

*Blueprint section every month*

# RADIO AGE

Your



*In This Issue:  
Is There a Radio  
Trust?*

**FEBRUARY 1925    PRICE 25 CENTS**

**MEET YOUR BROADCAST FAVORITES**



# ZENITH RADIO

TRADE MARK REG.



Super-Zenith VII—  
the ideal radio set  
for the fine home

They Cost More  
But They Do More



Super-Zenith X

## Fulfills your utmost desire, in beauty and performance

The new Super-Zenith is beautiful to look at—lends an atmosphere of dignity and worth to library or drawing room.

Naturally you expect unusual performance from so beautiful a radio set. And—unusual performance is exactly what you *get*.

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Before you make your choice, be sure to see and try the new Super-Zenith. A fifteen-minute test will give you a new standard of radio values, as applied to beauty of construction—and—*performance*.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise

### ZENITH RADIO CORPORATION

332 South Michigan Avenue, Chicago

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition  
Holder of the Berengaria Record

**T**HE complete Zenith line includes seven models, ranging in price from \$95 to \$550.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, using *any ordinary loud speaker*. Models 3R and 4R licensed under Armstrong U.S. Pat. No. 1,113,149.

The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation. It is **NOT** regenerative.

**SUPER-ZENITH VII**—Six tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44 $\frac{1}{2}$  inches long, 16 $\frac{1}{4}$  inches wide, 10 $\frac{1}{2}$  inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries) . . . . . **\$230**

**SUPER-ZENITH VIII**—Same as VII except—console type. Price (exclusive of tubes and batteries) . . . . . **\$250**

**SUPER-ZENITH IX**—Console model with additional compartments containing built-in Zenith loud speaker and generous storage battery space. Price (exclusive of tubes and batteries) . . . . . **\$350**

**SUPER-ZENITH X**—Contains two new features superseding all receivers. 1st—Built in, patented, Super-Zenith Duo-Loud Speakers (harmonically synchronized *twin* speakers and horns), designed to reproduce both high and low pitch tones otherwise

impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries  
Price (exclusive of tubes) . . . . . **\$550**  
Price (without battery eliminator) . . . . . \$450  
All Prices F. O. B. Factory.

Zenith Radio Corporation  
Dept. 2C  
332 South Michigan Avenue, Chicago, Ill.

Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name .....

Address .....







# RADIO AGE

The Magazine of the Hour

Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 4

February, 1925

Number 2

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## A Chat With the Editor

READERS have been quick to understand the insidious significance of the effort of Radio Corporation of America to prevent the registration of the title of this magazine in the Patent Office in Washington.

Radio Corporation confesses it controls "Wireless Age" and objects to our use of the name RADIO AGE on the ground that "Wireless Age" is likely to be injured thereby.

Radio Corporation did not make the claim until RADIO AGE had been flourishing for more than forty-one months, building up its name and good will throughout the United States, Canada and England.

Many readers have written us letters wishing us well in this strange contest between our independent magazine, capitalized at \$5,000, and a Corporation capitalized at \$33,000,000.

These letters not only have brought encouragement, but they have laid bare facts about Radio Corporation that were new to us; and we thought we were well informed. We invite more letters on the subject.

Counsel has been engaged and RADIO AGE will take its case to the Patent Office and fight it out. Our formal reply to Radio Corporation is being presented in Washington as we go to press.

We do not believe that Radio Corporation always can have what it wants when it wants it. If you are interested, you may watch our magazine for news of developments from month to month. Money talks. So do printing presses.

*Frederick Smith*

Editor of RADIO AGE.

It may interest our readers to know that Arthur B. McCullah, whose article on a "sure shot" Super-het appears in this issue, will contribute regularly to RADIO AGE beginning next month. Watch for one of his best articles in the March RADIO AGE, fully illustrated. Also, a lineup of other technical experts will be on hand with their latest offerings.





*Dry "B" Batteries are an economical, dependable and convenient source of plate current!*

No. 770. 45-volt extra large vertical. For heavy duty only. The ideal "B" Battery for use on multi-tube sets. Price \$4.75.

*Scientists constantly improve battery quality*

EVEREADY "B" Batteries today contain more electricity, more service, more satisfaction than ever before.

Processes evolved by the scientists of the Union Carbide and Carbon Research Laboratories, Inc., when put in effect in the Eveready factories, are responsible for this great accomplishment.

At the same time the factories have effected a still higher standard of workmanship. A system of inspection that is a marvel of efficiency was inaugurated. The results, gratifying beyond measure, were accomplished with a speed and completeness that have few parallels in industry.

The final tests showed more electricity, more battery service, greater Eveready satisfaction without increasing battery sizes and with a substantial reduction in price. "B" Battery operating costs, using the new Evereadys, in most cases show a reduction of at least one-half.

There is an Eveready Radio Battery for every radio use.

Insist on Eveready "B" Batteries.

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*

EVEREADY HOUR  
 EVERY TUESDAY at 9 P. M.  
 (Eastern Standard Time)  
 Broadcast through a chain of prominent interconnected radio stations.



# RADIO EDITORIALS

## Is There A Radio Trust?

**I**NASMUCH as we have an anti-trust law in the United States, and inasmuch as the radio industry has reached huge proportions, it is interesting and important to consider the question as to whether there is a radio trust. If there is such a combine, it is quite natural that law-abiding Americans generally and radio manufacturers, dealers and buyers of radio goods amounting to \$350,000,000 annually in particular should desire to smash it.

It is the business of the Federal Trade commission, created by Act of Congress, Sept. 26, 1914, to seek out trusts. The Commission issued a complaint against eight great companies on January 26, 1924, charging that they "have been and are using unfair methods of competition in commerce."

All the companies named in the complaint are concerned in either the radio or the wireless business and they are called upon to appear and "show why an order should not be entered by said commission requiring you to Cease and Desist from the violation of the law charged in this complaint."

The companies named are:

- General Electric Company
- American Telephone and Telegraph Company
- Western Electric Company, Inc.
- Westinghouse Electric & Manufacturing Company
- The International Radio Telegraph Company
- United Fruit Company
- Wireless Specialty Company
- Radio Corporation of America.

The complaint occupies fourteen closely typewritten pages of radio history that should be intensely interesting to every set-builder or vacuum tube buyer. That means to 20,000,000 citizens. All the companies accused have made replies to the complaint, denying portions of it, admitting other portions, expressing ignorance about others, asking for more facts on others and offering an ensemble of legal verbiage that would give a Philadelphia lawyer a long pause.

Radio Corporation is organized under the laws of the State of Delaware and was incorporated in October, 1919, with its principal place of business in New York City. Its capitalization is 5,000,000 shares preferred stock, par value \$5.00 and 5,000,000 shares of common stock no par value.

Radio Corporation is engaged in conducting communication service by wireless between points in different states in this Country and between ships and shore and with foreign countries. It is also engaged in the business of buying and selling apparatus and devices for use in radio broadcasting and receiving and in radio communication, and shipping such apparatus in inter-state commerce and to foreign countries.

In the month following its incorporation, Radio Corporation purchased the patents, physical assets and stock owned or controlled by the Marconi Wireless Telegraph Company. At the same time the General Electric Company purchased the British holdings of the Marconi stock in America. The Marconi Wireless Telegraph Company of America was then dissolved. For its services the General Electric Company was given 135,174 shares of preferred and 2,000,000 of the

common stock of Radio Corporation. The General Electric Company then granted to Radio Corporation license to use apparatus for radio purposes under all patents present or future, owned by the General Electric Company, the exclusive right to make and sell radio devices through Radio Corporation only. Radio Corporation agreed to generally restrict its business to radio supplies and not to enter into competition with the General Electric Company with any patented device, process or system, or encourage others to do so. All the foregoing is alleged by the Federal Trade Commission with the additional information that "The General Electric Company is the largest manufacturer of Electrical apparatus, including devices used in radio communication, in the United States."

