WCCG	The Detroit Free Press.....Detroit, Mich.	517
KFNF	Henry Field Seed Co., Shenandoah, Iowa	266	KLO	Detroit Police Dept., Detroit, Mich.	286	WCCH	Tampa Daily Times.....Tampa, Fla.	360
			KLP	Hale Bros., San Francisco, Cal.	423	WCCJ	Kansas City Star.....Kansas City, Mo.	411
			KLQ	Apple City Radio Club, Hood River, Ore.	360	WCCK	J. Laurence Martin.....Amarillo, Tex.	263
			KLR	Douglas Hill Electric Co., Pittsburh, Pa.	270	WCCL	Trinity Methodist Church (South), El Paso, Tex.	268
			KLS	Chas. D. Herold, 467 First St., San Jose, Cal.	360	WCCM	Lit Bros., Philadelphia, Pa.	393
			KLV	Berkeley Daily Gazette.....Berkeley, Cal.	275	WCCN	Sam Walte's Radio Shop.....Worcester, Mass.	360
			KLW	Post Dispatch (Pulitzer Pub. Co.), St. Louis, Mo.	540	WCCO	Slocum & Kibben, New Bedford, Mass.	360
			KLX	First Presbyterian Church.....Seattle, Wash.	360	WCCP	Radio Equipment Corp., Fargo, N. D.	244
			KLY	Examiner Printing Co., San Francisco, Cal.	360	WCCQ	A. H. Waite & Co., Taunton, Mass.	229
			KLZ	Portable Wireless Telephone Co., Stockton, Cal.	360	WCCR	Kirk Johnson & Co., Lancaster, Pa.	258

WBDB Herman E. Burns..... Martinsburg, W. Va. 268
WBDF Robert G. Phillips..... Youngstown, Ohio 246
WBDB C. T. Sherer Co..... Worcester, Mass. 266
WBBI Radio Specialty Co..... St. Petersburg, Fla. 228
WBBI Richardson-Wayland Electrical Corp..... Roanoke, Va. 229
WBCK M. F. Broz, Furniture Hardware & Radio Co..... Cleveland, Ohio 248
WBDB Maine Electric Light and Power Co..... Bangor, Me. 252
WBDB Rollins College..... Winter Park, Fla. 241
WBDF Superior State Normal School, Superior, Wis. 261
WBDF Morton Radio Supply Co..... Salem, N. J. 234
WBDF Tremont Temple Baptist Church..... Boston, Mass. 256
WBDS S. M. K. Radio Corp..... Dayton, Ohio 283
WBDB Taylor's Book Store..... Hattiesburg, Miss. 236
WBDB Strand Theatre..... Fort Wayne, Ind. 258
WBDB The Radio Den..... Columbia, Tenn. 263
WBDB Otto Hausr, 158 Dyckman St., New York, N. Y. 213
WBDB North Star Congregational Church..... Chicago, Ill. 258
WBDB Boy Scouts of America, Ulster County Council, Kingston, N. Y. 233
WDM The Church of the Covenant, Washington, D. C. 234
WDZ J. L. Bush..... Tuscola, Ill. 276
WEAA Frank D. Fallain, Police Building, Flint, Mich. 280
WEAF American Telephone & Telegraph Co., N. Y. 492
WEAH Wichita Board of Trade..... Wichita, Kan. 280
WEAI Cornell University..... Ithaca, N. Y. 288
WEAJ University of South Dakota, Vermillion, S. D. 283
WEAM Borough of North Plainfield, N. J. 280
WEAN Shepard Co..... Providence, R. I. 273
WEAO The Ohio State University..... Columbus, Ohio 360
WEAP Mobile Radio Co..... Mobile, Ala. 360
WEAU Davidson Bros. Company..... Houston, Texas 360
WEAY Irla Theatre..... St. Louis, Mo. 273
WEB Bemwood Co..... St. Louis, Mo. 273
WEBA The Electric Shop..... Highland Park, N. J. 233
WEBB Walter C. Bridges..... Superior, Wis. 242
WEBB Electric Equipment Service Co., Anderson, Ind. 246
WEBB Roy W. Waller..... Cambridge, Ohio 248
WEBB Edgewater Beach Hotel Co..... Chicago, Ill. 370
WEBI Walter Gibbons..... Salisbury, Md. 242
WEBI Third Ave. Ry. Co..... New York City 273
WEBK Grand Rapids Radio Co., Grand Rapids, Mich. 226
WEBL R. C. A. United States (portable), New York City 273
WEBP Spanish Fort Amusement Park, New Orleans, La. 280
WEBQ H. T. Radio Co..... Harrisburg, Ill. 226
WEBR H. H. Howell..... Buffalo, N. Y. 240
WEBT Dayton Cooperative Industrial High School, Dayton, Ohio 270
WEBU De Land Piano & Music Co., Do Land, Fla. 258
WEBX Betholt College..... Retort, Wis. 283
WEBX Nashville, Tenn. R. R. No. 9, Franklin Pike, John E. Cain Jr. 263
WEBY Hubert Radio Co..... Rollinsdale, Mass. 226
WEBZ Savannah Radio Co..... Savannah, Ga. 280
WEW Hurlburt-Still Electrical Co., Houston, Texas 280
WEW St. Louis University..... St. Louis, Mo. 280
WFAA The Dallas News, The Dallas Journal, Dallas, Texas 476
WFAN Times Publishing Co., St. Cloud, Minn. 273
WFAN Hutchinson Electric Service Co., Hutchinson, Minn. 266
WFAV University of Nebraska..... Lincoln, Neb. 273
WFBG Eureka College..... Eureka, Ill. 240
WFBG William F. Gable Co., Altona, Pa. 261
WFBH Concourse Radio Corp., N. Y. C. 273
WFBK Galvin Radio Supply Co., Camden, N. J. 236
WFBK Dartmouth College..... Hanover, N. H. 286
WFBM Onondaga Hotel..... Syracuse, N. Y. 286
WFBM Merchants Heat & Light Co., 519 Guaranty Building, Indianapolis, Ind. 268
WFBN Radio Sales & Service Co., 1 Broad St., Bridgewater, Mass. 226
WFBQ Wynne Radio Co., 226 Fayetteville, Raleigh, N. C. 252
WFBR Fifth Infantry, Maryland N. G., Fifth Regiment Armory, Baltimore, Md. 254
WFBT Gloucester County Civic League, Pitman, N. J. 231
WFBV Commonwealth Radio Association, Boston, Mass. 395
WFBW Strawsbridge & Candler, Philadelphia, Pa. 395
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa. 248
WGAN Cecil E. Lloyd, 216 W. Romana St., Pensacola, Fla. 360
WGAQ Youres Hotel..... Shreveport, La. 252
WGAZ The South Bend Tribune, The South Bend, Ind. 360
WGBA Jones Elec. & Radio Mfg. Co., Baltimore, Md. 268
WGBS Gimbel Brothers..... New York City 316
WGI American Radio & Research Corp., Medford Hillside, Mass. 360
WGL Thomas F. J. Howlette, 2303 N. Broad St., Philadelphia, Pa. 370
WGN Drake Hotel..... Chicago, Ill. 370
WGR Federal Telephone Mfg. Co., Buffalo, N. Y. 319
WGY General Electric Co., Schenectady, N. Y. 380
WHA University of Wisconsin..... Madison, Wis. 283
WHA State University of Iowa..... Iowa City, Iowa 484
WHAD Marquette University..... Marquette, Wis. 280
WHAG University of Cincinnati..... Cincinnati, Ohio 222
WHAM University of Rochester..... Rochester, N. Y. 283
WHAR Seaside Hotel..... Atlantic City, N. J. 275
WHAS Courier Journal and Louisville Times, Louisville, Ky. 400
WHAV Wilmington Electrical Specialty Co., Inc., Wilmington, Del. 360
WHAZ Renaeleer Polytechnic Institute, Troy, N. Y. 380
WHB Sweeney School Co., Kansas City, Mo. 411
WHK Radiolor Co., Cleveland, Ohio 283
WHN George Schubel, Loew's State Theatre Bldg., N. Y. C. 360
WHO Bankers Life Co., Des Moines, Iowa 526
WIAB Art A. Johnson's Garage..... Rockford, Ill. 252
WIAC Galveston Tribune..... Galveston, Texas 360
WIAD Howard H. Miller, 6318 N. Park Ave., Philadelphia, Pa. 254
WIAK Journal-Stockman Co., Omaha, Neb. 278
WIAS Home Electric Co., Burlington, Wis. 283
WIK K. & L. Electric Co., Mekeosport, Pa. 234
WIP Gimbel Brothers..... Philadelphia, Pa. 509
WIJB American Electric Co., Lincoln, Neb. 229
WIJD Jackson's Radio Engineering Laboratories, Waco, Texas 360
WIAG The Norfolk Daily News..... Norfolk, Neb. 283
WIJK Clifford L. White..... Greentown, Ind. 254
WIJM D. M. Perham, 332 Third Ave., W. Cedar Rapids, Iowa. 268
WIJN Peoria Star..... Peoria, Ill. 280
WIJR The Outlet Co., Providence, R. I. 360
WIJX Pittsburgh Radio Supply Co., Pittsburgh, Pa. 266
WIJY Union Trust Co., Cleveland, Ohio 339
WIJZ Chicago Radio Laboratory..... Chicago, Ill. 268
WJAD Denison University..... Granville, Ohio 229
WJJD Moosheart..... Moosheart, Ill. 278
WJY R. C. A..... New York City 405
WJZ R. C. A..... New York City 455
WKAA H. F. Paar, 1444 Sec-W Ave. E., Cedar Rapids, Iowa 278

WKAD Charles Looff (Crescent Park), Providence, R. I. 240
WKAF W. S. Radio Supply Co., Wichita Falls, Tex. 360
WKAN United Battery Service Co., Montgomery, Ala. 226
WKAP Mutch W. Flint..... Cranston, R. I. 360
WKAR Radio Corp. of Porto Rico, San Juan, P. R. 360
WKAV Michigan Articulture College, East Lansing, Mich. 280
WKAW Laconia Radio Club..... Laconia, N. H. 286
WKBF Dutee W. Flint..... Cranston, R. I. 286
WKY W. K. Y. Radio Shop..... Oklahoma City, Okla. 360
WKL Taylor Electrical Co., Tulsa, Okla. 360
WLP W. V. Jordan, 306 W. Breckenridge St., Louisville, Ky. 286
WLAX Greenwave Community Broadcasting Station, Greencastle, Ind. 231
WLB University of Minnesota at Minneapolis, Minn. Wisconsin Department of Markets, Stevens Point, Wis. 278
WLB Sears, Roebuck & Co., Chicago, Ill. 345
WLV Crosey Radio Corp., Cincinnati, Ohio 423
WLV Clive H. Meredith..... Cazenovia, N. Y. 261
WLV Round Hills Radio Corp., Dartmouth, Mass. 360
WMAF General Supply Co., Lincoln, Neb. 273
WMAK Northern Laboratories..... Columbus, Ohio 286
WMAJ First Baptist Church..... Columbus, Ohio 286
WMAQ Chicago Daily News..... Chicago, Ill. 448
WMA Alabama Polytechnic Inst., Auburn, Ala. 250
WMAK Kingshighway Presbyterian Church, St. Louis, Mo. 280
WMAZ Mercer University..... Macon, Ga. 261
WMC Commercial Appeal..... Memphis, Tenn. 500
WME Intercity Radio Telegraph Co., Duluth, Minn. 309
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WMO Doubleday-Hill Electric Co., Washington, D. C. 261
WNA Shopard Stores..... Boston, Mass. 278
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WNA Omaha Central High School..... Omaha, Neb. 258
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WOA 2nd Battalion, 12th Inf., P. N. G., Erie, Pa. 242
WOA Woodmen of the World..... Omaha, Neb. 526
WOAX Frank J. Wolf, 600 Ingham Ave., Trenton, N. J. 240
WOC The Palmer School of Chiropractic, Davenport, Iowa 484
WOI Iowa State College..... Ames, Iowa 360
WOO John Wanamaker..... Philadelphia, Pa. 539
WOQ Western Radio Co., Kansas City, Mo. 360
WOR L. Baumberger & Co., Newark, N. J. 405
WOSP Missouri State Marketing Bureau, Jefferson City, Mo. 441
WPAC Pennsylvania State College, State College, Pa. 263
WPAD Donaldson Radio Co., Orem, Utah 268
WPAJ Doolittle Radio Corp., New Haven, Conn. 268
WPBK North Dakota Agricultural College, Grand Forks, N. D. 283
WPBR Ward Battery & Radio Co., Beloit, Kan. 236
WPAU Concordia College, Moorhead, Minn. 296
WPAZ Dr. John R. Koch, Charleston, W. Va. 360
WQA Horace A. Beale, Jr., Parkersburg, Pa. 360
WQA Glash Radio Service..... Amarillo, Texas 234
WQA Moore Radio News Station, Springfield, Vt. 275
WQA Sandusky Register..... Sandusky, Ohio 240
WQA Electrical Equipment Co., Miami, Fla. 283
WQAN Seranton Times..... New York, N. Y. 360
WQAR Calvary Baptist Church..... New York, N. Y. 360
WQAS Prince-Walter Co., Lowell, Mass. 266
WQAX Radio Equipment Co., Peoria, Ill. 248
WQAW Calumet Radio Broadcasting Co., Chicago, Ill. 448
WRAF The Radio City..... Springfield, Mo. 273
WHAL Northern States Power Co., St. Croix Falls, Wis. 244
WRAM Lombard College..... Galesburg, Ill. 244
WHAC Slack Hawk Electrical Co., Waterloo, Iowa 236
WRAU St. Louis Radio Service Co., St. Louis, Mo. 360
WRB Antonio College..... Yellow Springs, Ohio 242
WRAW Avenue Radio Shop..... Chicago, Ill. 273
WRX Flexons Garage..... Gloucester City, N. J. 268
WRBC Immanuel Lutheran Church..... Valparaiso, Ind. 278
WREO Reo Motor Car Co., Lansing, Mich. 289
WRC Radio Corp. of America..... Washington, D. C. 468
WRL Doron Bro. Elec. Co., Hamilton, Ohio 360
WRM Union College..... Schenectady, N. Y. 380
WRI University of Illinois..... Urbana, Ill. 273
WRW City of Dallas Police and Fire Signal Dept., Dallas, Texas 360
WRR Tarrytown Radio Research Laboratory, Tarrytown, N. Y. 273
WSAB South East Missouri State Teachers College, Cape Girardeau, Mo. 360
WSAC Clemson Agricultural College, Clemson College, S. C. 360
WSAD J. A. Foster Co., Providence, R. I. 261
WSAI United Playing Card Co., Cincinnati, Ohio 399
WSAJ Grove City College..... Grove City, Pa. 360
WSAP Seventh Day Adventist Church, N. Y. C. N. Y. 263
WSAR Doughty & Welch Elec. Co., Fall River, Mass. 254
WSAU Camp Marlenfeld..... Chesman, N. H. 229
WSAV Clifford W. Vlek Radio Construction Co., Houston, Texas 360
WSAZ Chase Electric Shop..... Pomeroy, Ohio 258
WSB Atlanta Journal..... Atlanta, Ga. 429
WSL J. & M. Electric Co., Utica, N. Y. 273
WSOE School of Engineering of Milwaukee, Milwaukee, Wis. 246
WSY Alabama Power Co., Birmingham, Ala. 360
WTAB Fall River Daily Herald Pub. Co., Fall River, Mass. 260
WTAC Penn. Traffic Co., Johnstown, Pa. 275
WTAF Louis J. Gallo, 2222 Lapeyrouse St., New Orleans, La. 268
WTAL Toledo Radio & Elec. Co., Toledo, Ohio 280
WTAM Willard Storage Battery Co., Cleveland, Ohio 252
WTAP Cambridge Radio & Elec. Co., Cambridge, Ill. 242
WTAS S. H. Van Gorden & Son..... Osaço, Wis. 254
WTAR Reliance Elec. Co., Norfolk, Va. 286
WTAS Charles E. Erbstein, R. F. D. 6, Box 75, Tarrytown, Ill. 280
WTAT Edison Electric Illuminating Co., Boston, Mass. 244
WTAU Ruegg Battery and Electric Co., Tecumseh, Neb. 242
WTAU Agricultural & Mechanical College, College Station, Texas 260
WTAX Williams Hardware Co., Streator, Ill. 231
WTAY Oak Leaves Broadcasting Station, Oak Park, Ill. 283
WTAZ Thomas J. McGuire..... Lambertville, N. J. 261
WTG Kansas State Agricultural College, Manhattan, Kan. 273
WTL H. O. Saal Co., Chicago, Ill. 268

WWAD Wright & Wright, Inc., Philadelphia, Pa. 360
WWAE Lawrence J. Crowley (Alamo Ball Room), Joliet, Ill. 242
WWAO Michigan College of Mines..... Houghton, Mich. 244
WWI Ford Motor Co..... Dearborn, Mich. 273
WWJ Detroit News..... Detroit, Mich. 517
WWL Loyola University..... New Orleans, La. 280
Alaska
KFIU Alaska Electric Light & Power Co., Juneau 226
KFDQ Chivik Supply Co., Anchorage 280
KNT Walter Heinrich..... Kukak Bay 283
Argentina
LOR Cia. Radio Argentina..... Buenos Aires 350
LOX Radio Cultura..... Buenos Aires 325
LOZ Radio Sud America..... Buenos Aires 378
LCR Francisco J. Brusa..... Buenos Aires 300
Australia
2CF Farmer & Co., Ltd., Sydney 1,120
2BL Broadcastings Sydney (Ltd.), Sydney 400
2AB Associated Radio Co. (Ltd.), Melbourne 450
6WF West Australian Farmers (Ltd.), Perth 1,250
Austria
"Radio Wien" Technologische Gewerbemuseum, Vienna 700
OHW Radio Hexaphon..... Vienna 800
Belgium
SRB No data..... Brussels 405
BAV No data..... Brussels 506
Canada
CFCS Eastern Telephone & Telegraph Co., Halifax, Nova Scotia 410
CFAC Marconi..... Halifax, Nova Scotia 448
CHAC Radio Engineers..... Halifax, Nova Scotia 408
CIC Maritime Radio Corp., St. John, New Brunswick 400
CICR Jones Electric Co., St. John, New Brunswick 400
CFCE Quebec Electric Co., Montreal, Quebec 444
CHYC Northern Electric Co., Montreal, Quebec 448
CIBC Dupuis Freres..... Montreal, Quebec 429
CFAC La Presse Publishing Co., Montreal, Quebec 430
CFCU University of Montreal..... Montreal, Quebec 400
CFCJ Northern Electric Co., Montreal, Quebec 410
CHCD La Cle de l'Enseignement..... Quebec, Quebec 410
CFQC Semmelhaack-Dickson (Ltd.), Bellevue, Quebec 450
CFPC International Radio Development Co., Fort Frances, Ont. 400
CKOC Wentworth Radio Supply Co., Hamilton, Ontario 410
CJCF The News-Record (Ltd.), Kitchener, Ont. 426
CHXK J. R. Booth, Jr., Ottawa, Ont. 400
CFCH Abitibi Power & Paper Co., Iroquois Falls, Ont. 410
CFCR Laurentide Air Service..... Sudbury, Ont. 400
CFCW Queens University..... Kingston, Ont. 458
CJCG Free Press Printing Co., London, Ont. 420
CKQC Radio Supply Co. (Ltd.), London, Ont. 410
CKCE London Radio Shoppe..... London, Ont. 410
CFCA Star Publishing & Printing Co., Toronto, Ont. 450
CJCB T. Eaton Co., Toronto, Ont. 410
CHCB Marconi..... Toronto, Ont. 410
CJCN McMillan Motors..... Toronto, Ont. 410
CJCS Snows Agnew & Co., Toronto, Ont. 410
CJSC Evening Telegram..... Toronto, Ont. 410
CHCF Manitoba Free Press..... Winnipeg, Manitoba 430
CHCF G. Melrose Bell..... Winnipeg, Manitoba 400
CKZY Tribune Newspaper Co., Winnipeg, Manitoba 400
CKY Manitoba Telephone System, Winnipeg, Manitoba 420
CKCK G. Melrose Bell, Leader Publishing Co., Regina, Saskatchewan 450
CFCC The Electric Shop..... Saskatoon, Saskatchewan 400
CGAC G. Melrose Bell..... Calgary, Alberta 400
CHBC Alberta Publishing Co., Calgary, Alberta 410
CHCC Western Radio Co., Calgary, Alberta 400
CFAC Calgary Herald..... Calgary, Alberta 410
CFCN W. V. Grant Radio (Ltd.), Calgary, Alberta 440
CFCE Edmonton Journal..... Edmonton, Alberta 450
CFCK Calgary Telephone System..... Edmonton, Alberta 410
CJCK Perical Supply Co., Edmonton, Alberta 410
CJCE Sprott Shush Radio Co., Oids, Alberta 400
CKCD Daily Province..... Vancouver, British Columbia 420
CGAC Marconi..... Vancouver, British Columbia 410
CGAC Vancouver Merchants Exchange, Vancouver, B. C. 440
CHCL Vancouver Merchants Exchange, Vancouver, B. C. 440
CJCB J. G. Bennett Nelson..... Victoria, B. C. 400
CHCE Centennial Methodist Church..... Victoria, B. C. 400
CFCD Western Canada Radio Supply Co., (Ltd.), Victoria, B. C. 400
CFDC Sparks Co., Nanaimo, B. C. 458
Chile
CRC Radio Corporation of Chile..... Santiago, Chile 400
ABC Radio Corporation of Chile, Vina del Mar, Chile 400
Cuba
PWX Cuban Telephone Co., Habana, Cuba 400
2DW Pedro Zayas..... Habana, Cuba 300
2AB Alberto S. Bustamante..... Habana, Cuba 248
2DY Mario Garcia Velez..... Habana, Cuba 389
20K Frederic W. Borton..... Habana, Cuba 129
2CX Frederic W. Borton..... Habana, Cuba 229
2EV Westinghouse Elec. Co..... Habana, Cuba 239
2TW Roberto E. Ramirez..... Habana, Cuba 239
2MC Heraldo de Cuba..... Habana, Cuba 275
2LC L. de Casas..... Habana, Cuba 358
2KD E. Sanchez Fuentes..... Habana, Cuba 259
2MN Fausto Simon..... Habana, Cuba 279
2MG Manuel G. Salas..... Habana, Cuba 289
2JG Raul Perez Falcon..... Habana, Cuba 158
2KP Alberto Daza..... Habana, Cuba 259
2MS Julio Power..... Habana, Cuba 188
20L Oscar Collado..... Habana, Cuba 219
2WV Amadeo Suenz..... Habana, Cuba 219
3EV Leopoldo Y. Figueroa..... Colon, Cuba 389
6KJ Frank H. Jones..... Tuinucu, Cuba 340
6CX Antonio T. Figueroa..... Cienfuegos, Cuba 278
6DW Eduardo Terry..... Cienfuegos, Cuba 225
6BY Jose Gandure..... Cienfuegos, Cuba 308
6AZ Ysaelin Hillvari..... Cienfuegos, Cuba 308
6EV Josef Alvarez..... Camaguey, Cuba 225
7AZ Pedro Nogueiras..... Camaguey, Cuba 225
7BY Salvador Rionda..... Camaguey, Cuba 358
8AZ Alfredo Broecks..... Santiago, Cuba 248
8BY Alberto Raveles..... Santiago, Cuba 250
8FU Andres Vinnet..... Santiago, Cuba 225
8DW Pedro C. Andus..... Santiago, Cuba 225
8EV Eduardo Mateo..... Santiago, Cuba 180
8GT Juan F. Chibas..... Santiago, Cuba 200
Czecho-Slovakia
None Radio Journal..... Kbely 1100