In June, 1920, the Westinghouse Electric and Manufacturing Company received from the International Radio Telegraph Company assignment of the International Company's patents, with agreement as to mutual exclusive right to make, use and sell apparatus controlled by these patents. So says the Federal Trade Commission and further alleges that the Westinghouse Company was to sell all its products under these patents to the International Company and the International Company agreed not to enter under any patent rights into the field of the Westinghouse Company. On Dec. 31, 1922, the Westinghouse Company owned 1,000,000 shares of the common and 1,000,000 of the preferred stock of Radio Corporation.

In July, 1920, says the Federal Trade Commission, an agreement as to patents was made among the General Electric Company, The American Telephone and Telegraph Company, Radio Corporation of America and The Western Electric Company.

In March, 1921, Radio Corporation made an agreement with the United Fruit Company affecting patents and wireless communications. This agreement involved also the products of the Wireless Specialty Apparatus Company. On December 31, 1922, the United Fruit Company owned 160,000 shares of the common and 200,000 shares of the preferred stock of the Radio Corporation of America. It is alleged by the Federal Trade Commission that Radio Corporation made an agreement with the Wireless Specialty to permit that Company to make certain apparatus under patent license of Radio Corporation, but the Wireless Specialty Apparatus Company was specifically not permitted to make vacuum tubes.

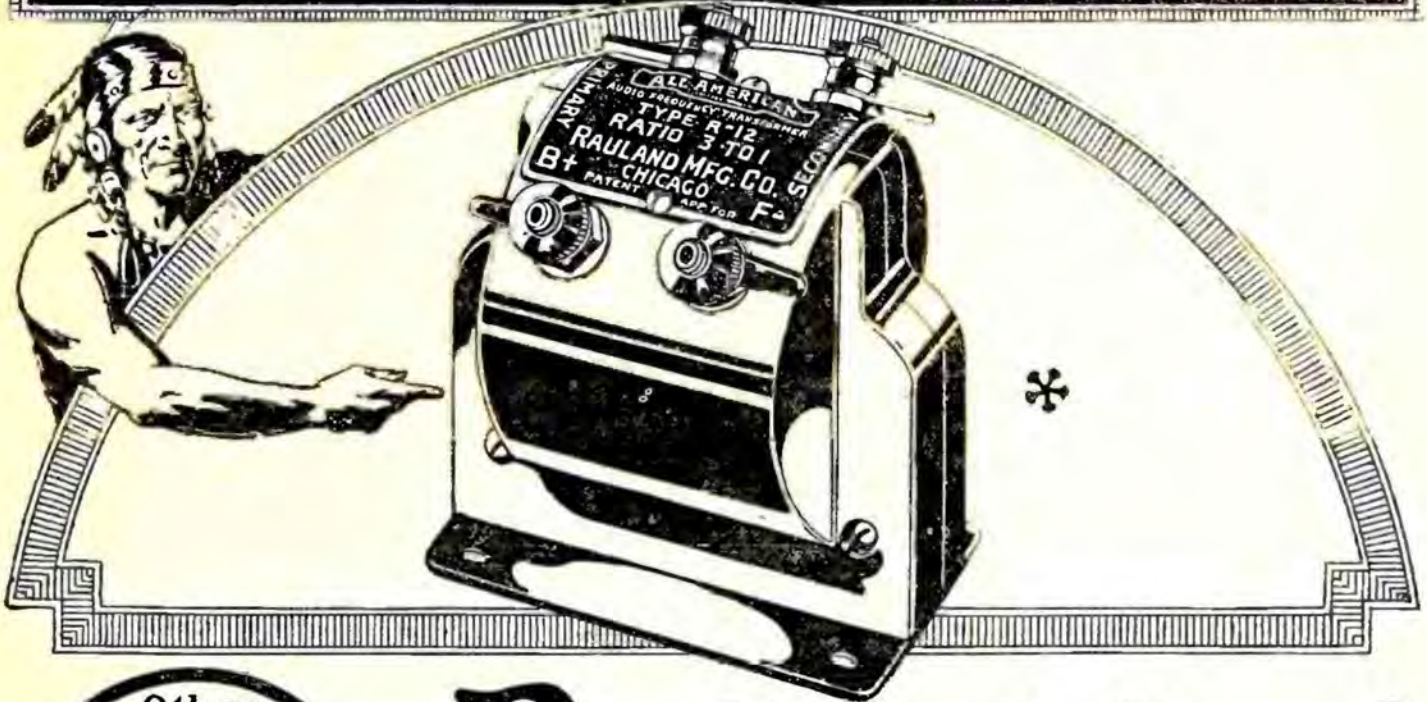
Other agreements as to exclusive rights were made by the Radio Corporation with various companies interested in wireless communications.

The Federal Trade Commission outlines the new famous "Patent license" policy of Radio Corporation to offer "just one more obstacle that non-licensees will have to overcome." It is alleged by the Federal Trade commission that the details of the transactions sketched briefly in the foregoing show that "the respondents have combined and conspired for the purpose and with the effect of restraining competition and creating a monopoly in the manufacture and purchase and sale in inter-state commerce of radio devices and apparatus."

(Turn to page 62)



# 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 (30 Kc.) Transformer**  
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.

## 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.

## 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 make wiring so easy as to be the work of only one delightful evening.

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

**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.



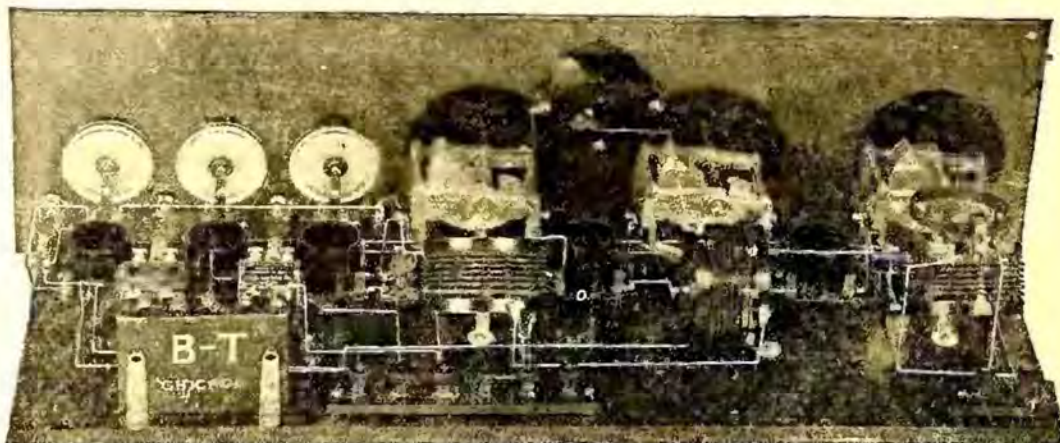
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Pioneers in the Industry  
2680 Coyne St., Chicago

# ALL-AMERICAN

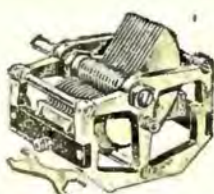
OVER A MILLION ALL-AMERICAN STANDARD AUDIOS IN SERVICE

\* Tested and Approved by RADIO AGE \*





# FOR REAL RADIO SATISFACTION BUILD A B-T LOW LOSS NAMELESS



**B-T LIFETIME CONDENSER**

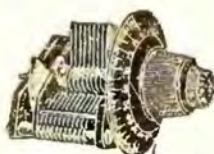
Type	Capacity	Price
L-7	125	\$4.25
L-11	250	4.50
L-23	500	5.00
L-35	725	6.50



**B-T LOW LOSS TUNER**

Made in two types for Broadcast or Short Wave. Ranges covered with 250 M.M.F. L-11 Condenser.

Type B	200 to 565	\$5.00
Type SW	50 to 150	5.00



**B-T VERNIER CONDENSER**

Type	Capacity (With 3 in. dial)	Price
V-11	250 M.M.F.	\$4.50
V-23	500 M.M.F.	5.00
V-43	1000 M.M.F.	6.00

In no other five-tube set can you get such hair-line selectivity, distance, volume and tone purity at a price so pleasant to the pocket book.

This year during the International Tests hundreds of Nameless owners reported, and had verified, their successful reception of English, French, German, Spanish, Dutch and Mexican stations.

Under ordinary conditions, when the usual barrage of nearby high power stations are on the air, the Nameless displays unusual ability in bringing in distant stations. The inherent selectivity of the circuit is further improved by the adjustable primary in the antenna circuit transformer which permits you to meet your local requirements.

The advanced low loss design of the B-T Lifetime Condensers and Low Loss 3-Circuit Transformers, plus the electrical correctness of the circuit on which the Nameless is based, have as a natural result, great range, volume, distance and distortionless reproduction.

If you are going to build a receiving set you will be well repaid in improved results and money saved if you make a point of seeing the B-T Kits at your dealers before you go ahead. A postcard will bring you our folder RF-32 which give more details of the Nameless—the radio set without a regret.

## BREMER-TULLY MANUFACTURING COMPANY

532 S. Canal St. Chicago, Ill.



**B-T LOW LOSS NAMELESS KITS**

Kit No. 3 contains three 250 M.M.F. Lifetime Condensers, three Low Loss 3-Circuit Transformers, one 40 M.M.F. Control Condenser with 2" Dial and complete blue prints, instructions and a list of other necessary parts. . . . \$26.50  
Kit No. 1 contains three Low Loss Transformers only (Nameless blue prints sell separately for \$1.00). . . . \$10.50



**B-T AIR CORE TRANSFORMER**

Type AC-3 as illustrated has adjustable untuned primary. Type AC-1 has fixed primary.

Type AC-3	\$3.50
Type AC-1	2.50



*Prest-O-Lite*

**RADIO CHART**

Voltage of Tubes	No. of Tubes	Type of Tubes	Total Rated Amperes Drain	Recommended Prest-O-Lite "A" Batteries	
				Order by following Types	Days Service Guaranteed
5-Volt Tubes	1	UV-200	1	69 WHR	22
				67 WHR	16
	2	UV-201A	1/2	67 WHR	33
	2	1 UV-200 1 UV-201A	1 1/4	611 WHR	22
				69 WHR	17
	3	UV-201A	3/4	69 WHR	29
				67 WHR	22
	3	1 UV-200 2 UV-201A	1 1/2	611 RHR	21
				611 WHR	18
	4	UV-201A	1	69 WHR	22
				67 WHR	16
	4	1 UV-200 3 UV-201A	1 3/4	613 RHR	22
				611 RHR	18
	5	UV-201A	1 1/4	611 WHR	22
				69 WHR	17
	5	1 UV-200 4 UV-201A	2	613 RHR	19
			611 RHR	15	
6	UV-201A	1 1/2	611 RHR	21	
			611 WHR	18	
8	UV-201A	2	613 RHR	19	
			611 RHR	15	
			69 KRL	22	
		2 1/4	69 KPR	18	
		2 1/2	69 KRL	19	
			69 KPR	16	

C-300 and UV-200 are interchangeable  
C-301A, DV-2 and UV-201A are interchangeable

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For sets using current at a rate higher than 2 amperes.



Write today for this free booklet

Whether you have a one-tube set or most advanced multi-tube outfit, you'll find a fund of interesting information in our booklet, "How to fit a storage battery to your set—and how to charge it."

This booklet gives you the complete Prest-O-Lite Radio Chart—technically accurate recommendations covering both "A" and "B" Storage Batteries for every type of set.

In addition there is much vitally important data on the care and upkeep of storage batteries—information that any radio fan will find of real value in keeping his set at its maximum efficiency. Write for your copy right now.

# What size batteries will work best in your set?

SELECTING storage batteries of the right size and capacity is necessary, not only for the best reception, but also to arrange the time between chargings to suit your convenience.

The Prest-O-Lite Chart now makes this easy. Illustrated above is a section of the master chart showing Prest-O-Lite "A" Batteries for 5-volt tube sets. If your set has these tubes, you will find, in the fourth column, the Prest-O-Lite "A" Battery that fits it exactly. Use either of the two sizes recommended, depending on the number of days' service you want between chargings (based on an average use of your set of three hours a day).

Thousands of radio dealers have the complete chart, showing you also how to select "B" Batteries, as

well as "A" Batteries for peanut tube sets. You'll prefer Prest-O-Lite Storage Batteries because of their special features designed for better radio reception. Improved separators and plates insure steady, unvarying current and years of life. The novel solid-seal top prevents external current leakage and possible short circuits. They're easy to recharge and priced remarkably low—from \$4.50 to \$38.25.

Let the Prest-O-Lite Chart guarantee you batteries scientifically correct for your set. It is endorsed by the world's largest electrochemical research laboratories. See it at your dealer's—or write for our interesting booklet, "How to fit a storage battery to your set—and how to charge it."

THE PREST-O-LITE CO., INC., INDIANAPOLIS, IND.  
New York Office: 30 East 42nd Street. Pacific Coast Factory: 599 Eighth Street, San Francisco. Canadian Factory: Prest-O-Lite Company of Canada, Ltd., Toronto, Ont.

*Prest-O-Lite*





Write today for your **FREE** copy of—

# Ward's New Radio Catalogue

**T**HIS advertisement is published to tell you three things everyone interested in Radio *should know*.

That we believe Ward's is today the greatest Radio store in the world—that it is the real Headquarters for Radio.

Second, that at Ward's you can buy everything in Radio without paying the usual "Radio Profits."

Third, that this big 68-page book—a genuine reference book on Radio—is yours free for the asking.

## Our Radio Experts

This Catalogue is a book gotten up by experts. It shows all the best hook-ups, everything in parts and com-

plete sets—so simple that you yourself can easily install them.

And it shows only tested and approved Radio equipment—selected and tested thoroughly by our Experts who are up-to-the-minute in Radio.

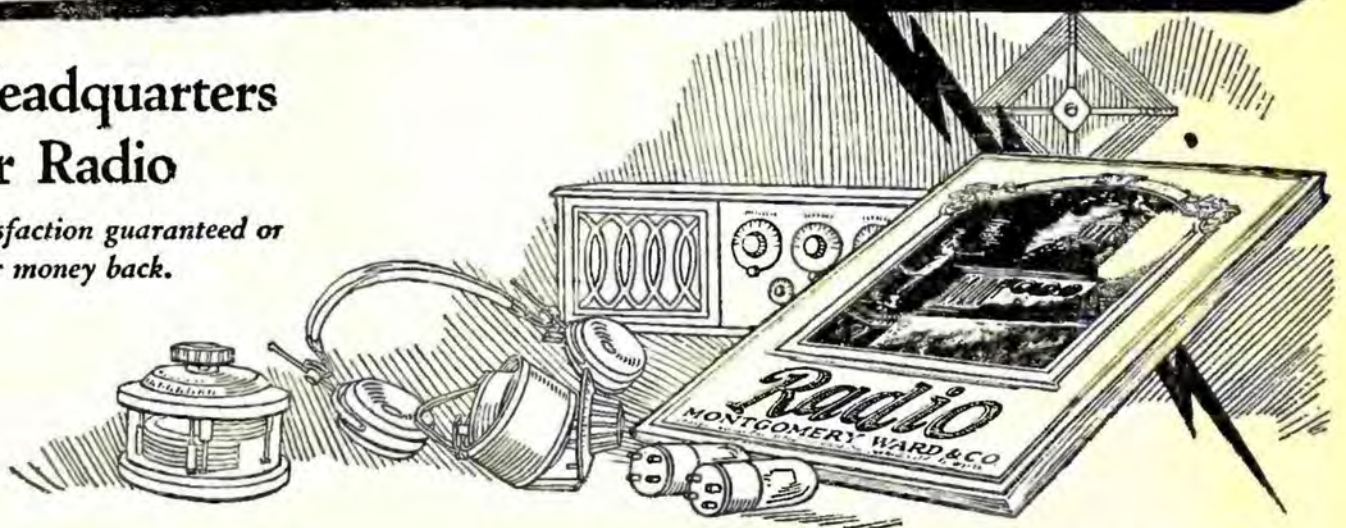
Write for Ward's free 68-page Radio Catalogue and see the low prices.