(Turn to page 94)

Afloat and Ashore with the Operator

By W. S. Fitzpatrick

AMERICAN steamship *Leviathan*, WSN, 850 miles east of Ambrose, traveling at a speed of 24 knots, now signing off.

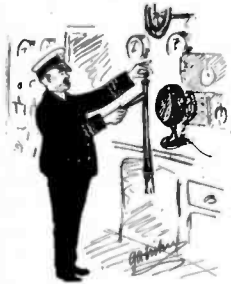
"Ding-ding, ding-ding, ding-ding—six bells, ship time eleven o'clock—good night."

Chief operator E. N. Pickerill was testing the *Leviathan's* duplex radio phone set on 316 meters, little thinking that his voice and the ship's "bells" were being heard two thousand miles away.

Not many minutes after, two fully-paid radiograms—one from Canada—were received aboard the *Leviathan* acknowledging the broadcast, then upon arrival in New York Pickerill received more than a hundred post cards and letters from radio listeners as far West as the Mississippi.

Almost every acknowledgment spoke of the clearness of the "bells" and the writers' elation over the unique experience of hearing the ship's time being struck so far away.

The "bells" consisted of a crowbar and a marlinspike!



SPEAKING of the *Leviathan* brings to mind a story illustrating the vastness of the big vessel, as told by Mr. Pickerill on his last arrival in New York.

It was to the effect that a ship's officer passing through one of the numerous companionways was stopped by an admittedly lost and very seasick passenger who inquired:

"Officer, please direct me the nearest way to the ocean."



AN exciting incident happened aboard a passenger ship about ten years ago which resulted in the radio operator—the present writer—receiving unusual recognition.

About eleven o'clock in the evening the operator was at work with his coat

off in the radio cabin when he heard the scream of a woman in the social hall. Rushing there he saw a man armed with a gun in each hand and a large knife in his cartridge-loaded belt.

Realizing that a show of authority was needed he ran back to the radio cabin where he quickly donned his uniform coat and cap and returned to the man with the guns.

"What're you doing here?" he bawled out in true rough salt-air fashion with the commanding tone of a combined captain, mate and bo'swain behind it.

For answer the man raised his arm and leveling one of his guns, pulled the trigger. The gun missed fire, because, as was afterward learned, it was loaded with old Mexican bullets that had been so imperfectly manufactured and improperly stored as to render many of them useless.

It was readily seen that the uniform and the commanding voice had no effect and was certainly no match against a man who would not answer except with wicked-looking guns.

Within one second after he looked into the barrel of the gun and heard the click, the operator was off with a spring which broke into the fastest run he ever made.

In the meantime the woman's screams had awakened many of the passengers and had also brought out the men from the smoking room. Passengers who did not hear the screams were awakened by the general confusion and practically the entire ship witnessed the operator's mile-a-minute sprint.

Someone went up to the captain, who in turn called the mate, and the battle was on to capture the bad man.

Everybody was cautious and a sight of the man caused a general scramble. The bartender had no desire to meet up with him, but out of curiosity wanted to get just a look at him—and that at a distance.

Proceeding very carefully he was about to take a peep around the corner of one of the halls when he came face to face with him.

"They're after me," he told the bartender.

"W—w—well g—g—give me your

g—g—guns and I'll g—get them," the frightened barman managed to speak out.

The man handed over the guns and knife and thus unarmed was immediately captured and made prisoner while the poor bartender collapsed from the excitement.

It was found that the man was an ex-British army sharpshooter who had been helping in a recent Mexican revolution and was on his way home to England.

The following day word came that the wireless operator was wanted in the smoking room. Arriving there he found it jammed with passengers. He was led to the center where a lawyer made a brilliant speech winding up with:

"... and heroic deeds have never failed to thrill. All the world looks up to and clamors to pay homage to the hero. Thus we have gathered here to greet you, the hero, the life-saver. It gives me pleasure to safety-pin this medal over your heart in recognition of your prompt and speedy act in saving a life—*your own*—by running."

This medal, cleverly fashioned of leather, neatly worded and with three bullets—the center one with a decided nick in the cap—suspended with baby ribbon, is still among the writer's most treasured mementoes of his travels.



AHUMOROUS tale surrounds the history of the early experiments during July, 1903, at the first radio station constructed at Cleveland, Ohio.

There was another station at Toronto with which an effort was being made to establish communication. Scheduled times had been arranged for transmitting and listening. Tests were carried on daily without results. The equipment of both stations was overhauled and the tests continued. Still no results! Word came from the Gulf that both stations were being heard down there.

With thoughts of directional aerials and "reflectors" the stations were again changed around. About this time someone thought of the hour's difference in time between the two places. This solved the problem and was a lesson the radio pioneers never forgot.



POTENTIOMETERS

By John R. Meagher

The Mysteries of this Important Device Explained in the Author's Usual, Easily-Understandable Mode of Writing. Mr. Meagher has the Knack of Making One Comprehend

A POTENTIOMETER or potential divider is generally represented as a fixed resistance shunted across a source of voltage and arranged with a slider to make contact with any portion of the resistance. The purpose of the potentiometer, as we use it, is to divide the voltage by making use of the "drop" across any portion of the resistance.

Figure 2 represents a potentiometer in shunt to a battery V ; R is the resistance; A and C are the ends of the resistance and B is the slider.

Irrespective of the resistance of R , we find by connecting a static voltmeter between the slider B and one of the ends, say A , that when the slider is at the other end, C , the meter reads the full battery voltage. If the slider is at the center of R the meter reads one-half the full battery voltage. When the slider is at the end A , the reading is zero. Thus we find that the percentage of resistance between the points A and B is to the total resistance R as the voltage across AB is to the total voltage.

Suppose the slider were turned to include 10 per cent. of the resistance R between AB and let the battery voltage equal 6, then 10 per cent. is to 100 per cent. as X —the unknown voltage across AB —is to 6. This gives X equal to .6 volt.

Or we can say the fraction of resistance between the points AB of measurement is also the fraction of voltage (of the total voltage) across AB . As in the case above, AB is 10 per cent. or one-tenth of R ; then the voltage across AB is one-tenth of the battery voltage or .6 volt.

EXACT RESISTANCE NOT IMPORTANT

This action can be explained in another way, but we wish to neglect the value of the resistance R .

It should be evident from the above that the resistance value of R has no bearing on the division of voltage—provided the resistance of the circuit connected across the portion of R is very high in comparison to R . In radio the circuits connected across the portion of R have a high resistance value compared to the usual values of R . The latter ranges in values from 100 to 1,000 ohms; the circuits (grid and

plate) have much higher resistances. The effect of having a low resistance across the portion of R is shown at (F) and (G) figure 3. Here the potentiometer has a resistance of R plus R or $2R$ and, in G, a circuit of R resistance is connected across half the potentiometer. Now the effective resistance from A to C is not $2R$, but is only $1\frac{1}{2}R$ so the voltage across AB is not $\frac{1}{2}V$ —as might be expected from the statements above—but is instead $\frac{1}{3}V$.

The reason for using a 400-ohm potentiometer in preference to a lower

DO YOU KNOW—

Of what importance is the actual resistance value of a potentiometer? Why do some people specify 200 ohms; others 400?

What happens when the slider on a potentiometer is moved from one end of the resistance element to the other end?

Are condensers necessary with a potentiometer? If so, what value should they have, and why?

Actually, what effect is produced by bringing the grid return lead to different points in the filament circuit?

What value should a rheostat have for the common control of three UV-201A tubes? Of five UV-199s? Of any number of tubes on any voltage?

Can you answer all these questions? If you can not, then dig right into this splendid article and learn something about direct current as encountered in radio work. You will profit by the knowledge, for, as Mr. Meagher points out, this phase of radio is very important and means a great deal in the successful design and performance of receiving instruments.

value is that the current drawn from the battery to which the potentiometer is connected is lower. With a 6-volt battery the current through a 200-ohm resistance is .03 ampere—half as much as the filament of a UV-199 requires on 3 volts. The current through a 400-ohm resistance on a 6-volt battery is only .015 ampere. As the action is no different it is advisable to use the higher resistance type.

HOW THE GRID VOLTAGE IS CHANGED

The potentiometer is used extensively for grid voltage control of radio frequency amplifying tubes; in this use it is frequently termed a "stabilizer" or

"volume control" as its purpose in controlling the grid voltage is to control self-oscillation of the radio-frequency amplifying tubes—for self-oscillation of a tube may be stopped by making the grid positive so the grid circuit will draw current.

In figure 4 is shown a diagram of a two-step radio frequency amplifier and crystal detector with a potentiometer as stabilizer. The grid leads from the two RF tubes after going through their tuning devices are connected to the slider of the potentiometer. When the slider is at the negative side of the filament there is zero voltage on the grids with respect to the negative terminals of the filaments. It is well to know that we always measure from the negative end of a system and talk about other parts having a definite voltage meaning that the voltage is of a certain value with respect to the negative end—in radio, to the negative terminal of the filament.

As the slider is moved along to the positive side of the battery, the grid voltage—which is to say the slider voltage—is made increasingly positive—with respect to the negative terminal of the filament. When the slider is at the center of the resistance the grid voltage will be one-half the filament battery voltage—and so on, as explained above, in considering potentiometer action.

If a grid or C battery is used, movement of the potentiometer slider varies the grid voltage about the steady C battery voltage by an amount equal to the change produced by movement of the potentiometer slider. Thus, if the C battery were of negative 3 volts and the change in voltage by moving the slider was from 0 to positive 6, then the grid voltage could be varied from negative 3 to positive 3.

When the potentiometer is used across the A battery for control of plate voltage the action is in every way similar to that given above for the grid control. Thus, if the B battery voltage is 10 and the movement of the slider makes a change of from 0 to positive 6 volts, the plate voltage can be changed from 10 to 16 by moving the slider from the negative to the positive side of the battery—or rather, the resistance. See figure 5.

Thus it should be seen that in effect, movement of the slider has the same result as if we brought the return lead from the plate or the return lead from the grid to a series of taps on the A battery. The advantage of using the potentiometer is that a fine adjustment can be secured.

Other voltage sources than the A battery can be used and indeed must be used when the range obtainable with the A battery is not sufficient for the purpose. Figure 6 shows an interesting case of voltage control to obtain either positive or negative differences. When the slider is in the center of the resistance, the voltage difference between the points A and B is zero; as the slider is moved to the left or to the

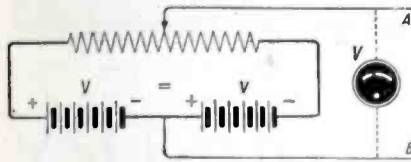


Figure 6.—Measuring the actual grid bias voltage with voltmeter

right the voltage difference increases, being negative or positive, as the case may be. This particular arrangement is often found in tube-testing circuits where a negative and positive range of voltages is required on the grid.

EFFECT OF RHEOSTAT

If we place a rheostat in series with the filament as at (L) figure 7, then, when the slider is at the negative side of the resistance there will be no voltage difference between the negative terminal and the slider; but if we shift the rheostat to the negative side of the line as at (M) figure 7, the slider does not touch the negative terminal of the filament and there is a difference of voltage equal to the drop of voltage across the rheostat. Say the tube were a UV-201A and the rheostat of 4 ohms value so that the terminal voltage across the tube was proper—namely, 5 volts, then there would be a drop of one volt across the rheostat—assuming the battery to be 6 volts. If the grid return were connected to the slider, the grid voltage could be varied from negative 1 with respect to the negative terminal of the filament, up to positive 5. Look at this carefully and apply some of the rules given above to “doping it out.”

CONDENSERS WITH POTENTIOMETERS

Now we come to something more interesting. Are

condensers necessary in shunt to the slider and filament? If so, why and what value should they have?

If we think of a potentiometer as a miniature single slide tuning coil of high resistance, we can more readily appreciate what follows:

When a potentiometer is used for grid-voltage control of one tube in a radio-frequency amplifier, it is advisable to have a fixed condenser from the slider to either side of the filament, so that movement of the slider will not change the wavelength adjustment of the circuit; the condenser acts as a by-pass around the turns of wire included between the slider and the filament, so that varying the number of turns does not materially affect the impedance of the circuit comprising the fixed condenser and the turns of wire of the potentiometer included in the circuit. Thus we need make the fixed condenser only large enough to keep the impedance constant, or practically so, for the frequency band being received. For regular broadcast reception using the regular type of wire wound potentiometer the fixed condenser may have a value of say .002 mfd.

When the potentiometer is used for grid voltage control of two or more tubes in a radio frequency amplifier, another factor in addition to the detuning effect, increases the necessity for a shunt condenser. This factor is the common coupling afforded by the turns of wire and the resistance of that wire included between the slider and the

filament. (Realizing, of course, that the number of turns and the resistance is the mean value of either side of the slider.) That is, before the grid circuits are complete to the filament, they must go through a single or common resistance and the latter, of course, provides a small amount of auto-coupling between the grids. The value of .002 mfd. suggested above is sufficiently large, on broadcast frequencies and with the usual type of potentiometer, to make the coupling of a negligible value. The last point applies also to carbon rod or other forms of “non-

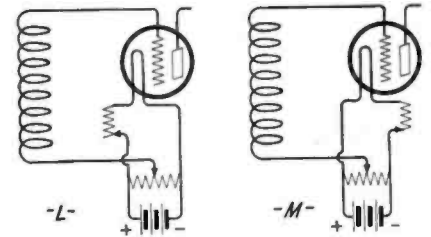


Figure 7.—The connection for positive and negative grid bias

inductive” potentiometers, as the auto-coupling in either case—with wire-wound or carbon potentiometers—is mostly resistive.

When a potentiometer is used for plate voltage control of one tube there is no necessity for using a by-pass condenser, as even the maximum effective resistance of the potentiometer would have little effect on the plate circuit.

But when, as in figure 8, the common negative lead of the plate battery for two or more tubes is brought to the potentiometer slider, a large audio-frequency by-pass condenser may be needed—depending on whether the maximum common coupling due to the common resistance coupling is large enough to cause sufficient inter-plate coupling for the production of continuous oscillations among the tubes. The necessity for this condenser can best be found by trial when using the regular tubes and plate batteries; if the amplifier howls then a condenser of .006 mfd. up should be connected from either side of the filament to the slider, or, better still, to the positive terminal of the B battery, as in this case the condenser shunts not only the used portion of the potentiometer, but also the B battery. If the set does not howl, then the condenser is not required. If a separate detector B battery is used, as in figure 9, and the negative lead of the amplifier B bat-

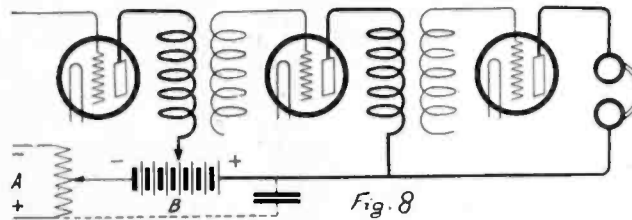


Fig. 8

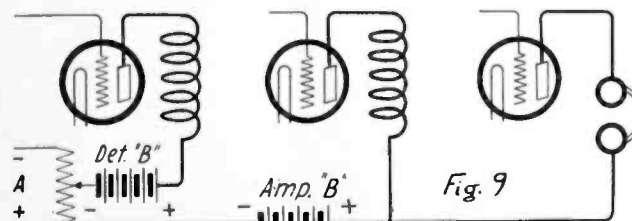


Fig. 9

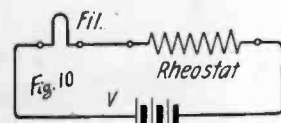


Fig. 10

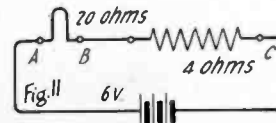


Fig. 11

Figure 8.—Shows the method of by-passing part of the potentiometer and B-Battery. This is a very important condenser and should not be omitted except when a separate detector B-battery is used as shown in figure 9. In figures 10 and 11 we have the usual filament-resistance battery circuit showing how the grid bias voltage is computed

(Turn to page 90)



Night view of Des Moines, Ia.

RADIOVIEWING THE INDUSTRY THIS MONTH

A. M. E. S. Report Radio Advertisers' Data Book Export Trade Survey and Trade Gossip

THE Associated Manufacturers of Electrical Supplies has issued a report on the radio appeal in the field of non-technical adherents to the art. This statement indicates the doubled volume of complete set sales for the past year also an increase in parts sales. Mr. George J. Eltz, Jr., of the Manhattan Electrical Supply Company, accounts for this change first, on the basis of available statistics and, secondly, on the critical interest in broadcast programs evidenced by the listening public.

THE WIRELESS AGE was the first radio publication to sense this trend and act promptly, in accordance with the public's taste.

THE Radio Department of Arthur Rosenberg Co., Inc., advertising agents, 110 West 34th Street, New York, is now distributing to radio manufacturers the first issue of the Radio Advertisers' Data Book, which it has compiled and published. This fifty-four page book contains the advertising rates, circulation, mechanical requirements and other data regarding all the radio consumer and trade publications, as well as those general magazines which feature radio—the allied trade papers, covering such fields as the electrical, hardware, talking machine, music trades and sporting goods in the United States and Canada. Other data of interest to the trade and buying public alike is included, fulfilling a demand of long standing.

A STUDY of the export trade has been undertaken by the Bureau of Foreign and

Domestic Commerce. With the assistance of American representatives in all parts of the world, the customs requirements and procedures, postal regulations and special peculiarities of each foreign market have been studied in detail. Definitions of samples and advertising matter, methods of shipment, handicaps of parcel post, duties, prepayment of duties, marking and docu-

mentation applicable to all countries, are fully discussed.