## Our 53 Year Old Policy

Every Radio set we sell is guaranteed to give complete satisfaction. In buying Radio from Ward's you are buying from a house whose reliability is above question. For 53 years we have sold quality goods only. Address our house nearest you. Dept. No. 18-R.

## Headquarters for Radio

*Satisfaction guaranteed or  
your money back.*



ESTABLISHED 1872  
**Montgomery Ward & Co.**

The Oldest Mail Order House is Today the Most Progressive

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Portland, Ore.

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Fort Worth



# RADIO AGE

## The Magazine of the Hour

M. B. Smith  
Business Manager

A Monthly Publication  
Devoted to Practical  
Radio

Frederick A. Smith  
Editor

## A Set for the Experimenter— A "SURE SHOT" Super-Het

**T**HE design of this super-heterodyne was made with the idea in mind to design a set that could be constructed by the average experimenter and to work like a laboratory product.

This is made possible by the design of the tuned long wave amplifier which automatically eliminates the slightest possibility of doubt as to whether or not the long wave amplifying transformers are working at the same wavelength. Also, the method of wiring which is used in this set reduces the coupling between the successive stages of radio frequency amplification to the point where the outfit is most stable.

Further, the method of wiring and coil mounting removes the necessity of inner stage shielding, which usually introduces serious eddy-current losses and at the same time complicates the construction.

### Plate Current Small

**T**HE "A" battery supply may be derived from either three dry cells or a four volt storage battery. The plate current is very small (8 Milliampères). This is because 199 tubes are used and the grids are all kept at a high negative potential. A 201-A tube can replace the 199 tube in the second stage of audio frequency amplification. Obviously the six 199 tubes must be put on one rheostat and the 201-A on another.

At all times the filaments of the tubes (the 199 tubes in particular) must be kept down as much as possible, as a slight over-load greatly decreases their life.

When a super-heterodyne does what a three tube set should do, the trouble usually lies in the long wave amplifier. Failure of this very important part of the set to give a great gain is usually due to the following:

Transformers not working at the same wave-

By ARTHUR B. McCULLAH

### A Tuned Long Wave Amplifier Big Aid

length as the transformers are peaked at. This latter failure predominates when working at the longer wavelengths; that is, in the neighborhood of 6,000 to 10,000 meters; i. e., Mr. Transformer Manufacturer will specify that a .0003 fixed condenser must be placed across his filter transformer to tune it to the wavelength the transformers are fixed.

Now, Mr. Condenser Manufacturer says our fixed condensers will vary within 20 per cent of their rated capacity. This means that you are running a small chance in getting your filter tuned to the same wavelength as your transformers are designed for.

This condition does exist and many three stages of long wave amplification are giving less amplification than one stage that is working properly.

### Watching the Transformers

**W**HEN working at the shorter waves, 1,000 to 3,000 meters, both of the

said difficulties are encountered, making the long wave amplifier a hopeless mess unless the transformers are accurately matched (also with the filter) and to do this is above the ability of the average experimenter.

There has been much discussion in current issues of different radio journals as to the proper wavelength at which to amplify, in a super-heterodyne. Some writers will make their choice with purely theoretical efficiency in mind. Another author in making his choice has considered both the theoretical efficiency plus the practicability of such a design. This is the probable reason for such a vast difference in opinions.

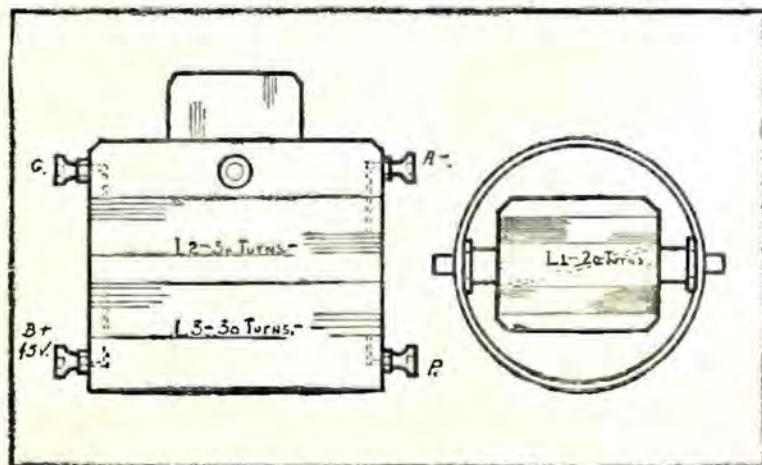
The tuned long wave amplifier is an expedient, but is a bit more difficult to build. Once finished, you can be sure that you have all that can be had in an amplifier.

On account of the high efficiency obtained with the tuned long wave amplifiers, only two stages are needed. That is, with two stages of long wave amplification, this super will get down to the "noise level" under average conditions. What is more, the fewer the stages, the more stable our set will be, because there is less chance for inter-stage reactions; also, if the same out-put can be had with less stages, our set will be more efficient.

The reduction of the number of tubes reduces the size, initial cost and up-keep.

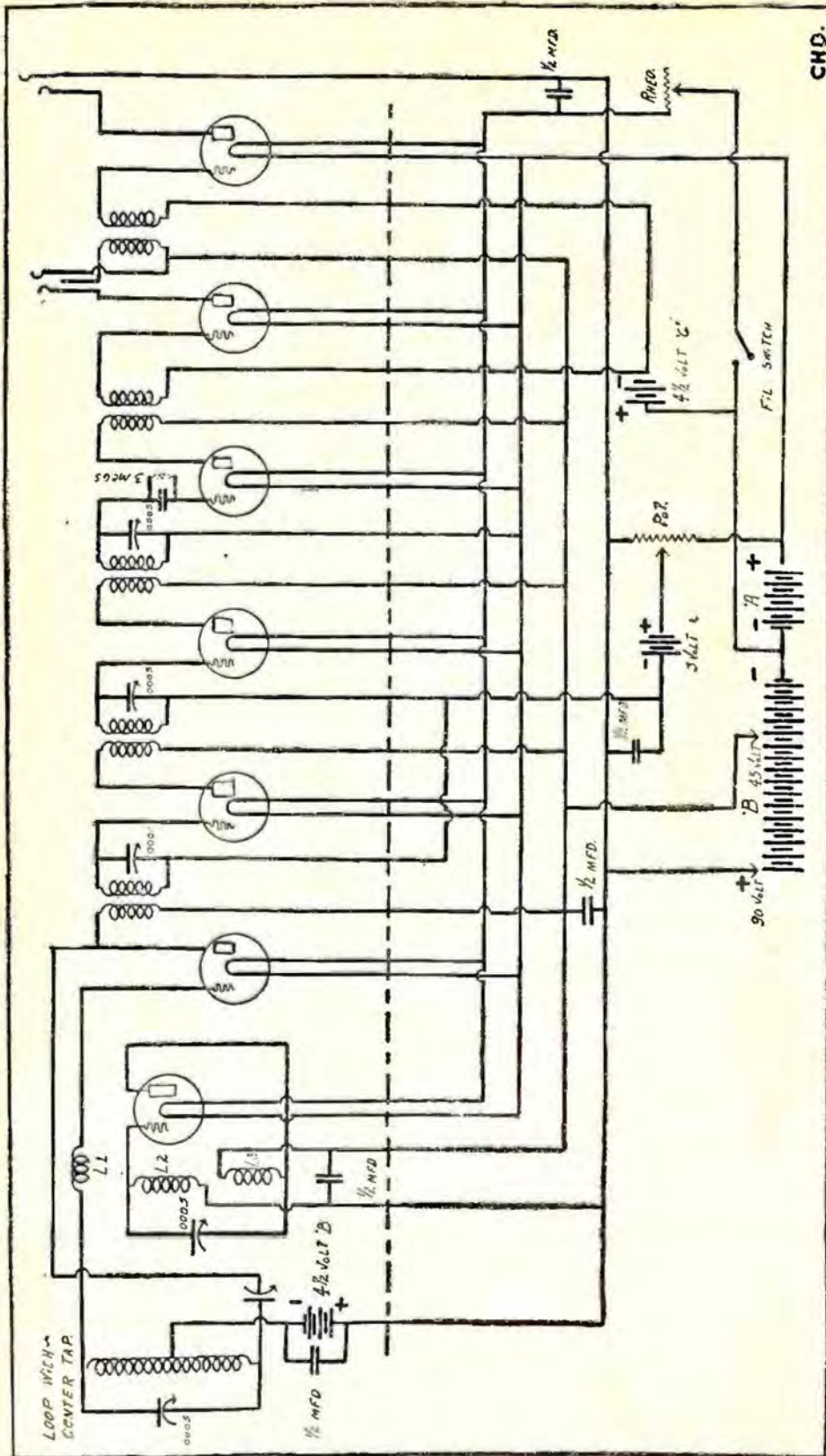
### List of Parts Required

- 1 Front panel 8"x30" x3-16"
- 2 Bakelite strips 1-2"x 18"x1-4" (coil mountings)
- 1 Bakelite strips 1 1-2" x24"x1-4" (To mount sockets)
- 1 Bakelite strips 3 1-2" x18"x1-4" (Condensers mountings)
- 2 Pieces brass rod 3-8" square 3 3-4" long
- 2 Pieces brass rod



Above is shown the method of wiring the oscillator coil for Mr. McCullah's super-heterodyne. L1—20 turns; L2—30 turns; L3—30 turns. The bakelite tube is 2 1-2 inches in diameter and 3 inches long.





The wiring diagram of Mr. McCullah's "sure shot" super-heterodyne. This set is designed especially for the experimenter, and yet results show that it is rarely exceeded as far as DX work, selectivity and clarity of tone are concerned. All wires below the dotted portion of the diagram are included in the cable.

- |                                  |  |
|----------------------------------|--|
| 3-8" square 2 1-2" long          | 6 400 turn coils (Of good make)          |
| 2 .0005 mfd. variable condensers | 3 Pieces Bakelite tubing 2" diam.        |
| 3 .0005 mfd. variable condensers | 3 1-2" long                              |
| 1 1/4 spring jack                | 7 199 tube sockets                       |
| 1 2 spring jack                  | 3 .5 mfd. by-pass condensers             |
| 1 On-off switch                  | 1 .002 fixed condenser                   |
| 1 Ten to fifteen ohm rheostat    | 1 Bakelite tubing 2 1-2" diam. x3" long. |
| 1 200 to 400 ohm potentiometer   |  |
| 2 Four inch dials                |  |

- 1 Bakelite tubing 1 1-2" diam. x1" long
- 2 Audio transformers (Of Good Make)
- 1 ——— Midget condenser .000045 m.f.d.

- 1 .00025 grid condenser
- 1 Three meg. grid leak
- 1 Loop with center tap
- 3 Three inch dials
- 60 Feet rubber covered wire
- Miscellaneous nuts, bolts and screws.

The best of parts must be procured for this set as the best are none too good.

After procuring all of the parts listed from a reliable dealer, the builder should proceed to grain and drill the panels.

The graining of the panels can be done nicely with Number One steel wool, rubbed lengthwise. After this a few drops of oil are put on the panel and rubbed with a piece of clean waste.

### Mounting the Sockets

**M**OUNT the four sockets and three variable condensers on their respective pieces of bakelite. Drill and tap the ends of the four brass rod for a 6-32" machine screw.

After the front panel has been finished, mount the two variable condensers, rheostat, potentiometer, two jacks and an on-off switch. Now screw front panel to base board. Mount the apparatus on the base board, leaving plenty of room for the cable that will run the length of the set.

The oscillator coil is wound on a 2 1-2" tube, 3" long. The pick-up coil is wound on a 1 1-2" tube 1" long. This coil is made to rotate within the larger coil so as to vary the coupling. The larger tube has two windings of 30 turns, each wound in the same direction. The smaller coil has one winding of twenty turns split in the center so as to let the shaft go through. Number 24 green silk wire is used.

The wiring is the only difficult part of the set. The wiring diagram shows what wires are to run in the cable (in brief all wires but the grid and plate wires are run in the cable).

Small finishing nails are driven into the base board in a line down the length of the set and opposite the points where wires come out from some piece of apparatus to join the cable. Several nails can be seen in the pictures.

After the set is wired, tie the cable with some waxed string, (any telephone repair man will show you how to tie the cable).

Now you are ready to try the set out. Set the three variable condensers that tune the long wave amplifier at about three-fourths of the way in. Connect up the batteries with the usual precautions; put tubes in the sockets and proceed to tune in. If the set is connected right, it will pick up some local stations immediately. After you pick up a local station, readjust the three variable condensers in the long wave amplifier until you get maximum signal strength.

Now try to pick up some distant stations and make some adjustments on the regenerative condensers and the pick up coil.



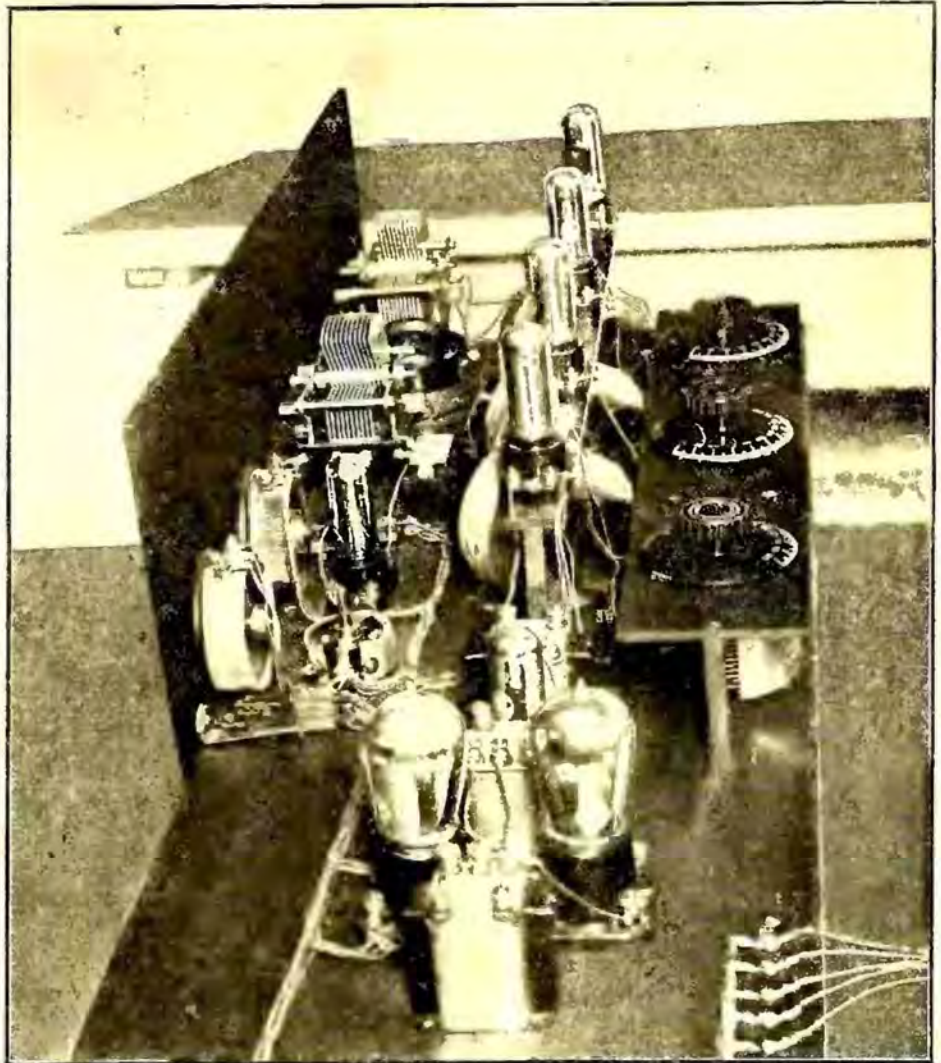
The use of the cable method of wiring may seem quite a radical departure from the usual method. However, it has proven its efficiency and is used in any number of high grade commercial sets today. The builder must, however, bear in mind the fact that all wires that connect the plate and grid circuits must be left out of the cable and not run parallel to one another for any great distance. When a section of cable is completed and ready to be bound together, it should be done in the following manner: Take a long piece of waxed string and fasten it securely to one end of the bundle of wires, and by looping a series of half hitches, at intervals of about one inch, the entire length of the wire to be bound, you will find upon completion that the cable is quite sturdy and will not easily be jarred out of place.