Well-prepared advertising matter and attractive samples and advertising novelties offer one of the most effective means of stimulating trade in foreign countries, but unless shipments of such articles are properly handled, they retard rather than promote trade, according to a recent trade bulletin, outlining in detail the various methods available and the costs of shipping samples and advertising matter to Latin America and the West Indies, by Henry Chalmers and Roberta Wakefield, of the Division of Foreign Tariffs, Department of Commerce.

THE Eagle Radio Company, at Newark, N. J., have recently acquired a daylight factory, at a point convenient to many street-car and bus lines, thus providing better working conditions for their employees. Add to this the music provided from the testing rooms, and the result is contented working conditions that should be reflected in the quality of the Eagle products.

C. BRANDES, INC., have launched an advertising campaign this season that merits wide notice. The significance of this campaign lies in the fact that better radio merchandise will be stimulated by the farsighted policy of this company.

OF the gossip of the trade, the following notes are of general interest: 1. Realizing the need for a plug, which could be easily and

(Turn to page 93)



Mr. Harry L. Welker, who was actively engaged in broadcasting the blow-by-blow description of the Carpentier-Dempsey fight and who was largely responsible for its successful reception over an area of 125,000 square miles, is now the Eastern Representative of the Adams-Morgan Company, well known manufacturers of the famous Paragon receivers

No. 772
45-volt
large
vertical
Price
\$3.75



No. 766
22½-volt
large
horizontal
Price
\$2.00

*Dry "B" Batteries
are more economical
and more dependable
than any other
source of plate
current!*

Cut your operating cost

THIRTY years' experience in the manufacture of dry batteries has enabled us within the past two years to steadily and greatly improve dry "B" Battery quality. Eveready "B" Batteries are now from two to three times better than ever before.

Eveready "B" Batteries will long outlast any others, and are the most economical and dependable source of plate current. These are strong statements, but they have been proved by tests in our own and in independent laboratories. Check them for yourself on your own radio set. Get Eveready "B" Batteries.

There is an Eveready Radio Battery for every radio use.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY

Radio Batteries

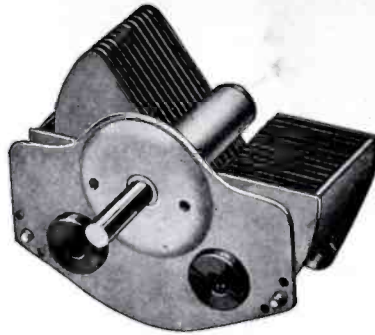
—they last longer

"Quality Goods for Quality Readers"

Appliances and Devices

Bradleydenser

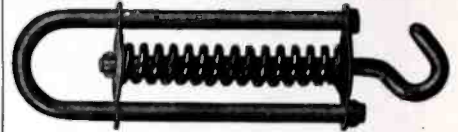
A NEW low-loss variable condenser, the Bradleydenser, is announced by the Allen Bradley Company of Milwaukee, Wis. A unique and superior feature is the one end plate construction. The rotor is supported on a long bearing sleeve, secured to the stator end plate, and thus does not depend upon the rotor shaft for alignment. It is, in fact, somewhat similar to the full-floating principle of automobile axles. A spring tension in the uniquely designed bearing takes up the slightest wear and keeps the rotor in accurate alignment. The rotor plates are



grounded to reduce the body capacity effects when tuning the Bradleydenser. A removable shield encloses the stator plates and protects them from dust. Stator and rotor plates are of brass, thoroughly soldered at all joints.

Antenna Tensionator

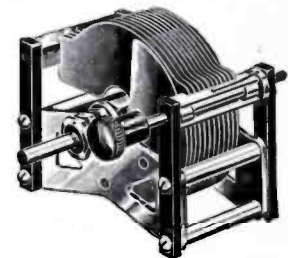
A NEW and original device, the Mitchell Antenna Tensionator has been developed by R. Mitchell Co. It absorbs shocks and strains and keeps an even tension on your



antenna. After a look at the aerials on the roofs of apartment houses in New York and Brooklyn it is very evident that there is a great need for this device.

New Vernier Low-Loss Condenser

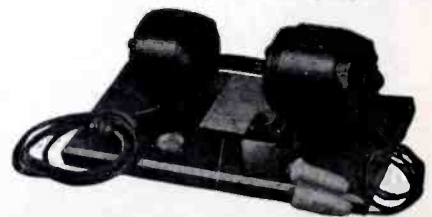
THE Hartford Instrument Co. has produced a new, distinctively low loss variable condenser. It will of course, work in any type of circuit and is made so that it can be mounted from one or three holes, panel mounting or table mounting. The plates are brass and the end plates aluminum. Adjust-



able cone bearings, and a good pig tail carefully insulated and soldered tend to make it an excellent condenser. The vernier is something new in micrometer controls. The vernier knob moves the entire stator plates on an eccentric cam. This instrument is made up in the usual capacity of .00025, .00038, .0005 and .001.

Motor-generator Charger

THE Ohio Electric and Controllor Co. has recently developed a motor generator charger for charging storage A and B batteries. A feature of this charger is that it cannot charge in the wrong direction. It operates very quietly and is equipped with



ammeter and rheostat for controlling the charging rate. It is equipped with 110 volt 60 cycle AC motor to drive the six to ten volt generator. This motor-generator charger is just the thing for your car and radio batteries.

The MOZART Baby GRAND Radio Reproducer



You Gave the Best

No piece of radio apparatus even in its price class is the best because its maker says so or because its dealer says so. It is only the best when everybody else says so as well.

"To say I was surprised is putting it mildly. It is the best I have ever had and I have had the _____ and others. Am going to recommend the M-G. I like to help a company that is on the square and gives everybody their money's worth."

(Signed) A. S. Kay, Charleston, West Virginia.

Baby Grand Reproducer, with gold plated unit, black and gold crackle or extra heavy coated all black satin finish (approx. 12" bell)	\$12.00
Baby Grand Reproducer, with nickel plated unit, black satin finish (approx. 11" bell)	10.00
Electro-magnetic unit (fits almost any horn or phonograph) with cord, nickel plated	4.00
Gold plated	5.00
Mozart Special Headset	6.00

No extra batteries required.

ORDERS. If your dealer cannot supply, order direct.

TRANSPORTATION. Single shipments, strictly F. O. B. factory. Free on two or more orders for each item.

GUARANTEE. One year from date of purchase or money back in ten days.

The MOZART-GRAND CO.

Manufacturers of Fine Instruments

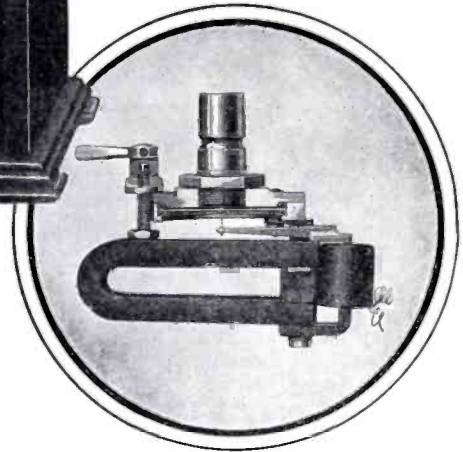
Newark, N. J.

U. S. A.

"Quality Goods for Quality Readers"



Model "C"
Cabinet Type
\$30.00



The New Cabinet Model

For those who admire the full, round, musical voice of the Audiophone, but prefer a cabinet design, we have brought out this splendid model.

The case is of real mahogany, of a character to give it equal fellowship with your grand piano. The design goes nicely with the most tasteful furnishings. The size, 17x10x10 $\frac{1}{4}$, is just right for the top of your phonograph or your receiving set.

It has the sound mechanism of our Model "S," but its square design gives it a sweetness of its own.

Not a "Phone Unit"

The voice of the Audiophone is not a "phone unit." It is a highly developed, electro-magnetic reproducer. This results in an instrument which reproduces with natural quality in most powerful tones, yet has a sensitiveness equal to any loud speaker developed.

The Bristol line includes five Audiophones priced from \$12.50 to \$30.00. If not at your dealer's, write for Bulletin No. 3022-V.

THE BRISTOL COMPANY, WATERBURY, CONN.

The Voice of the Audiophone



Model "S"
Audiophone
\$25.00

Rubber horn 14 $\frac{1}{2}$ inch diameter. Velvet mat finish of mottled bronze and gold; classic base.

Bristol

TRADE MARK
AUDIOPHONE **LOUD SPEAKER**
REG. U.S. PAT. OFFICE

"Quality Goods for Quality Readers"

Tube Checker

JEWELL INSTRUMENT CO., well-known manufacturers of precision instruments and a very complete line of meters, have produced the Tube Checker. This instrument includes a tube socket A and B battery terminal filament voltmeter and a plate current milliammeter. This instrument is made for dealers and testing labora-

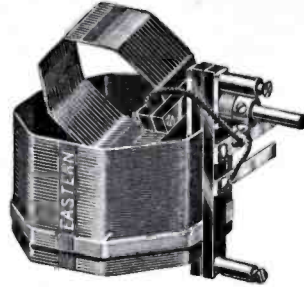


ories where it is desirable to check up on a tube's operating characteristics. The circuit return lead from the filament is made to the negative and filament supply giving zero grid voltage. An innovation is included in this device in the form of a 1000-ohm re-

sistance inserted in the negative B battery lead to prevent blowing out the tube in case of wrong connections.

A Real Low-Loss Coil

ATUNING unit, in which the dielectric losses and high frequency resistance have been removed to the greatest extent, has been brought out recently by the Eastern



Coil Co. and is known as the Eastern Low Loss Tuner. The coil is wound on the familiar pickle bottle form developed by M. B. Sleeper. The reduction of losses tend toward sharper tuning and greater distance when used in conjunction with a good low loss condenser. Large wire is used and the coil is quite strong. The Eastern Low Loss coil marks a step forward in low loss tuner construction.

Burns Loud Speaker

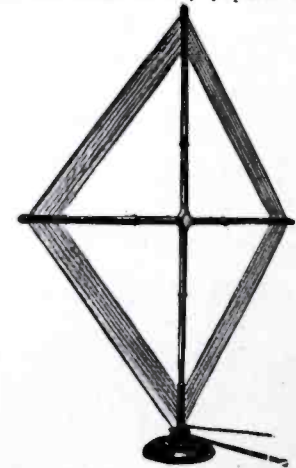
THE Burns Reproducer is a new entry in the reproducer line having distinctive beauty and gives good volume with remarkable clarity. The horn is of generous proportion, gracefully shaped and designed along scientific lines. The flare is 14 inches in



diameter and is made up of handsomely polished black Pyralin. This speaker is also made up with a more elaborate horn with handsome mahogany tinted Pyralin.

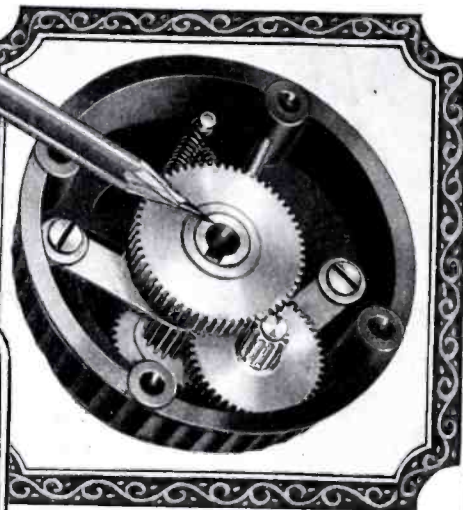
Basket Weave Loop

THE Bodine Folding Loop with the basket weave winding is a low loss precision instrument designed to increase the effectiveness and range of any popular loop cir-



cuit. The feature of its winding is the fact that it brings all of the turns in the loop close to the outside where they are most effective, thereby increasing the signal strength and sensitivity. It is markedly directional. It is equipped with a handle and with a graduated dial allowing the user to log the loop setting for any particular station or direction.

All Wobble Eliminated



By Long Center Bushing

Look at that long center bushing! Watch the new model Accuratune when you tune in—how smooth it operates—how precise its movement without the slightest indication of wobble.

Few vernier dials, built as they must be to take all standard condenser shafts, are designed as the Accuratune to positively eliminate this universal objection—dial wobble.

And just this one point of refinement characterizes the complete make-up of the Accuratune Micrometer Control—features that assure most unusual tuning efficiency.

Micrometer controls easily replace ordinary dials without any set alterations. Just tighten the set screw on the large knob.

At your dealers, otherwise send purchase price and you will be supplied postpaid. Price \$3.50.

NEW ACCURATUNE FEATURES

Geared 80-1 ratio.

No back lash.

No cutting of condenser shafts.

Flush panel mounting.

ACCURATUNE

Geared 80-1

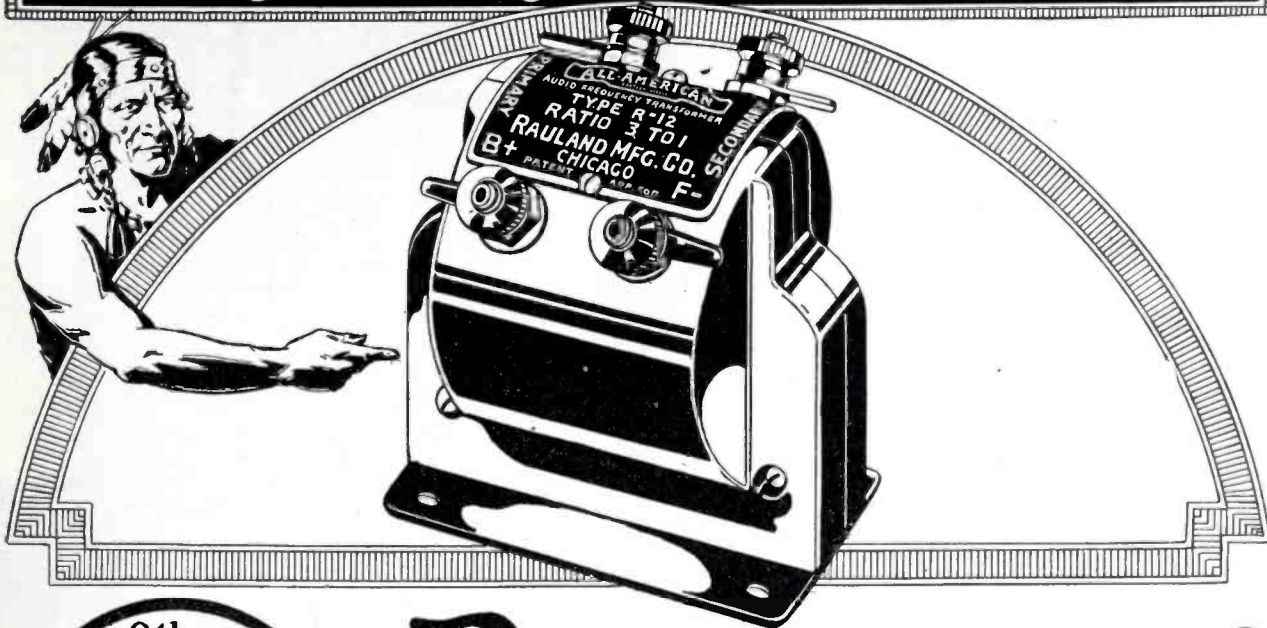
MICROMETER CONTROLS

Canadian Rep.
RADIO, LTD.
MONTREAL

Mydar Radio Company, 9-A Campbell Street, Newark, N. J.

"Quality Goods for Quality Readers"

The Largest Selling Transformers in the World



Other ALL-AMERICAN Guaranteed Radio Products

Power Amplifying Transformers
(Push-Pull)
Input Type R-30 \$6.00
Output Type R-31 \$6.00

Rauland-Lyric
A laboratory grade audio transformer for music lovers. R-500 \$9.00

Universal Coupler
Antenna coupler or tuned r. f. transformer. R-140 \$4.00

Self-Tuned R. F. Transformer
Wound to suit the tube.
R-199 \$5.00 R-201A \$5.00

Long Wave Transformer (Intermediate Frequency)
4,000 to 20,000 meters.
(15-75 Kc) R-110 \$6.00

10,000 Meter Transformer (30 Kc.)
Tuned type (filter or input). R-120 \$6.00

Radio Frequency (Oscillator) Coupler
Range 150 to 650 meters.
R-130 \$5.00

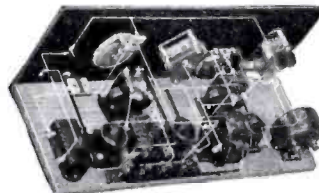


Super-Fine Parts
Consisting of three R-110's, one R-120 and one R-130
\$26

Reliable!

ALL-AMERICAN Standard Audio Frequency Transformers in any radio receiving set mean but one thing—*assured* efficiency in amplification. Since 1919 ALL-AMERICAN Audios have answered the demand for an instrument that could be *relied* upon for maximum amplification and faithful tone reproduction. Set builders who know radio do not experiment—they specify ALL-AMERICANS, with full assurance that they will consistently perform with highest efficiency.

All-American Reflex Receivers



Complete receiving sets, with all instruments mounted on panel and baseboard ready to be wired. Clear photographs, blueprints and a 48-page instruction book making wiring so easy as to be the work of only one delightful evening.

All-Amaj Junior is a one-tube set with remarkable selectivity and volume. It tunes out the locals and gets real distance, or it brings in the local stations on the loud speaker.

All-Amaj Senior is a three-tube set with three stages of r. f. amplification, crystal detector and two stages of audio. It is highly selective and brings in the far-distant stations on the loud speaker.

All-Amaj Junior (semi-finished) \$22.00
All-Amaj Senior (semi-finished) 42.00

Precision-Made

ALL-AMERICAN reliability is a natural result of ALL-AMERICAN precision manufacture. Each part is scientifically designed and accurately built to exact standards. Special machinery and testing equipment assist in achieving perfection.

When you are buying a new set, look under the lid for ALL-AMERICAN Audios. Or install ALL-AMERICANS in your present set if it is not already equipped with them. You'll appreciate the difference in amplification. 3 to 1 Ratio, \$4.50. 5 to 1 Ratio, \$4.75. 10 to 1 Ratio, \$4.75.

The Radio Key Book

The most valuable book of radio facts ever published, contains practical helps and tested hook-ups. Sent for 10 cents, coin or stamps.



RAULAND MFG. CO.
Pioneers in the Industry
2674 Coyne St., Chicago

ALL-AMERICAN

OVER A MILLION ALL-AMERICAN STANDARD AUDIOS IN SERVICE

"Quality Goods for Quality Readers"

Radion Speaker Horn

THE American Hard Rubber Co. is now manufacturing a beautiful loud speaker horn made of Radion. The horn unit stands about 14 inches high and on to its base is added a phone cap made in suitable threads for use with standard sized phone caps. It is intended primarily for use in sets where the loud speaker is enclosed in the cabinet. Its volume is remarkable when the size of its bell is taken into consideration. When used with a sensitive Baldwin unit it gives excellent quality and the volume is not directional, still it is ample to satisfy the home user and no additional battery consumption is involved.

Due to the moderate size of this instrument it can be concealed in a small space so that the artistic appointments of any home may not be disturbed.



Complete Portable Receiver

THE Operadio Corporation has brought out a receiver which is entirely self-contained. Batteries, aerial and loud speaker and connecting wires which usually are so conspicuous are entirely enclosed in the elaborate cabinet. Its completeness permits carrying the entire receiver to any part of the house or it can be taken along when



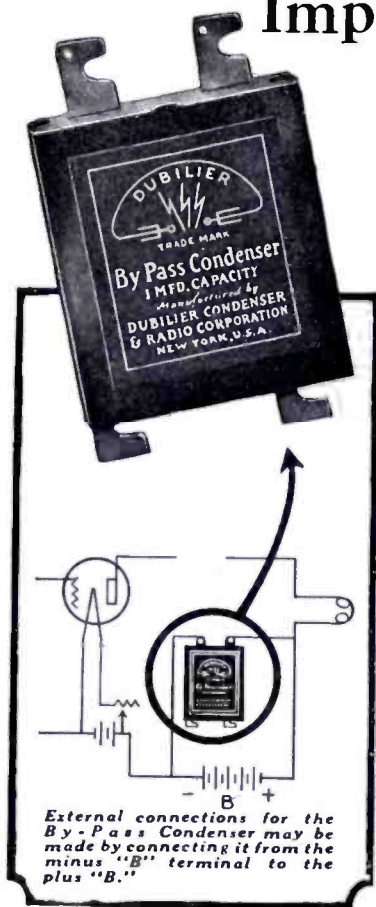
traveling or motoring. The receiver employs six tubes in a radio frequency circuit.

The By-Pass Condenser Improves Reception

YOU will get the program clearer if you install a Dubilier large capacity By-Pass Condenser in your radio set. Just locate it as the diagram indicates. The result is that the minute fluctuations of the "B" battery are smoothed out into a steady, even flow of current, devoid of all noises.

The result is astonishing! Signal strength is increased — tones purer — volume smoother. The whole program comes in far truer and pleasanter than ever before.

This By-Pass Condenser in quality of material and workmanship measures up to that high standard for which all Dubilier radio devices are famous.



External connections for the By-Pass Condenser may be made by connecting it from the minus "B" terminal to the plus "B."

Girl Scouts

(Continued from page 32)

treat. The very farthest north Girl Scout was Marjorie Mickleborough who enrolled from Grand Coulee, Saskatchewan, Canada.

Within a few weeks five hundred girls had joined the Radio Troops by letter, and thousands of Girl Scouts were listening-in. Girl Scouts from 40 states and from Canada were called together with whistle signals every meeting night. Lonely girls and girls not so lonely were interested. In cities and large towns, leaders gathered their troops together and attended the Radio meeting in groups. Girl Scout parents and neighbors joined the troop and wrote in telling Miss Holland what fun it was.

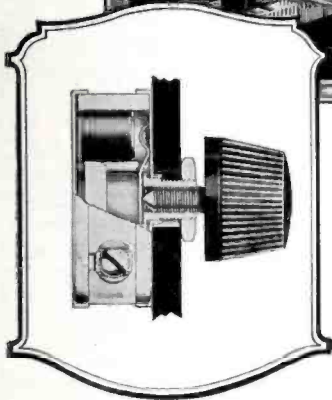
THE Radio troop was a blessing to shut-ins and invalids who were starving for contact with young people their own age. Clarissa Willard of Rutland, Vermont, who had been taken out of school in the fifth grade because of sickness and had never been able to return, joined the troop. Her address was broadcast by Miss Holland, so that other Radio Scouts could write her jolly letters. Bernice Knox, of White Plains, New York, listened to the Radio meetings from the bed where she was lying encased in a plaster cast for curvature of the spine.

Dubilier

CONDENSER AND RADIO CORPORATION

"Quality Goods for Quality Readers"

Before You Build Your Radio Set



See the New Allen-Bradley Line

Distinctive Features

- 1—Extremely compact without loss of control.
- 2—One-hole mounting for panels. Table mounting if desired.
- 3—Noiseless, stepless control, due to graphite discs.
- 4—Guaranteed against defects in material and workmanship.
- 5—Sold in distinctive checkered cartons by leading radio dealers

Radio amateurs are building better receiving sets, today! They want greater distance, better selectivity and clearer reception.

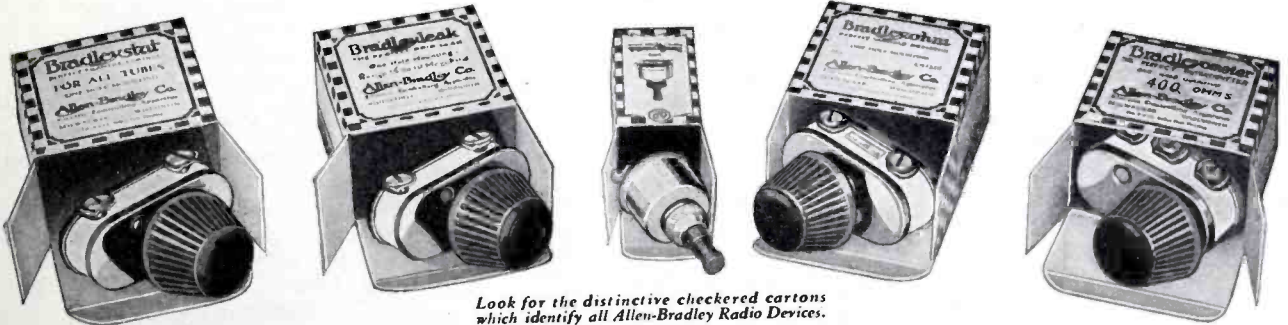
The new Bradleystat, Bradleyleak, Bradleyohm, Bradleyometer and Bradleyswitch have met with instant favor, everywhere. In a super-class, by themselves, they are the exclusive choice of the discriminating amateur who has learned from experience that noiseless, stepless control is essential for perfect radio reception. Your set will work better with Allen-Bradley Radio Devices. For sale by leading dealers.

Allen-Bradley Co.
Electric Controlling Apparatus

General Office and Factory:

283 Greenfield Avenue

Milwaukee, Wisconsin



Look for the distinctive checkered cartons which identify all Allen-Bradley Radio Devices.

"Quality Goods for Quality Readers"

"I found that the membership of my Radio Troop was mostly made up of the names of girls from small communities nobody had ever heard of," Miss Holland reported to the Girl Scout Headquarters in New York City. "I had letters from girls who were almost pathetic in their joy of being Girl Scouts—girls who lived in thinly-settled neighborhoods in which they had no companionship and no leaders to start Girl Scout work.

"You know there are, in round numbers, 10,000,000 girls in the United States between the ages of ten and twenty, and only half a million of these are reached by the nationally recognized organizations, such as Girl

Scouts, Campfire, Girl Reserves, Junior Red Cross, etc. Picture to yourself over nine million young girls in that formative period of their lives when the right sort of ideals and the right sort of use of leisure time means everything just drifting along in backward mountain neighborhoods, farm communities, small towns and rural hamlets! It was from these lonely, leaderless girls that the membership of the Radio Troop was drawn. You can imagine their enthusiasm and joy at getting a chance to use their surplus energies really doing something that was fun and service and education combined."

The letters came pouring in to Miss

Holland, and they will give you some idea of the service rendered by the Radio Troop.

"I have always desired to be a Girl Scout," wrote Margaret Wyman, of New Kensington, Penn. "While I was listening to your talk Monday evening, I realized that opportunity was knocking at my door over the radio. Is there an age limit for the Girl Scouts? I am twenty-two. My home life is on a farm among the hills, so I have every opportunity to study birds and flowers."

Mary Brandon Vaughn, who lived in Turnersburg, North Carolina, wrote: "I would like very much to join the Girl Scouts by radio. I live in the country, so I cannot have any of my friends come in and listen with me. There are no Girl Scouts in this community."

"I am a girl who lives in the Green Mountains of Vermont and not near any other girls," wrote Frances Wardell, "I think it is lovely to have a Radio Troop. It will help so many girls like me who haven't a chance to join a real troop."

Miss Holland has married and is now Laura Holland MacDonald, and her radio work for the Girl Scouts has come, temporarily at least, to an end. But the National Headquarters of the Girl Scouts have learned the value of radio in reaching isolated girls. Plans to use the radio extensively for education in Girl Scout work are being worked out at National Headquarters. And in the meantime, enterprising Girl Scout local leaders are calling radio magic to their aid and broadcasting to lonely girls in far-away places folk song choruses, troop programs, puzzles and games, stories, ceremonies, plays, nature study lessons, and other kinds of Girl Scout fun. Up in Vermont, my little friend, Lucy Williams, tunes in, listens joyfully, and feels a part of a worldwide sisterhood of girls.

At the Flip of the Dial

(Continued from page 20)

of operation is to be carried out, we dare not prophesy. And what of the radio fisherman? We all know the fellow who jumps from one broadcasting station to another during the evening. His sole interest is to identify the broadcasting station; and, once he has heard the call letters, he is off to another program. Surely, there is a radio fisherman in almost every home.

So the radio receiver of today and tomorrow must strike a happy medium between simplicity for the good wife and children, so that they may operate the set for their entertainment, and a little touch of the uncertain for the radio fisherman to try his luck. Our present receivers, with their dials that may be logged or charted, are just

SPAULDING-BAKELITE

Endorsed by

Andrews Radio Co.
C. D. Tuska Co.
Chelsea Radio Co.
Coto Coll Co.
Rawson Elec'l Instr. Co.
The Framingham Co.
Elec'l Products Mfg. Co.
Forest Electric Co.
American Mechanical
F. A. D. Andrea, Inc.
Rosas, Inc.
Magnus Electric Co.
E. E. Thompson Mfg. Co.
Dynamotro Radio Corp.
Ware Radio Corp.
Phoenix Radio Corp.
Chicago Radio Laboratories
Operadio Corporation
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H. G. Seal Co.
Krasco Mfg. Co.
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510 E. 4th St., Los Angeles
171 2nd St., San Francisco
609 First National Bank Bldg., Milwaukee

Specially Processed for RADIO

When you consider its source, you can readily understand why Spaulding-Bakelite is demanded by discriminative radio fans and leading manufacturers.

Made in the Spaulding plant, famous for over fifty years of specially processed fibre—accorded the Spaulding limitless facilities for uncommon manufacturing—this bakelite for radio panels and tubes is likewise specially processed and especially dependable.

Beautiful, black, everlasting, high gloss finish. Drills, saws and engraves safely; will not shrink or split. Highest in dielectric strength. Supplied in standard sizes, individually packed in envelope containers—special size to order.

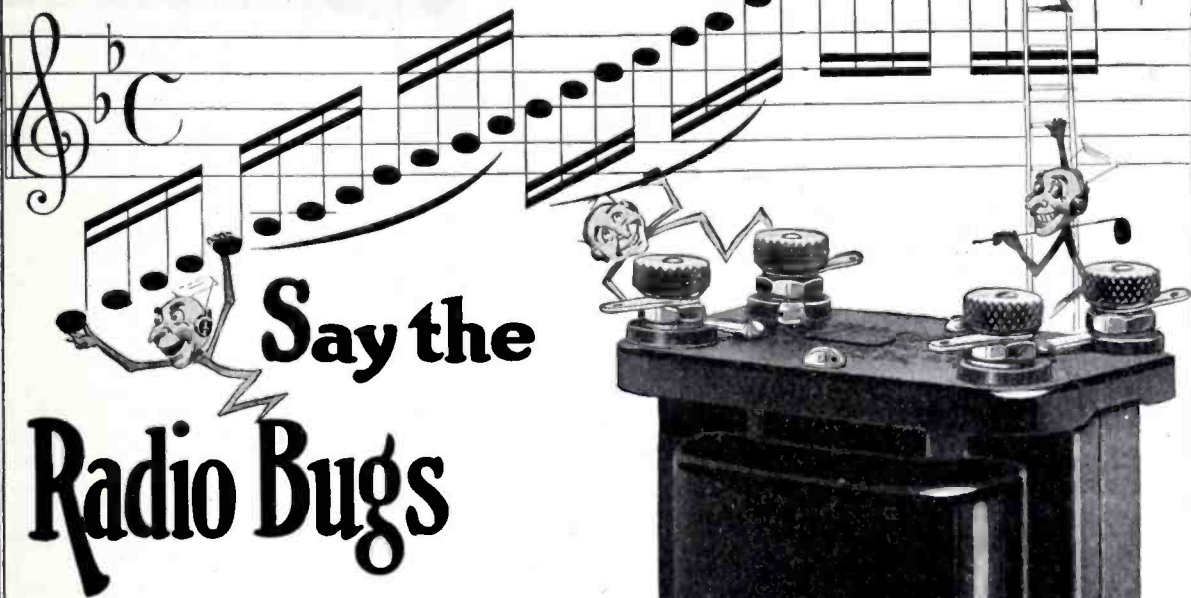
Write nearest office for descriptive circular.

Spaulding -BAKELITE



"Quality Goods for Quality Readers"

Clarity and Tone Range with Kellogg Transformer.



Say the Radio Bugs

THE reproduction of the highest tones as well as those at the lower extreme of the scale, with faithful, pure quality is essentially the spirit of Kellogg transformer design.

The lover of better music searches for a rendition simulating the original orchestra. The ringing tones of brass, the mellowness of wood, the shrill of wind and the fan fare of reed, all in their individual expression.

The Kellogg transformer accomplishes this to a wonderful degree because of its perfect magnetic properties accomplished with the silicon steel laminations without punched holes.

This feature, distinctly Kellogg, eliminates losses to a greater degree than could be otherwise obtained. A transformer is as good as its absence of losses.

Plainly marked terminals, brass shielding, moulded Bakelite top, perfect finish, are further quality and design expressions.

Amplify your pleasure with perfect amplifiers.

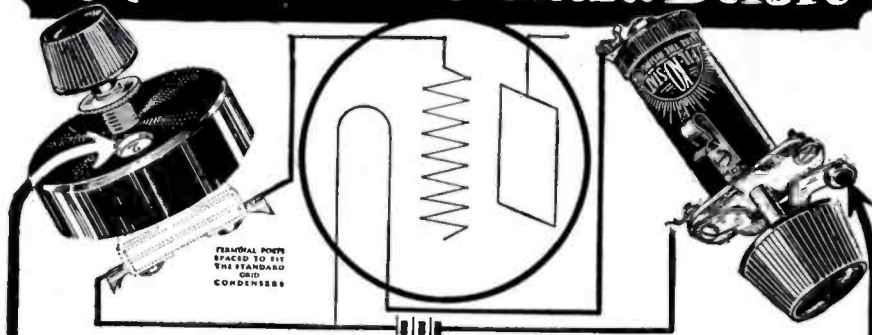
USE—Is the Test

No. 501—4½ to 1 } Equally efficient. Price \$4.50
 No. 502—3 to 1 }

KELLOGG SWITCHBOARD & SUPPLY COMPANY

1066 WEST ADAMS STREET, CHICAGO, ILL.

Stations You Never Heard Before



-thru scientific tube tuning

The most important (and most neglected) tuning unit on your set is the tube. It is the one thing you can adjust to bring weak stations to audibility—to eliminate distortion on local programs. Coils and condensers are easily tuned to incoming waves, but wave-length isn't everything. The antenna gets distant broadcasters but their signals never reach the phones unless you tune the tube to the different characteristics of the weak, distant stations. Here are two instruments distinctly designed to improve reception through their ability to control tube action—FIL-KO-LEAK to tune the grid by securing correct grid bias—FIL-KO-STAT to tune the plate-filament circuit by its control of electronic flow. Together they assure you maximum audibility, clearer signals and freedom from oscillations and other tube noises. *They bring in stations you never heard before.*

FIL-KO-LEAK \$2
SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK
Individually Calibrated
In Canada \$2.90

FIL-KO-STAT \$2
SCIENTIFICALLY CORRECT RADIO RHEOSTAT
with Battery Switch
In Canada \$2.90

You will get stations you never heard before with Fil-KO-Leak. Clear up distortion and increase volume. You can "log" your Fil-KO-Leak as you do your other tuning units. Each Fil-KO-Leak is individually hand calibrated over the operating range of all tubes 1/4 to 5 megohms. Set it for specified resistance and adjust it for best results. Resistance read in megohms through panel peep-hole. (Base-board mounting furnished.) Resistance element constant, accurate, not affected by atmospheric conditions, wear or jarring. Assures smooth, gradual control of resistance and correct grid bias. *Unconditionally guaranteed.*

Tune your tube filament with Fil-KO-Stat and receive stations you never heard before, get greater distance, louder signals, sharper tuning, freedom from tube noises. Fil-KO-Stat is the only rheostat that permits adjustment over the entire operating range of all tubes and enables you to get maximum audibility in phones or loud speaker. And now the improved model is fitted with battery switch that attaches to the regular mounting screws. Distinctly signals "on" and "off" and enables you to break circuit without changing Fil-KO-Stat adjustment. Fil-KO-Stat fits any type tube in any hook up. *Unconditionally guaranteed.*

FIL-KO-SWITCH
SCIENTIFICALLY CORRECT
"A" BATTERY SWITCH
Simple
Sturdy
Sure
50¢
In Canada 70¢

FIL-KO VARIABLE RESISTOR
SCIENTIFICALLY CORRECT
INDIVIDUALLY CALIBRATED IN OHMS
5000 to 250,000 ohms
For use in resistance
Coupled amplification or across secondary of transformer
\$1.50
In Canada \$2.10

FIL-KO LIGHTNING ARRESTER
SCIENTIFICALLY CORRECT
RADIO LIGHTNING ARRESTER
with the \$100 Guarantee
\$1.50
In Canada \$2.10

The "DX Booklet" on "Improved Reception Through Scientific Tube Tuning" sent on receipt of 2c postage.



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FOR TONE AND DISTANCE

Are You An INSULINE Fan?

Manufacturers, dealers and amateurs today are talking about INSULINE panels. Because more than any other panel on the market, INSULINE contains all those qualities that make for perfect radio reception.

INSULINE panels are impervious to all kinds of weather—it never warps or sags—it holds all mounted parts like a vise—it is easily engraved and machined—it does not absorb moisture.

INSULINE gives greater range and a silvery tone, because it is a poor conductor—it never wastes set power.

INSULINE comes in three beautiful colors—black, black anti-capacity, mahogany—and the new frieze finish. In all standard and special sizes.

For panels, dials, tubing, sockets and mounting strips—insist that your dealer give you INSULINE.

RADIO PANEL AND PARTS CORP.

59 WARREN STREET

(Insulating Company of America)

NEW YORK

Western Branch
INSULATING CO. OF AMERICA, Madison, Wis.

Manufacturers, Jobbers and Dealers Write Our Nearest Branch for Booklet and Prices

about right in this respect. They may be instantly adjusted for desired broadcasting stations well within range, and they may be tuned in the most delicate manner for the DX or long-distance stations.

IN the process of popularizing radio, the matter of batteries has come in for considerable attention. Our early radio receivers made use of cumbersome storage batteries and uncertain flashlight batteries for the plate circuit of our tubes. Of late the tendency has been towards simplifying the storage battery on the one hand, and eliminating it altogether in favor of the dry battery. Still more recently there have been several attempts to apply the usual lighting current to the operation of vacuum tubes, thus doing away with the batteries.

While many of the present-day receiving sets are equipped with dry-cell vacuum tubes, it is generally admitted that the large tubes, which are operated on a storage battery have a greater output, hence the old storage battery is far from being condemned to the junk heap. And since it remains a very necessary evil in our radio reception set-up, the next best thing is to make the most of it. This is exactly what is being done today. The storage battery, which is at best a messy thing, is being presented to us in neat containers with every precaution taken to avoid the spilling of its acid contents. Excellent rechargers are available so that we may charge the storage battery at home, thus saving in time and money over the former practice of sending it to the battery service station. To make the storage battery as fool-proof as possible, more than one manufacturer of late has equipped his batteries with a built-in hydrometer device, so that the radio layman can tell at a glance just how the battery stands as regards charge. The built-in hydrometer device usually consists of three colored balls which are free to float in the electrolyte of the storage battery. These balls are of such specific gravities that they will indicate, by floating or sinking in the various combinations, the condition of the battery at all times.

And yet, despite the built-in hydrometer and the convenient recharger, there is a still more attractive storage battery layout, in which a recharger is combined with the battery in such a manner that the storage battery is constantly on charge until it becomes fully charged, when the charging current is automatically shut off. The radio receiving set may be operated even while the battery is on charge, so that a fully charged battery is always available. This, so it would seem, represents about the last word in this respect, especially since the arrangement is furnished for supplying current to the filament and the plate circuits.

Wonders are being accomplished with dry-cell tubes. Through the de-

velopment of special filament material, we now have dry-cell tubes which do very well even on loud-speaker reproduction. Here again we find the strong influence of milady, who has never been keen about seeing a storage battery brought into the living room and placed on the best rug in the house, even though an old magazine was placed under the battery. The dry-cell tube has enabled radio manufacturers to make self-contained receiving sets, which certainly mark a new era in radio development. Whatever the dry-cell tube has lacked in the way of output has been made up by using more tubes, especially for loud-speaker operation.

TUBES and still more tubes is the order of the day. From one-tube sets we went to three tubes, and from that to five tubes, and now we are going to six, eight and in some instances ten and twelve tubes. Of course, more tubes stand for better results. Not only can we intercept weaker signals, but we can build up those signals for loud-speaker reproduction. Yet all the while we are placing a greater and still greater drain on our filament and plate batteries, especially on the latter. Tube engineers long ago foresaw the trend towards multi-tube receiving sets and set to work developing the improved thoriated or so-called XL filament tubes of today, with their extremely low current consumption of one-quarter ampere per tube for storage battery operation, and .06 ampere—a little over one-twentieth of an ampere—for dry-cell operation. The increased drain placed on the plate or "B" batteries has been offset to some extent by the extensive introduction of the so-called "C" battery or grid battery.

The increased number of tubes has boosted the cost of radio reception to be sure. The item of battery costs has loomed up larger than ever but the wonderful results obtained from our multiple-tube sets have made us overlook the operating expenses. Still, this is a matter which must receive due consideration sooner or later. It would seem as though the ultimate receiver must operate its tubes on the standard commercial lighting circuits, so that we may plug to the nearest electric light socket.