#### Long Wave Transformers

**T**O MAKE the long wave transformers, proceed as follows: Take the six 400-turn honey-comb coils and mount them on the three pieces of bakelite tubing that have been procured for this purpose. If you cannot get bakelite or other tubing whose outside diameter does not correspond with the inside diameter of the honey-comb coils, get the size tubing just under the inside diameter of the honey-comb coils and split it (the tubing) the entire length of one side. This will permit the tubing to expand enough to insure a snug fit inside the coils.

The three long wave radio frequency transformers are then mounted on their base, which is the two bakelite strips one-half inch wide and eighteen inches long by one-quarter inch thick. These strips are laid one on top of the other and holes drilled at intervals, to be determined by the experimenter after he has purchased the honey-comb coils. The three long wave transformers should be separated equal distances one from the other. You can use long brass bolts for fastening the transformers to the bakelite strips. It is well to mount the transformers so that there will be a little clearance between the bottom of the coils and the baseboard. Mounting them on the bakelite strip is to permit of changing the angle between them and thus reduce the inductive coupling between them to a minimum.

As before mentioned, the oscillator coil is wound on a tube three inches long and two and one-half inches in diameter. Our sketch shows the connections leading to four binding posts mounted on the tube. Soldering lugs can be substituted for the binding posts if the experimenter wishes. The pick-up coil is wound on a tube one inch long and one and one-half inches in diameter. Twenty turns of Number 24 double silk covered wire are wound on this piece of tubing, ten turns on each side of the shaft. Both sides of the coil must be wound in the same direction. The drawing shows both ends of the inner sides of the coil connected together, while the start and finish of the coil are connected to the shaft. The builder can bring the start and finish wires through a hollow shaft. If he decides to do this,



A side view of the super-heterodyne, showing the method of installing the 201A tubes in the push-pull audio amplifier.

he must remember to use flexible wire in making this connection. Number 24 double silk covered wire is used on both the oscillator and pick-up coil.

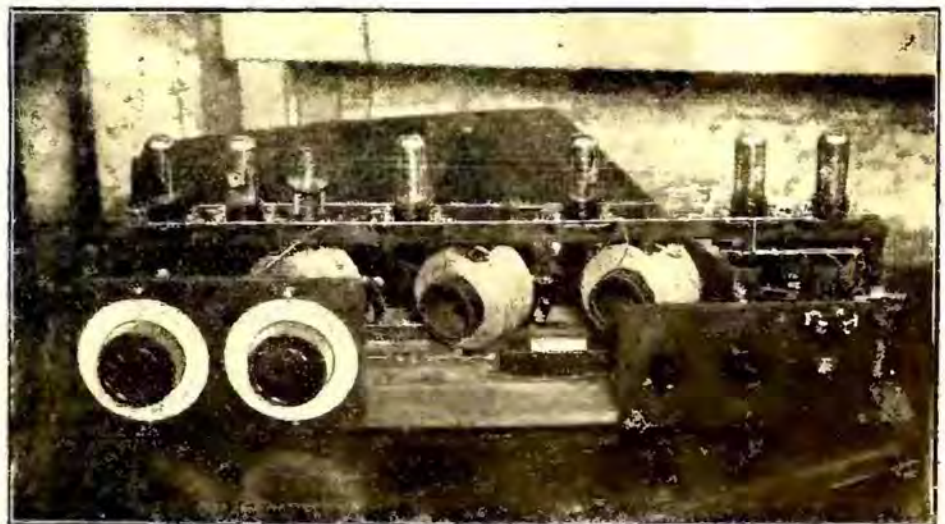
The design of the front panel is left to the builder's taste. The only thing that is necessary to have on the main operating panel is the secondary and oscillator condensers and a filament control switch, which enables the operator to turn the filament current off at

will without having to remove one of the battery leads from the battery, the rheostat and the potentiometer.

#### Watch Wiring Diagram

**U**SE great care in following the wiring diagram of the oscillator circuit and no trouble will be experienced in making the heterodyne unit oscillate.

The secondary of the three air core long wave radio frequency transformers



The experimental model of the McCullah super-het, showing the possibilities of condensing the outfit by mounting the audio amplifier under long wave amplifiers.



is tuned with three .0005 mfd., variable condensers that are to be mounted on a sub-panel three and one-half inches wide, eighteen inches long and one-quarter of an inch thick. This is done so that once the condensers are adjusted, they will be out of reach and you will not be tempted to turn them and throw the entire long wave amplifier out of tune. After the condensers are mounted on the sub-panel, the panel and condensers are mounted on the end of the baseboard farthest away from you, using the two pieces of brass rod two and one-half inches long and three-eighths inch square. The photograph on page 11 will show this quite clearly.

there is today, he may at times wonder how he is to know just what is the best. It is very easy to determine just what is best if you will but pay a little attention to the manufacturer of the kind of apparatus you want. Do not purchase any equipment from a manufacturer who will not guarantee his products, or from people who are known to be "bootleggers."

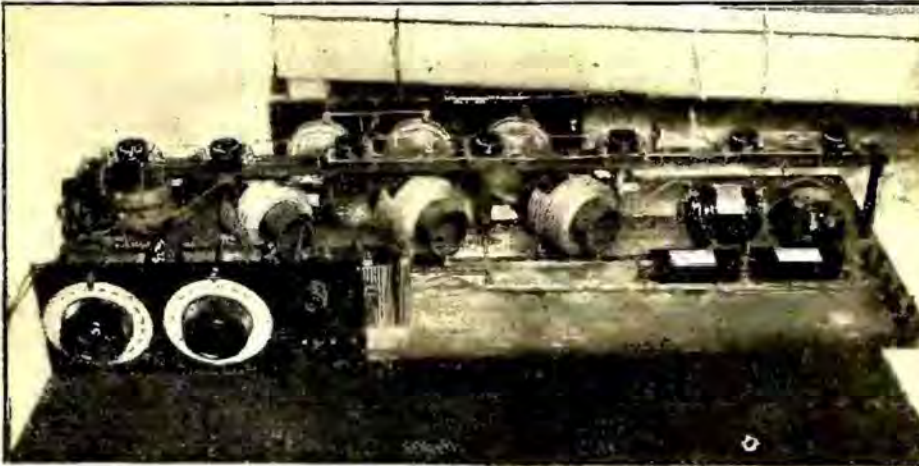
The variable condensers used in tuning the long wave amplifier do not have to be verniers, neither do they have to be of the more expensive low loss type. If condensers of the type that permit high losses are used, the efficiency of the set is *nil*. The oscillator condenser and

tubes, build for that purpose. If not, the smaller sockets should by all means be used.

The set can be made in a real portable manner if the lower picture on page 11 is followed. To do this, the sub-panel on which the three variable condensers are mounted is omitted and they are mounted at right angles to the bakelite base on which the tubes are mounted. Of course, it will be necessary to procure a longer piece of bakelite for this purpose than the one originally specified. It would be best for the builder to determine the length of this, as he will know just how wide he will want the set to be. The audio frequency amplifiers can be mounted under the detector tube as shown at the extreme right hand side of the picture.

In the upper photograph on page 11 is shown the circuit with push pull amplification. This is added in the usual manner, but it has been found best to use the larger type tubes for this purpose. This will necessitate the installation of another rheostat, to control the push pull amplifier and a modification in the "A" battery current supply to compensate for the increased amount of current consumed by these tubes. It is best to install push pull amplification after one stage of straight audio has first been added.

In purchasing the audio frequency



The incomplete experimental model, showing how the nails are used in laying the cables.

After you have mounted the four vacuum tube sockets on the piece of bakelite, one and one-half inches wide, twenty-four inches long and one-quarter inch thick, connect the filament leads together by means of a long piece of bus bar wire. While it is not necessary to use bus bar wire for this purpose, due to the fact that this is such a long connection, it is best to use a wire that is quite firm.

It will not be necessary to drill holes for mounting either the midget variable condenser or the grid leak and fixed condenser, as these two pieces of apparatus are so light that they will practically support themselves when soldered to their respective places.

It might be well to state that the grid leak should have a resistance of about three megohms and the condenser (grid) capacity should be .00025.

The builder may use any type of loop that he may choose, just so it will tune low and high enough to cover the broadcast range. One about two feet square and tuned with a variable condenser having a capacity of .0005 mfd has been found to give excellent results. However, a loop of this size is not absolutely necessary as some of the smaller ones on the market are every bit as efficient.

#### Watch Your Apparatus, Too

**I**N CHOOSING apparatus for a circuit of this type, the builder must remember (as before cautioned) to use only the best obtainable. With such a variety of equipment on the market as



A rear view of the Sure-Shot super. Note how the cable connections, condenser mountings, etc., are made.

the condenser across the loop should be of the low loss type, having a straight line wavelength curve, as with condensers of this type the settings for given wavelengths will be divided evenly over the entire dial.

While these condensers do not have to be of the vernier type, it will be found convenient at times to have some means of adjusting them very finely. For this purpose a dial or a device that will enable you to move them a mere fraction of an inch at a time will be found quite convenient.

Be careful in selecting the vacuum tube sockets and do not get those that are commonly spoken of as "moulded mud" products. Be sure that the contact prongs are springy enough to touch the prongs on the tube and here let me advise you against using adapters. If you wish to use the set with the larger

transformers it might be well to suggest that transformers of a low ratio be used, as those of a high ratio will only distort the speech and music. Two transformers having a ratio of four to one are considered the ideal type to be used in an audio amplifier by most experimenters. As the output of signal strength is so great in a set of this type the resistance coupled style of amplifier can be used quite nicely and very good success has been reported using two stages of resistance coupled amplification and a straight stage of audio. The output from three stages of resistance coupled amplification is about as great as the output from a two stage audio amplifier, but the clarity of tone and the freedom from distortion more than make up for this shortcoming.

Be careful in making your connections to solder all joints that you possibly can.



# An All-Round Receiver— The 3-Circuit REGENERATOR

THREE tubes is practically the minimum number that is suited for really satisfactory year-round loud speaker receiving. Of course, you can employ two tubes, with reflexing and have fairly good loud speaker operation, but in sure-fire tuning control, utmost sensitivity and in quiet, undistorted amplification, the straight regenerative detector and two stage amplifier form an unbeatable combination.

With so many reasonably priced three circuit couplers available, it is actually a waste of time and a very slight saving to construct your own. With one of these instruments and a good variable condenser, the receiving circuit is simple to connect, simple to tune and unequalled in the regenerative field for its selective ability, DX reception and accuracy of its dial settings.

Moreover, the outfit can be assembled in a very good looking style, if a bit of care be expended in the arrangement of the panel and its "fit" in the cabinet. A special cabinet was built for the receiving set illustrated, using mahogany with a piano finish in dark walnut. A cabinet-maker did the job for fourteen dollars. It has a 60 degree slope in front, proportioned to take a 7 by 18 inch mahoganite panel and having a 2 inch vertical frontal portion for added beauty.

## Cabinet Construction

TO obviate joints between sides and top, the opening for tubes and wiring is in the form of a rectangular door about 12 by 7 inches, located in the rear. Beneath it is a slot one half inch in width and three inches long, through which the flexible connectors for batteries, aerial and ground are passed. The dials for condenser, coupler and rheostats are in mahoganite likewise, so that the panel and woodwork of the cabinet present an appearance of elegance and refinement.

An added feature is the self-contained loud speaker—an idea which may not appeal to some of you, but which, on the whole, seems quite pleasing both in appearance and in results. The horn is a small molded product and a high quality phone unit is fitted to it by a special cap included with the horn. Leads from the phone unit are in the form of a single phone cord, with a plug at the end. The phone is

By BRAINARD FOOTE

## "Sure Fire" Tuning Control, Maximum Sensitivity, Easy with this Circuit

not permanently connected in the circuit, but joined to the plug just as though it were an external speaker. The cord comes out the rear of the cabinet along with the other wiring.

Two jacks are provided, one giving access to the detector for headphone use, and the other to the second step of the audio amplifier for the loud speaker. One rheostat controls the detector tube, which is of the "soft" (200 or 300) type, while the other rheostat regulates the filament current of both of the amplifier tubes.

The apparatus required for the set itself is as follows:

- 1 7x18 inch cabinet
- 1 7x18 inch panel
- 1 7x12 inch panel (as sub-panel inside)
- 1 Loud Speaker horn (if desired)
- 1 Phone Unit (if desired)
- 1 Three Circuit Coupler,
- 1 Variable Condenser to suit the coupler
- 1 6 ohm rheostat
- 1 10 ohm rheostat
- 4 dials for above instruments
- 1 single circuit jack
- 1 double circuit jack
- 1 phone plug and cord (for loud speaker)
- 3 tube sockets
- 2 audio frequency amplifying transformers
- 1 .00025 mfd. grid condenser and 2 megohm grid leak

1 .002 mfd. fixed condenser  
7 binding posts  
10 lengths bus wire for connections  
Screws to mount panel to cabinet  
The accessory equipment is listed as follows:

- 1 UV 200 or C 300 detector tube
- 2 UV 201A or C 301A amplifier tubes
- 1 6 volt storage battery
- 245 volt "B" batteries with 22½ volt tap
- Aerial and Ground equipment
- Lamp Cord for set connections to batteries
- Loud Speaker unless included in set
- Headphones if desired (for DX work on detector tube)

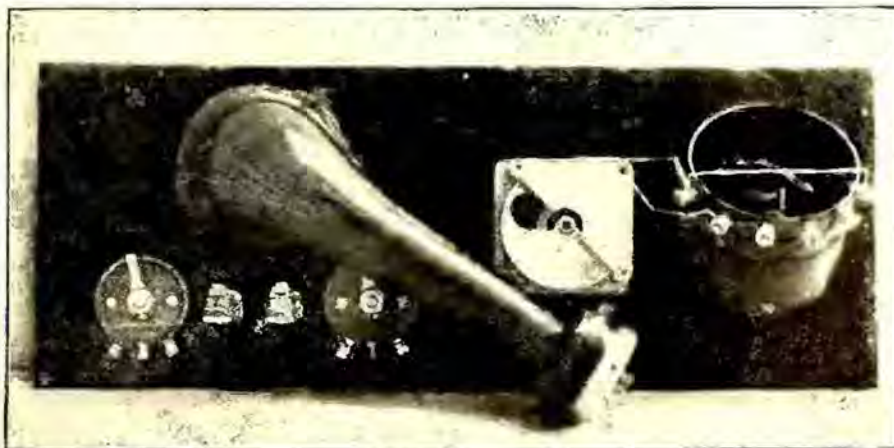
## Using a Vernier Control

THE three circuit coupler is usually accompanied by specific directions for its installation and use. The size of variable condenser needed with it is ordinarily mentioned, too. This condenser should preferably be equipped with a vernier control of some sort, or else a vernier type of dial may be purchased for it. The vernier should not be in the form of an extra plate or the type that changes the distance between the plates, as these prevent accurate "logging" of the dial adjustments for different stations.