Recently we have had an open season for devices to harness the standard lighting current to our vacuum tubes. One such device made its bow to the radio public, and immediately a flock of others appeared on the scene. These devices, for the most part, aim to replace the usual "B" or plate batteries in the operation of our vacuum tubes. They generally make use of a vacuum tube, in some instances the standard radiotron UV-201A, and in others the radiotron 50-watt transmitting tube

Type 6-D Broadcast Receiver

Non-oscillating ~ Non-radiating

IN dollar-for-dollar value, the 6-D Receiver leads the field.

This remarkable Receiver excels in every phase of performance—purity of tone, sharpness of tuning, range, volume and ease of operation.

You can pay more, but you cannot buy better reception. By all means examine the 6-D before making a final selection.

Price \$125.00
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• SPECIFICATIONS •

Circuit: Two stages of tuned radio frequency, detector and two stages of audio frequency. Non-oscillating.

Tubes: Five.

Batteries: Storage or dry-cells.

Cables: Complete set supplied.

Wave Lengths: 200 to 600 meters, with uniform efficiency of reception.

Panel: Aluminum. Black crystalline finish.

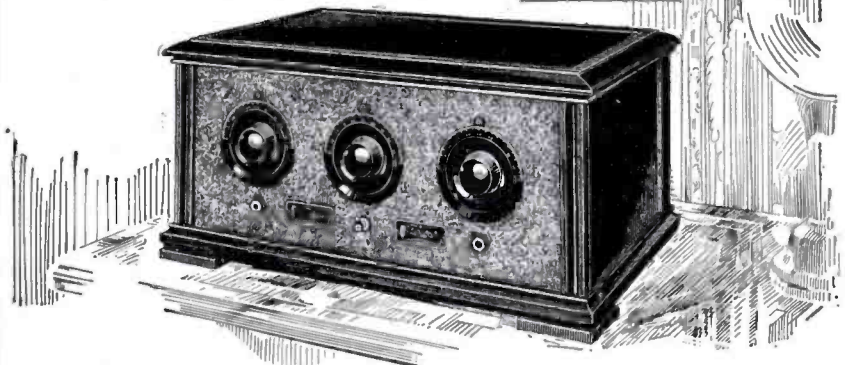
Dials: Sunken design.

Rheostats: Adequate resistance for all standard base tubes.

Condensers: Single bearing, low leakage loss.

Sockets: Suspended on cushion springs.

Cabinet: Mahogany, with space for "B" batteries.



EISEMANN
ELECTRICAL EQUIPMENT

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and even special types of tubes, for rectifying the alternating current, together with filtering devices for eliminating the hum and a transformer for stepping down the voltage to the desired degree. A few of these devices are intended to supply filament current to vacuum tubes.

Perhaps the most ingenious of these current-harnessing devices is one which makes use of the thermo-couple idea. Instead of rectifying the usual alternating current and smoothing out the ripples, this particular device merely uses the current to operate electric heaters, and these in turn heat a battery of thermo-couples. It may be well here to add that a thermo-couple is a combination of two dissimilar metals which, when one is heated while

the other is cold, will produce a flow of electricity. This electricity is of the direct-current kind and, of course, quite uniform if the heat is constantly applied. In the device in question, a large number of thermo-couples are connected in series, so that while the voltage from a single thermo-couple may be almost insignificant, it aids in swelling up the total voltage of the thermo-couple battery. This device is capable of supplying current to the filament of the vacuum tubes, to the plate circuits, and for the grid biasing service in place of the usual "C" battery.

It must not be taken for granted that we shall be operating our radio receiving sets directly from the electric light socket by tomorrow morning. A great

deal of sound development still remains to be done, before such a fond dream can be realized. The present devices, which aim at replacing the "B" battery, must be perfected in many instances. The author has found most of them to be far from ideal, in that they introduce hum and other objectionable noises in the loud-speaker horn. Then, too, some of them require too much current for their operation, so that they fail to show a marked economy over the very batteries which they replace. Again, if these devices are to be adopted in place of batteries, they must furnish current for the filaments, plates and the grid circuits of our tubes. They must do the entire job.

It is logical, at least, to look forward to the day when we shall no longer be using batteries for the operation of our radio receivers. But that day is still pretty far removed, and dry battery and storage battery manufacturers need not contemplate shutting down their factories just yet.

AND of loud-speakers, what shall we say? Have we reached the limit of perfection? Is there still ample room for improvement? Must we use the inartistic horn? And what is coming in this line?

Truth to tell, it is one of the anomalies of radio that a five-dollar pair of ear phones will produce better music than a fifty-dollar loud-speaker. Once we get our loud-speakers to the point where they can hold their own with a cheap pair of ear phones, we shall have reached practical perfection at least.

Although ear phones give the best reproduction of radio music, the public demand has been steadily growing in favor of loud-speaker reproduction. Few there are now who are satisfied to sit with receivers glued to their ears; for, once a loud-speaker is given a trial, ear phones are a thing of the past except for occasional DX or long-distance fishing.

We have already gone a long way in loud-speaker development. Our loud-speakers are far ahead of those of two or three years past, when radio broadcasting was in its swaddling clothes. Not only do we get real sound volume out of our loud-speakers, but we get fairly good musical reproduction. It is not difficult for us to guess that many of the radio manufacturers producing loud-speakers have enlisted the efforts of acoustical experts in perfecting their instruments, for the results speak for themselves. Still, it must be admitted that there is ample room for further development, especially in the way of developing loud-speakers that will do justice to the entire musical range. We have some loud-speakers which render good instrumental music, but are poor on vocal, and vice versa. Yet this is as it

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Radio Editors and engineers throughout the country specify B-T Low Loss Condensers and Inductances in their hook-ups because they know that they are good.

R. A. Bradley, Technical Editor of Wireless Age, says: "The results obtained with your tuner have never been equaled by myself or my associates. The adjustable primary is one of the most valuable things that has been added to the regenerative type tuner."

See the December issue for the hook-up used.

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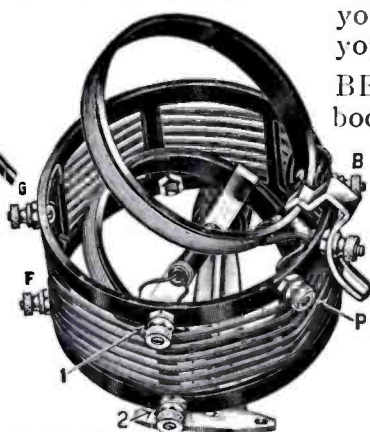
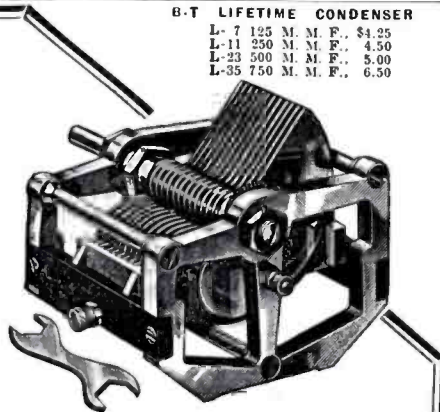
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L-7	125 M. M. F.	\$4.25
L-11	250 M. M. F.	4.50
L-23	500 M. M. F.	5.00
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Made in two types for Broadcast and Short Wave work. Ranges covered with an L-7, B-T Lifetime Condenser.
Type B, 200 to 565, \$3.00
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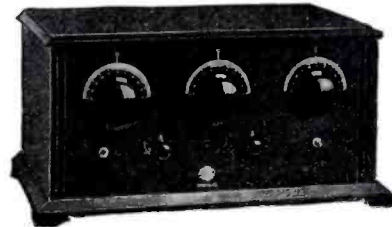
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One Dial—Six Tubes

Distance is no barrier to reception with this set—it is very selective and has wonderful volume. Resistance Coupling is used for its amplification making the tone quality perfect. Cabinet in American Walnut or Mahogany.

List Price	\$125
West of Rockies	135
Canada	165



A Five-Tube Set

Here is a tuned Radio Frequency set that is especially designed to meet the demand for a high grade receiving set at a medium price. It is very selective, having extraordinary distance range and great volume. Cabinet of genuine American Walnut.

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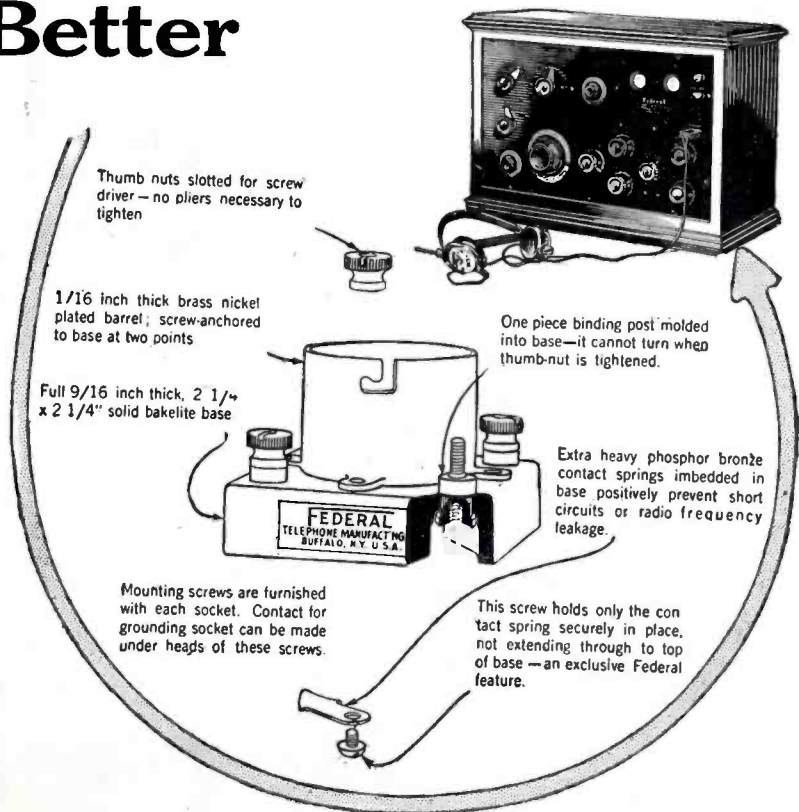
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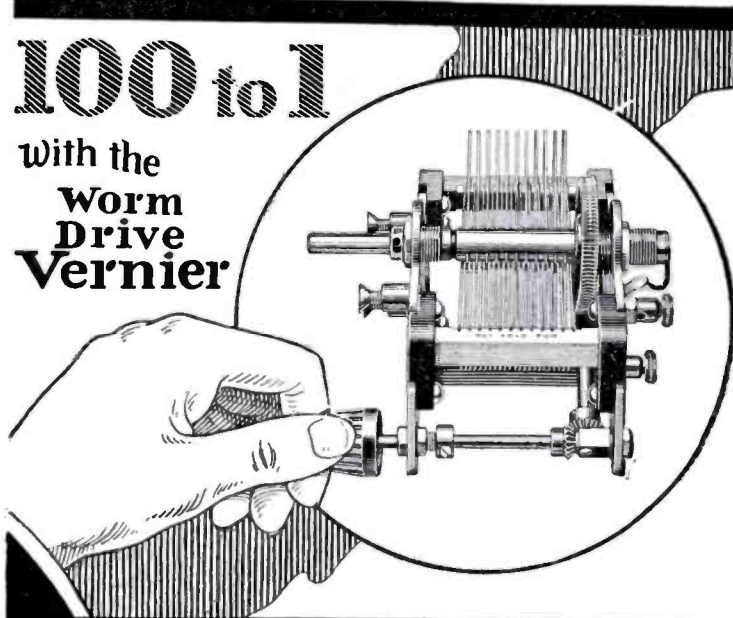
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With the
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In justice to yourself you should examine the American Brand Condenser with the 100 to 1 Worm Drive Vernier before you finally decide which condenser you will put into your set.

You will be agreeably surprised by its sturdy build — by its wonderful fine tuning possibilities — by its remarkable electrical qualities. Here is a real low loss condenser that we guarantee to improve any set. Let your dealer show it to you.

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Sharp tuning, selectivity without vernier made possible by the use of *visidials*. Brunswick De Luxe Low Loss receiver equipped with *visidials* forms an unequalled combination. Low Loss

instruments of the highest grade are used throughout the entire circuit. It is without doubt the "lowest loss" receiver that has ever been offered to the public.



Price \$65.00

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NEW YORK CITY

should be, according to school-boy physics; for, to think of it, how can we expect a single diaphragm, which has a natural period of its own, to reproduce everything in the musical line from high C coloratura soprano to the lowest note of the pipe organ?

The author, who has done considerable research work with phonograph reproducers and has been responsible for a basically new reproducer in which the diaphragm may be instantly adjusted for different natural periods so as to handle vocal or instrumental selections to the best advantage, goes on record at this time to predict that we shall ultimately have multi-diaphragm loud-speakers. At least one radio manufacturer has had the vision to work along this line, and more must follow. We shall have far better radio reproduction of musical programs when our loud-speakers are equipped with at least two diaphragms, one favoring the low and deep notes of instrumental music, and the other the shallow and high notes of the human voice, both diaphragms being free to vibrate at all times.

The parchment cone loud-speaker, which has recently appeared on the market, aims to take in a wider range of sounds than the usual run of loud-speakers. This loud-speaker is of the hornless type. It makes use of a sound projector in the form of two 18-inch parchment cones which have their bases cemented together. The apex of one cone is connected with the driving rod which is actuated by the electromagnetic apparatus, which in turn receives the fluctuating current from the usual amplifier. Instead of depending on the conventional horn for converting the vibration of the conventional diaphragm into air impulses of sufficient spread to scatter the sound throughout the room, this hornless loud-speaker applies the vibrations directly to a large vibrating surface, and this in turn imparts its vibrations to a large spread of air.

There are several distinct advantages gained with the new hornless type of loud-speaker. First of all, the tone quality is really excellent and much of the distortion to be found in many of our horn type loud-speakers is conspicuous by its very absence in this new design. Secondly, the sound is spread throughout the room, without the directional effect which is had with the usual horn type. This may or may not be an advantage, depending on personal likes and dislikes. Again, the music is soft, sweet, and realistic. This may be an advantage or disadvantage, too, depending on personal taste. Why? Because there is such a thing as a loud-speaker ear, just as there is a phonograph ear. Many of us have become accustomed to distorted radio music, and like it just that way. The hornless loud-speaker will generally give less volume for a given amplifier output than the usual horn type. But we are all agreed that

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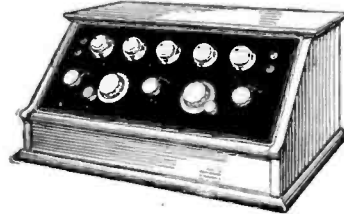


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Sets that satisfy and serve



HUNDREDS of different types of radio receivers are on the market today, some good and some bad. The Crosley Trirdyn 3R3 Special and the Kennedy Model XV everyone knows is good. They have satisfied and served the most discriminating buyers.

The manufacturers of these two sets have given the best possible receiver at the least cost. Sets that

will satisfy and serve your customers as these two receivers have been doing are sure never to become dead items in your trade.

Stock these sets and watch your customers buy. There is plenty of national advertising back of them to help you sell. The radio receivers that sell themselves are the ones you make your best profit on.

2090-Q

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\$1 ONE DOLLAR BUYS THE ANTENNAPHONE

REPLACES THE AERIAL

The Antennaphone placed under your telephone and connected to the antenna post of your radio receiver (tube or crystal) gives you sharper tuning, thereby

INCREASING SELECTIVITY AND QUALITY OF RECEPTION

SAFER than a troublesome outdoor aerial.
BETTER than an slightly indoor aerial.
EASY TO INSTALL —not attached to the telephone.

The Antennaphone, complete with insulated wire. Price \$1
Telephone can be any distance from Radio.

OUR MONEY BACK GUARANTEE
The Antennaphone will not interfere with the use of your telephone and is guaranteed to work perfectly with any receiver (crystal or tube) or your dollar will be refunded. **AT YOUR DEALER OR SENT BY MAIL UPON RECEIPT OF ONE DOLLAR.**
Correspondence solicited from radio dealers and jobbers.
THE ANTENNAPHONE COMPANY,
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FANS EVERYWHERE ARE REPLACING Their Coils With EASTERN Low-Loss Couplers

Designed by M. B. Sleeper

THE IDEAL TUNER!

This coil for the standard 3 circuit tuner, has replaced numerous other coils, and in every case has improved the results of the set in distance range, selectivity and increased volume reception.

One fan writes: "Several of my friends have purchased your coil after seeing mine (EASTERN LOW-LOSS COUPLER) and have replaced the tuners which they had in their sets—. They are very enthusiastic over the improved quality and selectivity.

Very truly yours, (Signed) H. J. AUGHE, Detroit, Mich."

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Zenith amplifies with Thordarsons!

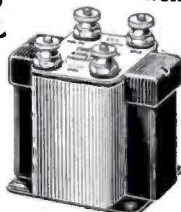
2 THEY SAY OF THE KENNEDY:
 "The Kennedy tone quality is superb; full-rounded, musically pure reproduction of any program within a good long range. No hollow tones or distortion. For the Kennedy is a musical instrument. A musician will enjoy its purity of tone."
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 "To hear the real voice of the nation full and clear—you want volume. . . . Volume that floods your room. . . . Distant stations can be tuned in with remarkable clearness and volume."
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 "It secures the finest tone and high selectivity with increased volume and distance. It brings to the home . . . a reproduction of music really comparable to the original. In volume the Deresnadyne will give anything from a mute tone to a volume that fills a large hall."
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NOTE—
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Transformer Specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
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Super
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Standard on the majority of quality sets

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the hornless loud-speaker is more attractive to gaze upon than the horn type, and so it finds its way into the most favorable place in the living room.

Loud-speakers must follow in the footsteps of the phonograph. Just as the old morning-glory and polished brass horns were abandoned in favor of cabinet-type phonographs, so must the radio loud-speaker shed its visible horn. Already the process is under way, not only in conjunction with complete receiving sets with self-contained horns, but also the loud-speakers themselves which are now going into hiding in attractive cabinets.

ONE more word about loud-speakers, before we pass on. It is not altogether fair to charge the loud-speaker with all the distortion which comes out of it. The amplifier is also responsible for distortion. With the radio audience becoming more and more critical as regards the rendition of musical programs, especially since the novelty of picking music out of the air has long since worn off, distortion has got to go.

Just how far our radio engineers can go in eliminating whatever distortion still remains in the usual run of amplifiers, is difficult to predict. Lately we have had a good deal said to us about resistance-coupled amplifiers and their distortionless operation. Anyone who has tried this type of amplification, which is simplicity itself, must admit that the loud-speaker reproductions obtained therefrom is really sweet and beautiful. But the volume! Here is the disappointment. Three stages of resistance-coupled amplification will usually barely equal two stages of transformer-coupled amplification. So it is a question of quality versus quantity, and most of us do like quantity or volume. Still, it may be that we shall see another tube or two added to our multi-tube sets, so as to give us resistance-coupled amplification.

THAT'S that. The outward signs of radio progress are all about us. Receiving sets are being made more attractive all the while. The plain sets of last year are coming out this year with sloping panels and more attractive cabinets. There are more and more self-contained receiving sets, with loop, loud-speaker, batteries. Just as the automobile manufacturers have learned to cater to milady's whims by throwing in a silver-plated vanity case and a cut-glass flower vase in the coupé, so radio manufacturers are now putting their good old sets in period cabinets. The new slogan of radio seems to be "Heard, but not seen!"

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So much better you won't believe it. Greater distance, less fading. No carbon, graphite or sliding contacts to wear out and get noisy. Insist upon Turn-It.

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"Quality Goods for Quality Readers"

Jimmy Clark

(Continued from page 33)

its worthy companion pieces. Just to think that Mark Twain missed this! Jimmy says these floating palaces are still to be found on the Mississippi and the Monongahela Rivers. After that he did a trick piano act for several seasons on small Southern and Southwestern circuits. Then he traveled about with a tent show in the Middle West, which gave musical comedy, vaudeville, and dramatic shows. Here he was musical director and also played comedy in juvenile parts.

We next see him as interlocutor with John Vogel's "Big City Minstrels" doubling with an alto horn and trombone in the band. This took him through the West and East as far north as Green Bay, Wisconsin. Having been tied down to a big city all my own life I will never be able to understand how Jimmy Clark gave up this fascinating existence to come and work with music publishers on Broadway and tour a legitimate Keith and Orpheum Circuit with Fay Templeton, as her accompanist. He broke away from this however, during the war, to become a Y. M. C. A. Secretary at Camp Dix attached to the Base Hospital Division, his biggest achievement at this time being to put on an elaborate show at the Trent Theater, Trenton, New Jersey. This possessed an orchestra of twenty-five, a band of twenty, and twenty-five participants in a musical review, the entire group collected from Camp Dix and being coached and trained by himself.

The end of the war brought him back to New York, broke, and he started with Irving Berlin as a floorman. When radio came into its own he was told to go ahead and get all he could out of it and because he had so much competition he found it necessary to build up a big act to beat the other teams. He "grabbed" his talent off the floor as they came in for music and so his "White Way Entertainers" have included such people as: the Kaufman Brothers, Hope Vernon and the eight Vodka Singers who are so fascinatingly introduced by Ed Wynn (himself) in the Grab Bag. These "White Way Entertainers" have appeared at WEA, WFBH, WAHG, WHN, WOR, WEBJ, WAAM, and WBS, so if you haven't heard them it's nobody's fault but your own. The average group is from five to twelve and includes singers, elocutionists, harmonica and ukulele artists, and Clark himself doing syncopating piano solos. In fact, it includes as he himself says, "everything but trained seals."

There are none of the earmarks of the professional about Clark—nothing to show that he has wandered all over the country and endured all the hard-



Magnavox Receiving Set TRF-5

A 5-tube tuned radio frequency receiver, including M4 Reproducer (as shown above); \$125

TRF-50

Same as above but enclosed in larger cabinet with built-in Magnavox Reproducer; . . . \$150

Magnavox Vacuum Tubes

Can be substituted for ordinary tubes to great advantage in any receiver; . . . \$5.00



THE NEW Magnavox Receiver has assumed a place of acknowledged leadership among the enduring radio achievements of the past year.

Whether you purchase the Magnavox TRF-5 or TRF-50, you are assured of the most pleasing musical tone, and all the advantages of the Magnavox one-dial Station Selector.

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Look this plug over. Compare it with all others, then you will know why set and loud speaker manufacturers have adopted it as standard equipment. There is nothing to equal it for quality, workmanship, design and service. Don't waste time and money experimenting, buy the best—buy Carter.

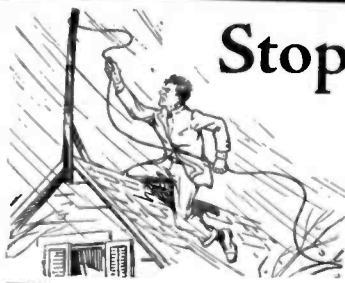
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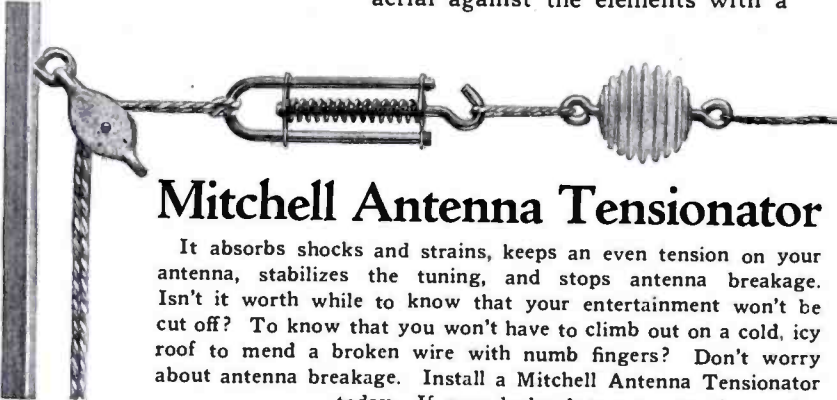
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Stop antenna breaks!

BE independent of the weather. Don't let cold, wind, snow, sleet, or ice break your antenna and cut off your radio entertainment just when you want it most. You can insure your aerial against the elements with a



Mitchell Antenna Tensionator

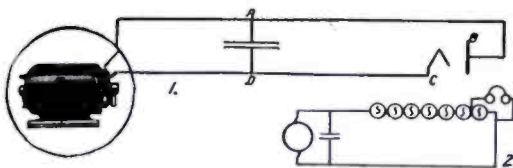
It absorbs shocks and strains, keeps an even tension on your antenna, stabilizes the tuning, and stops antenna breakage. Isn't it worth while to know that your entertainment won't be cut off? To know that you won't have to climb out on a cold, icy roof to mend a broken wire with numb fingers? Don't worry about antenna breakage. Install a Mitchell Antenna Tensionator today. If your dealer does not carry them order direct. No tools required. Simply insert one Tensionator between the insulator and support as shown in picture.

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Follow them thru monthly.*



THE CONDENSER. The simplest effective step toward ripple reduction is the condenser across the line. If the ESCO generator set is disconnected from the transmitter and loaded with a lamp load as in 2, this effect may be easily noticed. With a one or two mfd. condenser the result will be amazing.

Here is what takes place. The D.C. with a slight ripple component finds at A, two separate paths back to the generator. One thru AD, the other thru ABCD. Both paths offer impedance. That thru ABCD is practically all resistance, about 10,000 ohms for the smaller tubes. This, in so far as the ripple frequencies are concerned, remains constant. The path thru AD is different, its impedance will decrease as the frequency increases. That is, the higher the frequency, the more ripple current it will by-pass.

A 1 mfd. condenser across an ESCO generator with a commutator ripple of 2802 and a slot ripple of 934 will produce the following results. The impedance for D.C. thru AD is infinite, thru ABCD about 10,000 ohms. The impedance for commutator ripple thru AD equals 56.8 ohms, thru ABCD 10,000 ohms. The impedance for slot ripple thru AD equals 170 ohms and 10,000 ohms thru ABCD. Following the paths of least impedance the D.C. passes 100% thru ABCD, commutator ripple 176/177 thru AD and 1/177 thru ABCD, and the slot ripple 58/59 thru AD and 1/59 thru ABCD.

ESCO Generators have such a small ripple component that even with this crude attempt at filter they will surpass A.C. supplies with intricate filter systems, both in tone and miles per watt.

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ships of a traveling showman's life. He is tall and slim and quiet, and awfully pleasant, but it's all of this stuff that has caused him to win the second prize, a bronze medal, in the recent popularity contest of the "New York Evening Journal," and the third prize, a loving cup, in the recent New York "Mirror" contest.

Regenerative D-Coil

(Continued from page 35)

(x) and (y). Using a No. 18 drill, bore four holes around the base of the tubing, spacing them symmetrically, for the insertion of the terminals for the transformer windings. Use $\frac{5}{8}$ inch, 8-32 round head brass machine screws for the terminals as they are as good as anything and are easy to get and are also inexpensive. Insert the terminals before starting the winding, supplying two washers and two nuts for each terminal. For facility in making the winding, procure three $\frac{3}{4}$ pound spools of No. 24 double cotton covered copper wire. Taking two of the spools, fasten the free end of the wire on one of them to terminal No. 2. This is the start of the primary winding. Then fasten the free end of the wire on the other spool to terminal No. 3, this is the start of the secondary winding. Commencing with the wire that is attached to terminal No. 2, start winding in the direction shown by the arrows in the figure; going through the slot at (x) and out at (y) and continuing in the direction of the arrows, around to (x), through this slot and out at (y) and back towards terminal No. 2 again. When terminal No. 2 is reached, one complete turn has been wound. This complete turn should form a figure 8 and if such is not the case, the winding is not correct and before going any further, the directions should be gone over again carefully and a new start made, being sure that you have started correctly before going ahead with the winding. Now, if you are sure that you have got the idea of the manner in which the winding is made, note that on the first time around, when you come to terminal No. 3, pick up the beginning of the secondary winding and carry it along in parallel with the primary winding. The primary and secondary windings are thus interwoven, insuring close coupling. Continue until you have wound on 14 turns, then cut off the wire that you are using for the primary winding. Drill a hole through the tubing at the fourteenth turn, above terminal No. 1. Pass the end of the primary winding through this hole that you have just made and connect it to terminal No. 1. Thus the primary is composed of 14 turns interwoven with the secondary and connected to terminals No. 1 and No. 2. Now continue

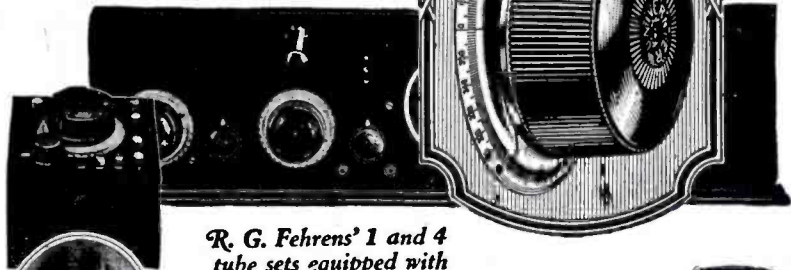
"Quality Goods for Quality Readers"

with the secondary winding until you have completed 56 turns. Cut the secondary at this point, drill another hole through the tubing here, located above terminal No. 4, pass the end of the secondary through this hole and connect it to terminal No. 4. Thus there are 56 turns in the secondary winding and the ends of this winding are connected to terminals No. 3 and No. 4. The ratio of the secondary winding to the primary winding (transformer ratio) is 4 to 1. The length of the space taken up by the primary and the secondary windings is 2 3/16 inches. This leaves 5/16 of an inch at the end of the tubing which is necessary for the fastening on of a bakelite end plate to be inserted in this end to act as a bearing surface for the tickler, or feed-back coil. This bakelite end piece is to be a disc, 2 7/8 inches in diameter and 1/4 of an inch thick. This allows for its sliding inside the 3 inch tubing which has the 1/16 inch walls. At the center of this disc, drill a hole with a No. 28 drill and tap this hole with an 8-32 tap. Countersink this hole on the under side and screw into it a 1/2 inch, 8-32 flat head brass machine screw, thus allowing a little more than 1/4 of an inch to protrude through the top of the disc. This is to function as a pivot for the tickler coil to revolve about and if you wish, it would be a good plan to file down the surface of the screw a bit to eliminate the sharp edges. Slip this disc inside the coil you have just wound, until the top of the disc is flush with the end of the tubing. To fasten the disc inside the tubing, drill four holes through the tubing, spaced symmetrically, so that the drill will penetrate the disc midway between its top and bottom surfaces. Use a No. 33 drill and tap this hole with a 6-32 tap. Fasten the disc in place with 3/8 inch, 6-32 round head brass machine screws and this transformer has been completed. If you are not particular, this end disc may be made of wood. In that case you would use small wood screws instead of machine screws to fasten the disc inside the tubing. Use 1/2 inch, No. 4 round head brass wood screws in this event. It might be well to note here that if you wish to drill a hole to tap for a 6-32 machine screw, use a No. 33 drill and if you wish to drill a hole to allow a 6-32 machine screw to pass through, use a No. 27 drill.

In making the feed-back coil, first procure a piece of bakelite tubing, 3 inches in diameter and 2 inches in length. Make two slots in the sides of this tubing in the same manner that you made the slots in the previous case, making them 1 inch wide and extending from one end of the tubing to within 3/4 of an inch of the other end. Only two terminals will be necessary for this

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Mahogany Knob and Gold-plated dial \$1.50

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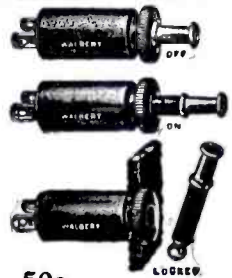


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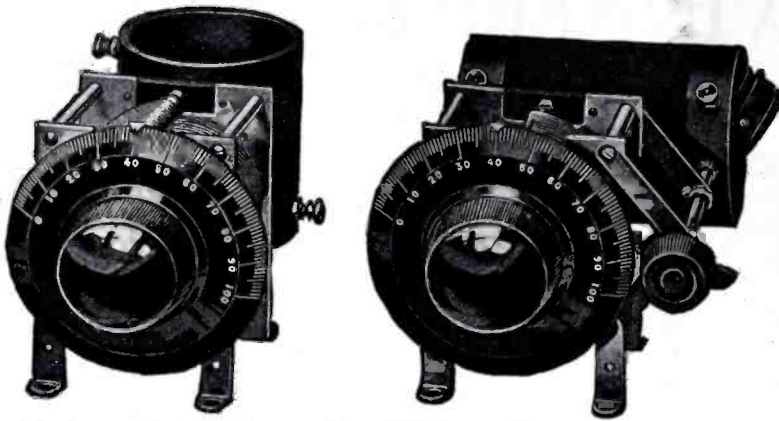
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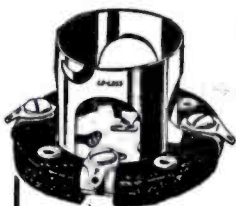
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unit, therefore, it will only be necessary to drill two holes with the No. 18 drill, around the base of this piece of tubing as shown in the diagram in figure 2. Here also, use $\frac{5}{8}$ inch, 8-32 round head brass machine screws for the terminals and spot them, one on either side of the tubing, for the sake of symmetry, as shown. Use No. 24 double cotton covered copper wire for this winding, also, and connect one end of the winding to terminal No. 5 and start winding in the direction shown by the arrows. This has to be a figure 8 winding in order to effect coupling with the secondary of the transformer just completed, since it is a figure 8 coil itself. Continue winding until you have wound on 30 turns, then cut the wire and fasten this end to terminal No. 6. The length of winding space necessary for this coil is $\frac{15}{16}$ of an inch, thus there will be $\frac{5}{16}$ of an inch left at the end of the tubing for the insertion of the bakelite disc which is to bear against the disc inserted in the end of the third transformer which we have constructed first in this instance. It will be necessary to procure another bakelite disc, $2\frac{7}{8}$ inches in diameter and $\frac{1}{4}$ of an inch in thickness. Drill a hole through the center of the disc with a No. 18 drill. It is well to note here that if you wish to drill a hole to tap for an 8-32 machine screw, use a No. 28 drill, but if you wish to drill a hole to pass an 8-32 machine screw, use a No. 18 drill. Another point regarding the diagram—the $2\frac{7}{8}$ inch dimension applies to the diameter of the disc and therefore is the inside dimension of the tubing which is 3 inches outside. Now insert the disc which you have just been working on, into the end of the tickler coil tubing and fasten with $\frac{3}{8}$ inch, 6-32 round head brass machine screws in the same way that you fastened the other disc. Now it will be possible to place the tickler coil on top of the radio-frequency transformer so that the two end discs bear against each other and the pivot on the top of the one fits in the hole through the other. Thus it will be possible to turn the tickler coil and change the angular relation between it and the secondary of the radio-frequency transformer and thus change the coupling between them to any desired degree, from minimum to maximum, and get any amount of regeneration that you wish.

The first two radio-frequency transformers are made in the same manner as the one just described, except, of course, that there is no necessity for an end disc and therefore it is left off.

Now as to connecting the transformers in the circuit. This point evidently, was not made clear in the previous article and caused trouble to a great many who were experimenting with the circuit. The numbers on the



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terminals of the transformers as shown in the diagram in this article are relatively the same as those that appeared on the diagram on page 36 of the June WIRELESS AGE. That is, No. 1 is the end of the primary winding, No. 2 is the start of the primary winding, No. 3 is the start of the secondary winding and No. 4 is the end of the secondary winding. In the case of the first transformer the ground is connected to the end of the primary winding, No. 1 terminal. The antenna is connected to the start of the primary winding, No. 2 terminal. The start of the secondary winding, No. 3 terminal, is the filament side and the end of the secondary winding, No. 4 terminal, is the grid side. In the case of the second transformer, the plate of the first radio-frequency amplifier tube is connected to the start of the primary winding, No. 2 terminal. The positive "B" battery lead is connected to the end of the primary No. 1 terminal and the secondary connections are made in the same manner as in the case of transformer No. 1. The connections to the third transformer are made in the same manner as the connections to the second transformer. This scheme of connections holds for the transformers in the circuit that was described in the June issue of THE WIRELESS AGE. As stated before, those who experienced trouble in getting the circuit to function properly, had the connections to one or all of these transformers reversed. For instance, if the grid were connected to terminal No. 3 and the filament to terminal No. 4, that circuit, instead of tuning over the entire broadcast wave band would probably start at about 360 meters and tune up to 550 meters. This would be very unsatisfactory, since the lower range of broadcast wavelengths would not be covered and the tuning condenser would only function over one-half of the scale. In many cases fellows wrote in that two of their condensers covered the entire range of broadcast wavelengths perfectly, but the third wouldn't tune any lower than 360 meters and that they couldn't understand the reason for this since they had followed directions perfectly and had wound all the transformers in a like manner. Obviously, in this case, the trouble was not in the method of winding the transformers, but in the method of connections and whereas two of the transformers had been connected in the circuit as they should have been, the third had the connections reversed with the subsequent trouble in tuning. Some fellows didn't even have this much success, since they had all of their transformer secondary connections reversed and subsequently could only cover half of the broadcast waveband on all three tuning condensers. In all these cases that I had time to write to,

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Aerial Mast \$25
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20 ft. Mast, \$10 or 60 ft. Mast, \$45. All steel construction. Each mast complete with guy wires and mast head pulley. Write for literature and *free* blueprint.

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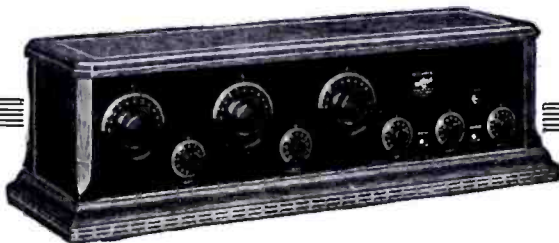
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and state the scheme of connections that should be employed, the answer that came back to me from the men in question was that they had found reversed connections to the radio-frequency transformers to be their trouble and upon correcting this the trouble was eliminated.

When tuning this circuit, you will find that all the condensers will tune in any particular station at approximately the same point on the condenser scale. The middle one will be slightly more selective than the other two and if your antenna has very much resistance in its circuit, the first condenser will tune the broadest of the three.

The more efficient the antenna used, the greater will be the selectivity of the first condenser. After tuning in a station, adjust the tickler coil coupling to the third transformer secondary, until you get maximum signal volume, without distortion and without oscillation. After once adjusting the feed-back, on the lower range of wavelengths, you will find that it will hold for the entire range of wavelengths without causing instability. However, if you adjust the tickler for maximum pep on the higher range of wavelengths, you will probably find that the circuit will be unstable on the lower range and that as you go down in wavelength you will also have to decrease the feed-back coupling. The application of regeneration to this circuit is excellent for bringing in distant stations and you will find, if you have already constructed the receiver that was previously described, that you will get stations that you were never able to get before by the application of regeneration as described.

Out of hundreds of letters received, there were a couple that mentioned the fact that there seemed to be a tendency for the circuit to become unstable on the lower band of wavelengths. This was due to lack of care in the construction of the receiver—either faulty transformer construction or that the transformers were placed too close together, all three being located side by side and therefore too much inductive coupling being experienced. Although these transformers have a very small stray field, if they are all put right alongside of each other, there is bound to be enough coupling between them to cause instability of operation. However, if they are placed at a distance apart, equal to that at which the transformers in the ordinary neutrodyne receiver are placed, the circuit will remain stable, no matter in what angular relation they are placed. For those that have already constructed the D-Coil receiver and who have placed the transformers too close together, expecting too much of them and who have proba-

(Continued on page 93)

"Quality Goods for Quality Readers"

When the Monsoon Broke!

(Continued from page 25)

ing eyes and a jet black, shaggy beard that forked in the middle after the manner of the Sikhs, he spoke English beautifully and committed his murders with something of an air.

He sat at the head of the mahogany table in his house in the mountains, which was an abandoned Sivite temple hewn out of solid granite. Late in the afternoon the distinguished prisoner—no less than the once fearful Director of Central Intelligence himself—was brought into his presence.

"Won't you sit down, sir?" the dacoit brigand asked suavely.

"I think bloody well not!" the Director shouted. "You filthy pariah! You killer—you half-breed! I'll have the whole police department of the Residency after you for this outrage! Kidnapping an I. C. S.—that's the best joke I've ever heard in this country. Why, I'll wipe out your whole race!"

The brigand pulled at his forked beard. He was dealing with a very important magistrate—there was no doubt about that. But the very seriousness of it tickled him.

"Who will ever know, sir, that you are brought here? No man on this earth. Your spy system is not quite so thorough as mine. You were lost in the jungle in a Monsoon. Who can find you?"

"The whole British army will jolly well be up in arms. They will find me. This isn't in the days of the thags, you know. The whole of India from Tuticorin to the Himalayas will know of it before nightfall!"

"Oh, yes, you have your telegraph systems—which I and my ancestors and my people are very much averse to. But what good are they? There are no telegraph stations for ten miles around this mountain. You are in the heart of India—which has not changed for countless centuries!"

A DWARF dacoit entered the granite chamber and announced in Telegu: "Another prisoner, O son of the Son. A filthy dog of a white man!"

Although the Director had not understood what the announcement was, he happened at that very moment to think of the persistent and foolish young Mr. Wemble. It was that point about the dacoit's system of spies being better than the Department's. And likewise that mention of the utter futility now of the Department's greatest power—the telegraph.

The Director was mumbling strange prayers to himself: "Good God, if that young codger were only here with his infernal machine!"

The dwarf dacoit went on: "A dog white man, a heap of filth, who must have traced our men who took this magistrate prisoner."



Samson Super-Kit

Another Radio Achievement

KIT INCLUDES

- 3** Samson Long Wave Transformers
5000 meter wave length
- 1** Samson Filter Transformer
for this wave length
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Also full information on how to Build This Set



All Samson Transformers are made with the FAMOUS HELICAL WINDINGS

Remember that "Samson" stands for 42 years of leadership in the manufacturing of electrical specialties. Other Samson Radio products:

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Write for proof of Samson superiority.

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Different
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Grid Leaks
Variable:—
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Over 1/2 meg., 50¢; under, 75¢.

75¢

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"Nonsensical!" the incredulous, but superstitious Bukri Dhinn snorted.

"Not at all. I will prove to you that we can bring down out of the empty air a sound that is going on—let us say at Madras."

Mr. Wemble's salesman instinct could not permit him to remain silent. "You see, sir," he said enthusiastically to the brigand, "If I adjust these two screws, you know, to a certain number, I hear what is going on at Madras."

"Nonsense in the extreme," the native scoffed. "You must have wires."

Both the Director and Mr. Wemble turned to each other with a triumphant laugh. "We'll prove it!" the latter cried. "The band of the First Gurka Rifles is playing at the Fort. Is that not so?"

One of the dacoits—an old man and counselor—spoke up. It was true. At that hour every afternoon for years the band played at the Fort.

Mr. Wemble worked quickly and enthusiastically. Martial music came down out of the air. It filtered in through the long doorways, penetrating as it were the granite rocks themselves. It swelled, a definite and catchy rhythm, it brought the vision of soldiers marching, of a great army, of the power of the British Raj, of devastating war.

"There are wires!" the brigand cried, standing up, his forehead wet with sweat. "Lift it up! I say there are wires—else I will not believe!"

Mr. Wemble lifted it up and the chieftain passed a sword under it, above it, around it, after the manner of the street jugglers. He wiped his forehead. His eyes bulged, till he showed their whites.

"It is a thing of a thousand devils!" he cried.

"Of course it is!" the Director shouted without mercy. "A magic box that will bring you all to damnation! Do you realize, you murderous pariah, that we can not only hear everything in any part of India we want—if it is properly adjusted—but my Department down at Pangarh is at this very moment listening in on every word we're saying!"

Mr. Wemble stared. This was stretching it a bit. It was a receiving set—didn't the Director understand that? But he said nothing. He understood the real significance of the Director's words.

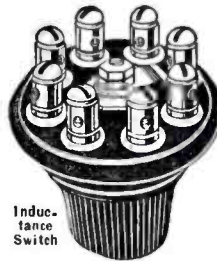
Out of the box came another voice—broadcast from the Calcutta Times: Ghandi was imprisoned. The Governor-General was to review the Imperial Light Horse. A woman's voice started in on a bed-time story of Seven Goblins and a Giant.

The superstitious Bukri Dhinn wrung his hands and quaked at the knees. He had always been afraid of the telegraph

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THE MATERIAL OF A THOUSAND USES

—a magic and bedeviled system of spying upon his depredations. The singing of wires in the Monsoon wind made him crazy. But here was a new contraption possessed of seventy and seven spirits. No wires that could be cut down or steered clear of! Where could he flee now? What chance of hiding if his deeds could be sent through the very air?

"Take it away! Out of my sight!" he screamed in terror. "It is a thing of devils. It will pursue me like furies. It will make me mad. It will hound me to the end of time—to the end of space and I will not have a cave in the mountains where I may lay my head in peace!"

"He seems to have a very good idea of what wireless means," Mr. Wemble said enthusiastically.

"And these two scurvy white dogs—let them go!" he cried to his men. "And do not for the life of you harm a hair of their heads. For they have a power greater than the power of Krishna and Kaali and Brahma and all the gods!" He turned breathless, terrified, respectful—to his two white prisoners. "Go your way, sahibs, in peace. Neither I nor my people will ever cause you trouble more!"

* * * * *

The pompous Director and the genial Mr. Wemble were riding down the ghats on two ragged little tat-ponies. The Director's nerves seemed very much restored after the Monsoon had cleared the air.

"I owe you my life, sir," he said to Mr. Wemble. "You did a very dangerous thing following me, up this mountainside—when I was taken prisoner."

"I didn't know you were a prisoner," Mr. Wemble said. "Thought you were bandaged for some wound or other, you know—in that elephant stampede and storm. I thought your men were packing me off! I followed you to show you what a difference this Monsoon will make. Less static you know, and all that sort of thing. No trouble tuning. Clearest tone I ever had. No bally twanging or rasping or rattling!"

"You mean you followed me up this mountain—to sell me one of those confounded machines!" the Director gasped.

"Not to sell you one. But to sell one to every constable in your Department. I have three consignments—six hundred outfits you know—in the P. & O. warehouse in Madras—magnificent sets virtually rotting away and eaten by ants. Can't make a sale. Look at my clothes. Can't be a gentleman in India, you know—without making a go of it. Now your Department can not afford to be without—"

"Six hundred outfits!" the Director cried. "My word, old man, I've never

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seen a fellow have faith in his wares as you have! You've sold me six hundred outfits! When we get to Bangarh I'll have my writer draw you out a voucher." He chuckled all over his tremendous body as the little tat-pony stumbled along down the steep trail. "Lord, but I'd have come an awful cropper—if you hadn't scared that brigand with that contraption of yours!"

The persistent and genial Mr. Wemble considered it a day's work, but he was now thinking of tomorrow.

"How about the Bombay City Police—yes, and the Railway Police? Perhaps I could get rid of two more consignments?"

The fat magistrate burst out in a guffaw. "Very likely if you scare the life out of a few more Hindus, sir!"

Home Comforts

(Continued from page 38)

They can sit by their fireplace and be only a few steps away from the concealed set. They regulate the loudness of the tone desired by keeping the closet door ajar at just the required space to provide the loudness desired.

Still another home I know had had a parlor desk recabineted so that the radio set is built on the upper ledge of the desk, and harmonizes with the wood and color scheme of the rest of the home.

I have heard and seen frequent examples of so-called boudoir radio sets in pink and white, but I fear that these are more of stunt ideas than of practical reality. But radio sets in bedrooms are most desirable. We have found it very simple to run wires to several rooms, including one on the second story, from the set in the living room and thus be able to provide a pair or telephones in the bedroom for someone who desired to listen in, especially for someone temporarily ill. In the case of a considerable length of sickness, I believe the best possible idea is to have the complete radio set installed in the sick room, for when one is ill the fun consists largely in doing one's own tuning in, and thus lessening the tedium of the long time in bed.

There is nothing in my entire list of sick room helps that is quite so valuable as the radio set, whether for child or adult. I have tested this half a dozen times in the last two or three years and found it absolutely true. Even small children, who are not much thrilled at music or speeches find a radio set a lot of fun, because of the childlike things they can do with it, even such as lighting the tubes. The strangeness of various voices and sounds and the joy of tinkering with the instrument are valuable features for sick room amusement for the child, quite in addition to anything they may actually listen to. I believe a family with a fair income can thoroughly well afford two radio sets; in the case of a well-to-do family with

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made of the finest low loss materials and in a beautiful genuine solid mahogany cabinet, that is attractive enough for the most pretentious room, and at sixty dollars, economical enough for the most modest. It certainly is

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Combines all points essential to the perfect receiver. Real distance reception without that squealing and howling. So selective that once a station is picked up—it can be brought in again on the same points on the dials, whenever you want it. And what's more,

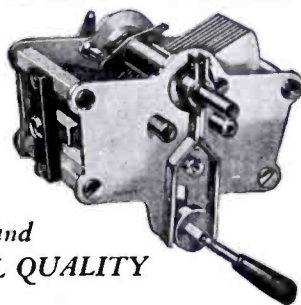
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Beware of Imitations and Counterfeits.

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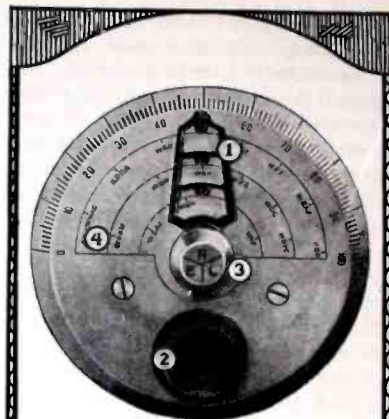
High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too.

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servants, I believe they can find real usefulness in *three* sets—one for the servants, one on the second floor, and one on the first floor. This is perhaps a startling thought to give to those ready figurers who love to calculate to how many millions of people listen in. A 3-set standard per family provides them with a few more extra millions of radio sets to juggle with! But as a practical housekeeper, I know whereof I speak. I have two phonographs and two automobiles, why not two or three radio sets? In winter radio is more useful than phonograph or automobile!

There are great numbers of well-to-do families with homes in the suburbs or the country who have a definite prob-



and now - Forget Wavelengths

In the Arabian Nights story, the words "Open Sesame" magically—instantly—opened the door. The ULTRA-VERNIER Tuning Control is the "Open Sesame" to any station once difficult to find, or stumbled upon.

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1. This alignment is the gauge for penciled station records.
2. Operates vernier for hair-splitting adjustment.
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lem in keeping their servants. They do not like them to go a long distance off in the evening for fear they may not come back again in time for their duties; and for many such, situated a mile or two away from the average amusement for servants, it is a very important question. Radio unquestionably helps greatly to solve this problem. I know it has for me.

A radio set for the upstairs room, with an antenna all of its own, and special wiring for comfort in bed, has more usefulness than merely for occasional sickness. There are many who like a lot of comfort in bed morning or evening and also who like to listen in at very late hours to some of the western programs that come in late. I know more than one person who goes to bed with earpieces on and lets himself be lulled to sleep by what's on the air! The only drawback is that these people sometimes let the set go on all night and waste a lot of juice; but they seem to like it nevertheless.

Another way to greatly increase the comfort and usefulness of the radio set is to provide for its summer time use on the veranda or on the lawn. For two or three months in hot weather it seems somewhat of a bore to many people to be in the house at all except when absolutely necessary. They have a cozy veranda or lawn, and following the principle I have outlined here, that of placing radio right, the members of the household can derive great pleasure in the summer time by having the radio adjusted for use on the veranda or lawn. In my case we did this, not by dismantling the set in the living room, but by leading wires from the telephone binding posts to the veranda in a permanent manner, and having a terminal to which two or three telephone sets can easily be plugged in.

I went much further than that last summer. I had over 200 ft. of wire carried from the instrument out to the lawn, under a tree, to a lawn swing, so that of an evening we could sit very comfortably watching the sunset and the fireflies and hearing a concert, without being kept indoors. We have also formed a habit of eating on a permanent table we have on our lawn, and frequently enjoyed a radio concert *al fresco*.

These are all indications of how a bit of real interest in radio and home ingenuity can adapt the new marvel to its use. It is quite unnecessary to regard radio as a fixed and immovable instrument for certain specified occasions; its charm and variety lie in its flexibility to different moods, different times and under different conditions.

Used as I have outlined herewith, it is certainly a very good friend of the home maker. Women can thank radio for a number of rather important things, such as the elimination of their



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Aluminum sound column

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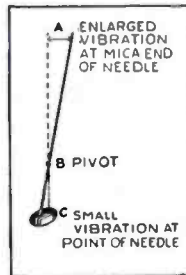
Throw back the rugs, tune in your favorite dance orchestra and step to the lively scintillating tune of the latest Fox Trot as it comes in over the Needlephone and phonograph.

For better reproduction you will want the Rhamstine* Needlephone because it embodies the principle of "magnified reproduction" and the laws of acoustics as worked out in the phonograph.

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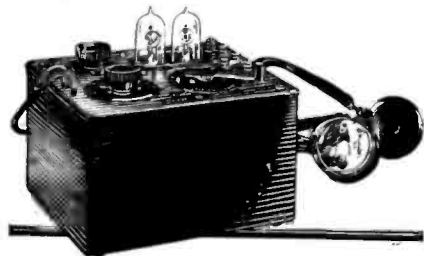
Mail
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Send me the Needlephone. I'll pay the postman \$10 upon its arrival. It is distinctly understood I may return it if I desire, within 5 days, and receive a refund in full.

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own isolation; the greater interest which it brings to the home as a place, and a greater variety of entertainment and comfort which it makes possible in the home. But radio must be touched with woman's housekeeping genius before it can become all that it may.

Loud Speakers

(Continued from page 41)

original sound with some distortion, of course, and second, it makes possible signals of increased loudness in exact proportion to the increased strength or pull caused by the permanent magnet. The performance of these two functions, of course, is absolutely necessary for radio reception and it is perhaps well, I think, for us to have at least a general conception of how a loud speaker unit works.

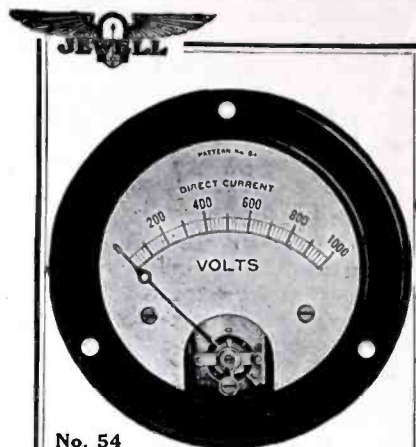
A schematic sketch of the balanced armature type of loud speaker is shown in figure 6. The various parts are named in the diagram. The iron armature is balanced between the pole pieces, is supported by a stiff spring at the mid-position and has no tendency to move nearer the pole pieces when the coil is not connected to the signal current. Just as soon as the signal current from the radio receiver passes through the coils, the iron armature becomes a weak magnet whose ends become alternately north and south in unison with the signal current through the coils. This causes one end of the armature, say the north pole end, to move down on the left side. At the same time the opposite (right) end is a south pole and it moves up, that is, toward the north and away from the south pole. The two ends, then, of the little iron armature are working together to produce vibrations of the diaphragm, connected to the armature by the connecting link.

In this type of unit the diaphragm does not have to be iron, but the bipolar type, described above, has to be magnetic in order to be forced into vibrations. In this balanced armature type, the little iron armature carries only the alternating magnetism and the permanent magnetism flows right through the armature between the north and south poles of the permanent magnet.

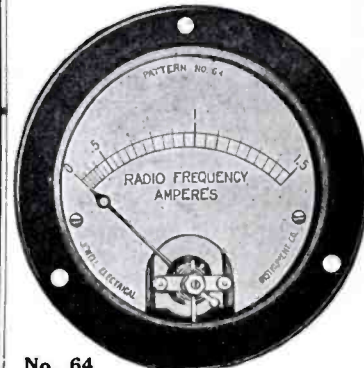
There is thus no danger of the armature becoming "saturated" with magnetism. In the bipolar type of unit both the permanent and alternating magnetism pass through the diaphragm from one pole to the other. There is thus danger of "saturating" the iron diaphragm particularly in view of the fact that it is a few thousandths of an inch in thickness. Saturation of the iron should be avoided since it will cause distortion of the signals.

A so-called magnetic-shunt is often used, therefore, to shunt out some of the permanent magnetism from the diaphragm. Better results are obtained because of this construction. For ex-

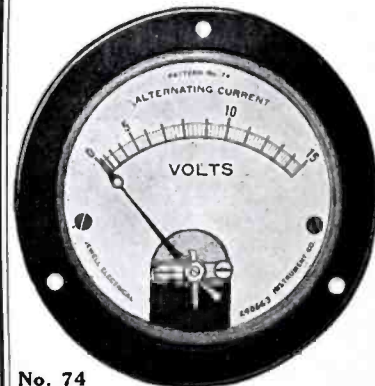
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15-A Radio Catalog

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25 Years Making Good Instruments

ample, this type of magnet shunt is used in the unit of all the Radiola loud speakers, such for example as the UZ 1320 and UZ 1325 types. Just as already stated the magnet should be a powerful one in order to produce loud signals. This holds for this balanced armature type of unit just as for the bipolar type. Distortion will also be less, unless the magnetism is great enough to approach saturation. We see, then, that a compromise must be arrived at to give the best results.

In practice a poor permanent magnet will weaken. If such permanent magnets are used, then a loud speaker will produce weaker signals. Not only will this happen, but the distortion will become greater and unsatisfactory results will be obtained. The introduction to this paper may, then, be read with more than passing interest. This is where one wishes he had purchased a loud speaker from a reliable concern whose engineers are thoroughly experienced in the art, and are able to turn out apparatus which will not depreciate in this way.

Three other types of loud speakers have been described in this paper, namely, the moving coil type, the moving strip type and the induction type. We cannot describe the manner in which these types operate in the short space remaining for this installment. These three types are very interesting and can be made to give good results. For this reason we should look at them in some detail as will be done in the next paper.

Our object is to lay a foundation upon which we can build our future study of loud speakers. No better foundation can be built than that of becoming familiar with the types of units now available and of becoming familiar with the purpose and action of the horn itself.

One-Control Regenerative Receiver

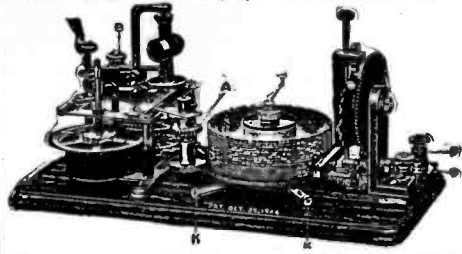
(Continued from page 43)

denser. Line up your various pieces of apparatus so that the shafts are in straight line down the center of the panel. If a 7 inch panel is used, a pencil line drawn 3 1/2 inches from either edge will serve well for this purpose. The audio frequency transformers are mounted between tube sockets as this is the only logical arrangement. Keep these along the rear of the baseboard so that the jacks which protrude back of the panel will not interfere.

In wiring up the set figure out in your own mind beforehand all the places that connection will have to be made. Then use one piece of bus wire and connect the two furthest instruments. If this is done correctly it will then be possible to, somewhere along its length take off connections

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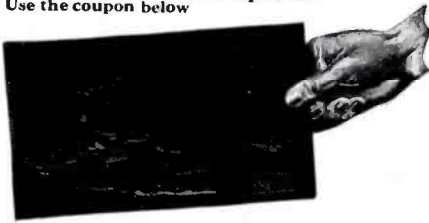
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to the other instruments. Let us take for instance the positive filament lead. This runs from the last amplifier tube socket to the A plus binding post with several pieces of apparatus in between. One connection is made from your last socket to the binding post. Then with short pieces of bus wire connect the other tube sockets into the circuit. In the negative filament lead this is done the same way. It runs from the last Bradleystat on the second stage audio tube to the ground and A minus binding post. All the Bradleystats are placed in the negative leads. This negative lead runs to the ground binding post and places the negative A battery lead at ground potential throughout the circuit. As the rotary plates of the variable condenser and its entire framework are connected to the negative filament that is likewise at ground potential no hand capacity effects are noticeable even on the finest tuning. For best results with this receiver we recommend a UV-200 in the detector, but for general use the UV-201A will be very satisfactory. The Bradleystats were specified because they provide excellent control of tube filaments. We have always taken exception to the use of a rheostat as a tuning device for we still insist that all the tuning should be done with the tuning controls. However, when you are trying for that elusive DX station and you have little more than a faint carrier wave to work upon it is a real pleasure to know that a slight adjustment of a Bradleystat on the detector tube will bring it in.

You are undoubtedly wondering why we called this a one-control receiver when it has a tuning condenser and a variable tickler coil. Simply this: The manufacturers of this coil have so designed the tickler coil with respect to the secondary, that the circuit will oscillate over the entire range of the secondary tuning condenser with but a very small change in the tickler. In tuning this receiver properly and as it should be done it will be noticed that it is possible to keep the detector circuit just on this side of the oscillating point without varying the tickler coil more than a few degrees, consequently it is necessary to adjust the tickler only when the very finest tuning is to be done. All but this latter can be done by merely rotating the condenser dial to previously determined settings and the stations will roll in.

Vacuum Tube Detectors

(Continued from page 49)
 which is included in the grid circuit of figure 7. In many present-day circuits the "C" voltage is obtained by connecting the return lead of the grid circuit shown at point A in figure 7 to the negative terminal of the "A" battery and utilizing the so-called voltage drop through the filament lighting

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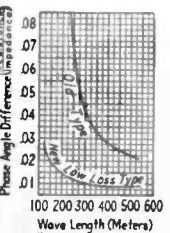
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rheostat as the so-called biasing voltage. The sole reason for this action is to do away with the necessity of purchasing an extra battery. Let us look at this curve as drawn in figure 8. With 2 volts negative the plate current corresponds to the height A, while with a positive potential of 1 volt upon the grid the current passing through the tube corresponds in value to the height B. It can therefore be readily seen that all other conditions being equal it is more economical to work on the lower bend of the characteristic curve, that is, where the grid is slightly negative with respect to the filament. Providing the bends of the curve are equal the signals will be equal as the signal strength is dependent, not upon the total value of the plate current, but upon the variation in the plate current caused by the incoming signals.

Having laid our basis for explanation we are now ready to again take up this radio frequency energy which we have brought to the grid of our tube and see what happens to it by virtue of the functioning of this tube as a detector. With the curve in figure 8 redrawn again as figure 9 and a wave of the form of figure 6 to be used as the input to the grid of the detector tube it will be seen that, owing to the bend in the curve, the incoming wave which is as much positive as it is negative does not produce equal variations upon the plate current, with a result that while the incoming radio frequency is reproduced in the plate current there is also caused to enter into the picture another varying current which corresponds generally to the over all shape of the modulations of the incoming radio wave. Our telephone receivers, or loud speakers are instruments which are not quick acting enough to give response to these radio frequency currents, but will respond to all audio frequency currents impressed upon them and therefore we might say that the telephones and loud speaker are tuned to audio frequencies which is actually the case. In a similar manner if any other radio frequency currents have a general over all shape which is varying at an audio frequency rate such as the waves in figures 3 and 5 it will result in the modulations being reproduced in the telephone receivers. If, however, the incoming wave is the output of a tube transmitter using D.C. as a power supply, and it is unmodulated, giving a wave of the shape of figure 4, the resulting signal as heard in the phones will be a straight direct current which rises in value when the transmitting key is depressed and falls in value when it is lifted, with the result that this form of signal energy does not interfere with broadcast transmission. Therefore we will not particularly concern ourselves with its actions and how

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Valley Battery Charger

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The Valley Battery Charger will completely recharge 2-volt peanut tube cells, 6-volt A batteries and from 1 to 4 V 24-volt batteries. It is the only charger necessary for all radio batteries.

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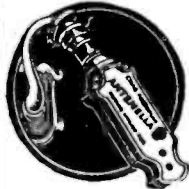
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to receive it, as that is an entirely new problem or, at least, it calls for different apparatus from that used for broadcast reception.

It is to be appreciated that in most cases the tube as a detector is employed with a grid condenser and grid leak, and under these conditions the action is somewhat different, as it depends upon the shape of a different curve known as the grid-current characteristic curve, which being an entirely separate problem will need an entire article for treatment with an explanation of the action of the grid condenser and the grid leak and therefore it will be reserved for future discussion.

Trouble Shooting

(Continued from page 47)

cuit. The grid and plate terminals are most sensitive to body capacity effects. Keep the parts of the coil or apparatus to which the grid or plate is connected as far as possible from the panel. The filament circuit must be properly grounded. When variable condensers are mounted on the panel, connect the rotor plates to the ground or filament side. There are variable condensers on the market with end rotor plates, which can therefore be termed self-shielding. With a series condenser in the antenna, the rotor plates should be connected to the antenna; with the condenser in the ground circuit, the rotor plates should be connected to the grounded side. A condenser across the secondary should have the stationary plates connected to the grid.

With a variometer in the secondary circuit, the stator end is connected to the grid; in the plate circuit, the stator end is connected to the plate. Where a tickler is at the end of an inductance, which is the case with many variocouplers, the end of the coil farthest from the tickler end should be connected to the grid.

In locating the sockets, keep the grid and plate terminals farthest from the panel, and place the filament leads toward it, as they are not affected by body capacity. It is helpful to shunt the phones with a fixed condenser of .001 or .002 mfd. capacity, or if amplification is used, to connect a fixed condenser across the plate terminal of the detector tube and the negative side of the B battery. In neutrodyne circuits it is very desirable to shield the neutroformers to avoid inter-coil coupling.

Potentiometers

(Continued from page 55)

tery is brought direct to the filament, there will be no necessity for this condenser.

When the plate battery of a receiver

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has a high resistance, a large fixed condenser is generally shunted across it to reduce the effect of the common coupling between all the plates that the battery is feeding. We can see no reason for this condenser unless the audio-frequency amplifier howls and placing the condenser there stops the howling—or unless the radio-frequency amplifier oscillates and can not be controlled with the potentiometer and placing the condenser across the battery makes the radio frequency amplifier stop oscillating. In all our radio experience we have never seen one receiver that required a B battery condenser. The talk about improving tone or increasing volume, we are confident, is purely imagination. We asked a radio man, who for some reason believes a B battery condenser is essential, to look the other way while we lifted the condenser connection on and off—every time we had it on he said it was off; when we had it off he said it was connected. The fact was that it did not make any difference at all—though at times when the set is adjusted to the point of oscillation, touching the battery alone will make a change.

Nor can we see the necessity for double condenser connection to the slider of the potentiometer—one condenser to one side of the line and the other condenser to the other side. It would be just as well to use one large condenser connected to either side of the battery line. We would suggest that the connection be made to that side of the line on which the ground is connected—though the resistance of the battery is so slight that there should be no difference either way.

THE NEGATIVE GRID BIAS

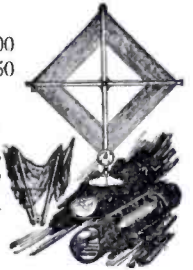
One of the easiest ways of understanding the "howl" of grid bias is with the aid of figure 10. Here a filament is arranged in series with a rheostat across a battery.

Remember that we always count with reference to the negative terminal of the filament—the negative terminal of the filament we can consider as being the binding post on the tube socket, for that is the place nearest it that we can reach. Let us think of the filament and rheostat in figure 10 as being a potentiometer connected across the battery. We can reach only one point on the resistance—the connection from the negative terminal of the filament to the rheostat. We are going to measure from this point, so let us connect one terminal of a voltmeter to it. Now, if we brought our return lead to the negative terminal of the battery and placed the other lead of the voltmeter at this point, we would find that there was a difference of voltage between the two points. This we expect from the discussion on potenti-

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ometers above. And we know that the value of this voltage difference would depend upon the percentage of resistance of the rheostat to the total circuit resistance. And we know that the battery terminal is negative with reference to the negative filament terminal. If we brought the return lead from our grid or plate circuit to, say the positive battery terminal it would have a higher voltage than the negative filament terminal. We may calculate the voltage difference if we know the total value of resistance of the circuit and also the amount of resistance from the point where the return lead is connected to the negative filament terminal.

This may be clearer in figure 11. Here we have a battery of 6 volts, a 20-ohm filament (UV-201A) and a 4-ohm resistance for the rheostat. B is the negative terminal of the filament—if we connect a voltmeter from B to C, we find that it registers 1 volt (4:24 as X:6. X=1 volt). So we know that if we connect the return lead from the grid to C, the grid will be one volt negative—with respect to the negative terminal of the filament. If we connect the voltmeter across A and B, it will register 5 volts. So if we connect the return lead from the grid to the point A, the grid will be 5 volts positive—with respect to the negative terminal of the filament.

It would be well to take each tube with the A battery voltage generally used with it, figure the correct amount of extra resistance to keep the current at the specified rate and then find what negative bias could be had with it.

Also see what the voltage is with respect to the positive side of the filament.

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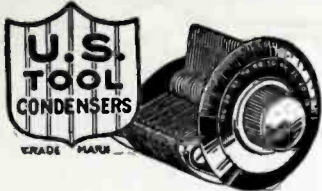
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Solid Rubber
Case

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To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. And you save \$2.00 by ordering now.

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Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts) \$12.00. Pay Expressman after examining batteries, 5 per cent discount for cash in full with order. Send your order NOW and save \$2.00.

WORLD BATTERY COMPANY
Makers of the famous World Radio "A" Storage Battery
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SAVE \$2.00 BY ORDERING NOW!

A voltmeter, a socket, a battery and some vacuum tubes and rheostats will be of great help in enabling the student to actually see some of the effects noted above.

Radioviewing the Industry

(Continued from page 56)

quickly attached to the phone cord, and at the same time have an electrically perfect contact, Mr. Pacent of the Pacent Electric Company, developed the first radio plug that employed a spring-pressed connector for retaining the phone cord tips.

2. The Radio Trade Association, at Detroit, Mich., was organized to promote and protect the interests of radio and radio business, and to educate its members in the business along lines which be of maximum benefit to the radio listeners-in, the encouragement of broadcasting and encouragement of the amateurs.

3. The Faraway Radio Co. has been incorporated under the laws of the State of Ohio with shares of no par value stock. H. A. Lockwood is president; J. H. Bradwell is vice-president and Treasurer; R. C. Pater is secretary.

4. The Coast Radio Supply Company, San Francisco, California, organized by Henry E. Lapkin, formerly of the National Carbon Company, and Harry L. Auger, formerly of McCoy Motor Supply Company, have opened their new quarters at 648 Howard Street, with a complete stock of radio receiving sets, accessories and parts. This Company will wholesale only.

5. Owing to the enormous demand for the "Amplion" Loud Speaker last season, which far exceeded the supply, a new company has been formed entitled The Amplion Corporation of America, with head offices at 280 Madison Ave., New York, to manufacture and sell Amplion Loud Speakers in America.

6. The Allen-Bradley Company of Milwaukee, Wis., has made some remarkable refinements and improvements in their well-known line of graphite disc radio devices, the Bradleystat, Bradleyleak, Bradleyohm and Bradleyometer.

D-Coil Receiver

(Continued from page 78)

bly installed the apparatus in a neat cabinet of small dimensions, it would probably mean taking the apparatus all apart and putting it in a larger cabinet, say a 24" x 7" or a 26" x 7", to obtain stability of operation. Therefore, in order to avoid this, I would suggest that you apply neutralizing condensers to the circuit as you now have it. Connect one neutralizing condenser between the points marked (A) and (B) on the schematic diagram in figure 1, that is, from the grid terminal of the first tube to the grid terminal of the second tube. Then connect a second neutralizing condenser between the points marked (B) and (C) on the diagram, or in other words, from the grid terminal of the second tube to the grid terminal of the third tube. The application of neutralizing condensers

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City

State

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A-1-25

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Proves satisfactory World performance. Mail this ad with your name and address — we will ship battery day order received; and give you your choice of "B" or "A" Battery or a handsome nickel finish Auto Spotlite. FREE. Write TODAY.

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This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for \$6.00. It is the only battery of its kind equipped with solid rubber casing and insurance against acid and leakage. Take advantage of this remarkable introductory offer NOW. To those who prefer it, we will send FREE a handsome nickel finish Auto Spotlite, instead of the "B" Battery. Be sure to specify which is wanted.

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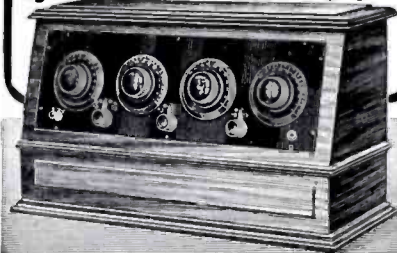


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to your circuit in the condition that it now stands, although entirely avoiding the point of the circuit, will probably bring your receiver back to a condition of stability without any undue work on your part.

Broadcasting Station Directory

(Continued from page 52)

PGR	No data	Prague	1800
ZKB	No data	Brunn	1800
Denmark			
OXE	Danish Government	Lyngby	2400
Finland			
3NB	Amateur Radio Society	Tammerfors	300
	Nuoren Voiman Liiton Radiolyhyistys (Radio Division)	Skatudden	450
France			
FL	Eiffel Tower	Paris	2600
ESP	Ecole Supérieure des P. T. & T.		450
YA	French Government	Tours	2500
YV	French Government	La Doua (Lyons)	480
SFR	Levallois (Radiola)	Paris	1780
None	French Government	Nice	460
None	French Government	Issy-sur-Moulineux	1600
None	French Government	Abbeville	900
SAJ	No data	Paris	1780
Germany			
LP	Königsruherhausen	Berlin	2800
None	Vox Haus	Berlin	450
None	Mitteleutsche Rundfunk, AG	Liepzick	436
None	Südwestdeutsche Rundfunk, AG	Frankfurt	460
None	Norddeutsche Rundfunk, AG	Hamburg	392
None	Schlesische Rundfunk, AG	Hirschau	415
None	Ostmarken Rundfunk, AG	Königsburg	460
None	Süddeutsche Rundfunk, AG	Stuttgart	437
None	Deutsche Stunde in Bayern	Munich	485
	No data	Eberswalde	2930
Great Britain			
None	British Broadcasting Co.	Sheffield	303
None	British Broadcasting Co.	Plymouth	330
SWA	British Broadcasting Co.	Cardiff	350
ZLD	British Broadcasting Co.	London	365
ZZY	British Broadcasting Co.	Manchester	375
GBM	British Broadcasting Co.	Bournemouth	385
SNO	British Broadcasting Co.	Newcastle	400
ZSC	British Broadcasting Co.	Glasgow	415
None	British Broadcasting Co.	Belfast	435
5IT	British Broadcasting Co.	Birmingham	475
2BO	British Broadcasting Co.	Aberdeen	495
SXX	British Broadcasting Co.	Chelmsford	1600
GED	British Broadcasting Co.	Grosden	900
SSC	British Broadcasting Co.	Glasgow	420
ZLS	British Broadcasting Co.	Leeds-Bradford	346
Hawaii			
KGU	Marion A. Mulrony	Honolulu	360
KYQ	The Electric Shop	Honolulu	270
India			
SAFO	Radio Club (2BZ) Operated by Marconi	Calcutta	425
Italy			
ICD	No data	Rome	3200
None	Ing. Italeri	Itome	350
None	No data	Centocella	2900
Jugoslavia			
	No data	Belgrade	1625
Martinique, French West Indies			
HYV	French Marine de Guerre	La p. des Carrières	600
Mexico			
CYB	El Buen Tono	Mexico City	360
CYL	El Universal	Mexico City	360
None	Colegio Ateneo Fuentis	Saltillo	450
Netherlands			
PCKK	Velthuizen	The Hague	1050
PCMM	Mikklelaad	Umliden	1050
PGGG	Nederlandsche Radio Industri	The Hague	1050
PCUU	Laboratorium Heussen	The Hague	1050
PAS	Smith and Houghton	Amsterdam	1050
PCFF	Vas Dutch Press Office	Amsterdam	2000
NSF	Radio Apparat Factory	Hilversum	1050
New Zealand			
4XO	Otago University	Dunedin	140
1YA	Auckland Radio Service	Auckland	260
1YL	G. H. Pearson for Newcombe (Ltd.)	Auckland	260
2YB	Wellington Broadcasters (Ltd.)	Wellington	275
2YK	Dominion Radio Co.	Wellington	275
2YM	Gilborne Radio Co.	Gilborne	335
4YA	British Electric & Engineering Co.	Dunedin	310
Porto Rico			
WKAQ	Radio Corporation of Porto Rico	San Juan	360
Portugal			
None	Aero Lisboa	Lisbon	370
South Africa			
None	Association of Scientific and Tech. Soc.	Johannesburg	450
Spain			
EGC	No data	Madrid	2100
EBX	No data	Cattagna	1200
PTT	No data	Madrid	400
	Radio Iberica	Madrid	392
Sweden			
None	Royal Telegraph Radio Office	Stockholm	440
None	Svenska Radioactiefolaget	Stockholm	470
SAB	Royal Telegraph Radio Office	Goteborg	700
SMZX	Ingenior Ellassons	Goteborg	460
SAI	Royal Telegraph Radio Office	Bohlen	460
	Nya Varvet	Goteborg	700
Switzerland			
HB2	Champ de l'Air	Lausanne	1060
HB1	Station T. S. F. Cointrin	Geneva	1100

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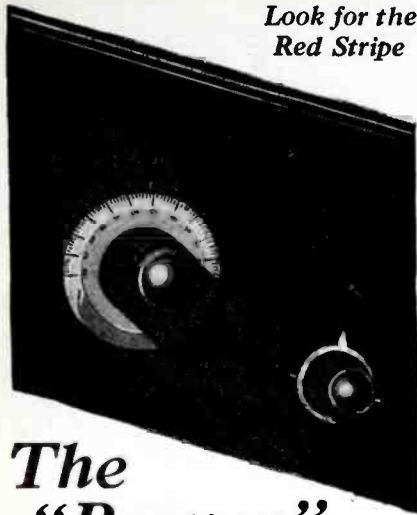
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IMPERIAL Four Tube Radio Frequency Receiver—\$45.00. Guaranteed one year. To see or hear the IMPERIAL means to buy it—and buying it means satisfaction. Write for literature on this and other types of receivers. Agents wanted—full or spare time. Write for our proposition. IMPERIAL RADIO COMPANY, BINGHAMTON, N. Y.

MAKE YOUR NEUT REACH OUT—Same panel, same layout, fewer parts. Our \$5.00 Kit includes the one different part, 22 feet real gold sheathed wire, lithographed print of Kladag Coast to Coast Circuit, and Complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. Not obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction guaranteed. Details, 10c. Kit prepaid anywhere, \$5.00. New 48-page catalog, thousands of items, many exclusive, for stamp. We accept postage stamps same as cash. KLADAG RADIO LABORATORIES, KENT, OHIO.



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No matter whether you build or buy a set, look for the thin red stripe along the edge of the panel and you will be sure of a Bakelite-Dilecto panel, the best than can be made.

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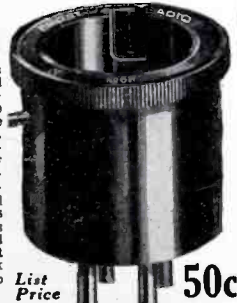
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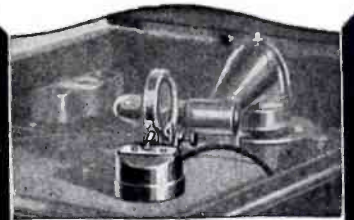
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place the needle on the Dulce-Tone reed

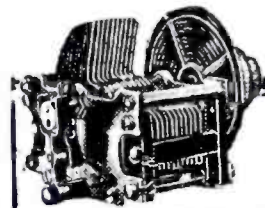
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PRECISION MOVEMENT, ABSENCE OF GEARS OR COMPLICATED PARTS



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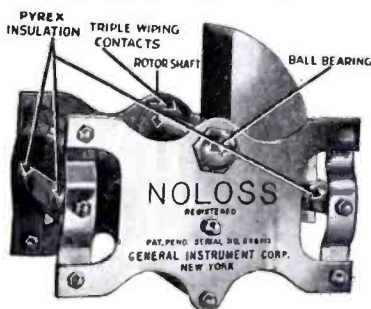
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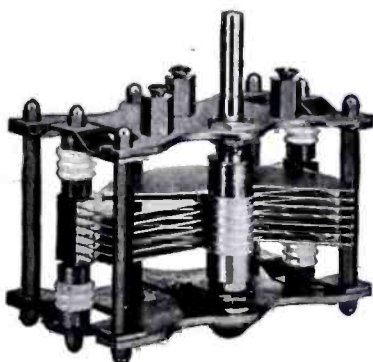
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a CROSLEY
 Better - Costs Less
 Radio

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Parkersburg, W. Va. September 30, 1924.
 "Wish to congratulate you on the one-tube Crosley 50. Have listened to Havana, Cuba, and as far west as Oakland, Los Angeles and San Francisco. This is what I call a wonderful set."

Rockville, Maryland. October 1, 1924.
 "I thought it would interest you to know that on September 15th, I received Oakland, California on my two-tube Crosley 51. That station is 2,434 miles from here. I had a hard time making my friends believe it until I wrote to California and had them verify what I heard. As soon as I can afford it, I expect to get a Trirdyn."

Olney, Illinois. October 15, 1924.
 "I'm getting stations from New York to Seattle, Wash., on my Trirdyn. Monday night, October 13th, I received clearly and plainly the announcer and music from Honolulu, Hawaiian Islands, 7,000 miles away. My machine is not for sale."

(Names upon request)

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 YOUR CHOICE WILL BE A CROSLEY
 For Sale By Good Dealers Everywhere**

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 Powel Crosley, Jr., President

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Cincinnati, Ohio

Crosley Owns and Operates Broadcasting Station WLW



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 Model 50, \$14.50
 With tube and Crosley Phones \$22.25

Crosley
 Head Phones
 Better—Cost Less
 \$3.75



Crosley Two Tube Model 51, \$18.50
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Crosley Three Tube Model 52, \$30.00
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Crosley Trirdyn Regular, \$65.00
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The ideal dry cell
tube.



Radiotron WD-12.
The standard base
dry cell tube.



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