The incorporation of "low-loss" apparatus will go far toward increasing the receiving radius and at the same time the selectivity of the outfit. This applies in particular to the coupler and the variable condenser. The panel is laid out first and the parts are situated with an eye toward effective balance and symmetry. The rear view of the panel shows just what parts are mounted on it and where they ought to go. In case you decide to use an external loud speaker, the two jacks and the two rheostats may be raised nearer to the center line, or one jack might be placed beneath each rheostat to preserve the good looks of the layout.

## The Wiring

Wherever possible, use connections to binding post in place of soldered lugs or soldered joints of any sort. Not only does soldering make for a weak joint mechanically, but it means more places for corrosion to take place. Good connections may be made with one of the new radio tools now on the market, built something like a pair of pliers but



The parts mounted to the panel are few and their arrangement is neat. The loud speaker horn is a novel feature, being included in the cabinet. Any high quality type of three circuit coupler will answer the purpose.



having a rounded nose on which a neat loop may be formed for fastening beneath the binding post screws.

The 7x12 inch sub-panel is useful for assembling the three sockets, the audio transformers and the binding posts. These last-named may be suspended on a separate "binding post panel" as illustrated if this stunt appeals to you. In fact, such panels may be obtained all ready for use, drilled for seven or eight posts. Wiring on the main panel and sub-panel should be done individually, locating all the wires that do not interconnect between the two panels. Then, the panels are placed in the same physical relation to each other that they will have in the finished receiver, whether the cabinet chosen be sloping or upright.

Bus wiring between the two panels will serve to hold them together until they are placed in the cabinet, where both may be screwed firmly into position. With the connections complete, you are ready for the installation of the set with its accessories. The aerial and ground system are standard so far as dimensions and erection go.

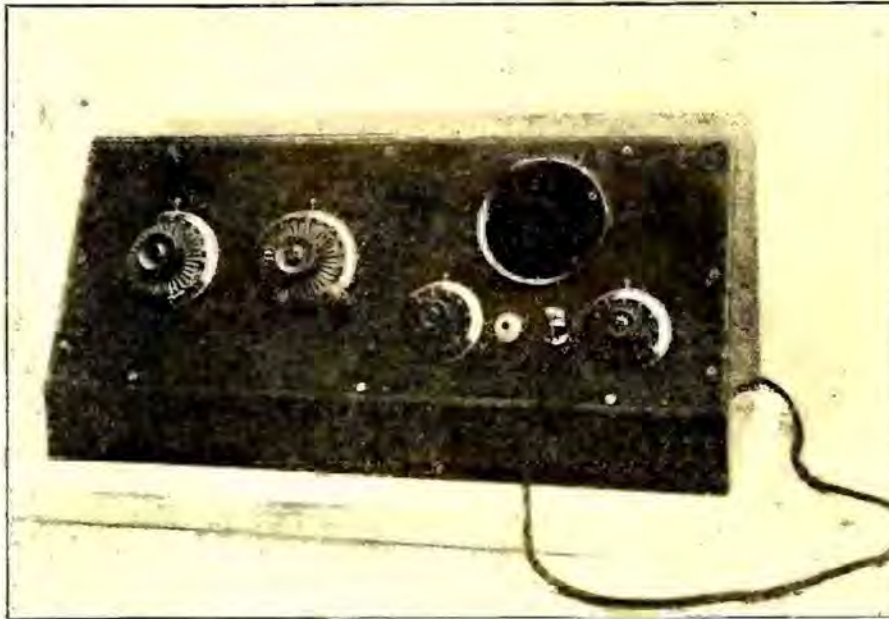
The antenna should preferably be all one wire from its outer end right to the antenna binding post, to eliminate soldered joints. It passes through a porcelain tubing either through the wall or the window frame. The ground lead may be another length of the same type of wire, running without joints from the ground binding post right to the water or steam pipe, where a connection is made with a ground clamp. The pipe must, of course, be scraped clean down to the bright metal before the clamp is put on.

The "soft" type of detector tube makes for extreme sensitivity, once its filament be correctly adjusted. It is important to get its "grid return" lead on the negative side of the filament. If, however, you decide to employ a hard tube for the detector, this lead should go to the positive side of the filament instead. In the case of the soft tube, the filament rheostat should be turned up to a point just below that brightness at which a "hissing" noise begins.

#### Tuning

THERE is only one knob that is called upon for extensive operation—that of the tuning condenser. With such a setting of the tickler dial that no whistles or squeals are heard, it is possible to tune from low wavelengths to high wavelengths by a progressive

movement of the condenser dial. All local stations will then be heard clearly. For distance work, it becomes necessary to advance the position of the tickler dial to secure regeneration—but you should be very careful not to advance it enough to cause whistles and squeals.



*If you like a sloping model of cabinet, here's one that is particularly handsome. The three circuit tuner is used for reception, with a two stage amplifier, and the outfit has a self-contained loud speaker. Make yourself one!*

When you do this, you interfere with other listeners round about you and it is not necessary to actually arrive at the point of "oscillation" where such noises commence in order to make your receiver sensitive to distant signals.

#### Keep a Log, Too

YOU also ought to keep a careful list of all the stations you hear, together with their advertised wavelengths and the dial readings of the condenser dial at which these stations are heard. Not only will this help you locate them again, but at the same time it will enable you to know pretty closely the setting of your dial for any wavelength. And if you are trying your best to "log" some DX stations, you will then know, for instance, that KDKA comes in at 26 and you won't waste time trying to get the call letters of a station coming in at that setting, for it must be KDKA.

The three circuit tuner is particularly easy to control for another reason. The coupling between the antenna and the set is constant and therefore the tickler dial is practically constant for good regeneration no matter where the tuning condenser is set.

This means that the tickler dial need scarcely be touched and means that as a critical control, the tickler is no annoyance.

All in all, there's no set so easy to operate and so extremely satisfying in its results in comparison to the expense entailed and the trouble of tuning it. It's really the standard three tube receiving set and it is deservedly the standard.

MANY of our readers get considerable enjoyment out of constructing their own apparatus, and for their benefit the following instructions will enable them to build the three circuit tuner as described in this article.

First, procure an old vario-coupler and strip it of all winding. The tube on which the tapped primary was wound will be from 3 to 3 1-2 inches in diameter. Beginning at the lower end of the tube, approximately 3-4 of inch from the bottom, wind 15 turns of No. 22 double silk insulated wire. Anchor the ends of this coil by drilling small holes in the tube in the proper position to take the end down through one hole and up through the other.

These holes should be about 1-4 inch apart and in line with the winding. At a distance of 1-8 of an inch from this coil, start the secondary winding, which consists of 40 turns of the same kind of wire used in making the first coil. Both the starting and finishing ends of this coil are anchored in the same way. Next, the rotor is to be wound with 42 turns of No. 26 double silk insulated wire and the ends fastened to the same terminals to which the unwound coil was fastened. This completes the tuner.

#### Wind in Same Direction

It might be well to state that the two coils wound upon the tube must be wound in the same direction. When mounted in the set, the top end of the 15 turn coil is connected to the aerial binding post and the lower end to the ground binding post. This forms the primary winding. The top end of the 40 turn coil is connected to the grid leak and condenser and to the rotary plates of the variable condenser, and the other end to the stationary plates of the variable condenser and the negative side of the "A" battery, as shown on the wiring diagram.

One of the rotor terminals is connected to the top spring of the detector jack and the other terminal to the plate connection of the vacuum tube socket.

#### Audio Transformers

REGARDING the audio transformer, if the builder desires to obtain extreme amplification in preference to good tone quality without distortion, then one having a ratio of 10 to 1 should be used in the first stage and that of the second stage should be of a lower ratio, such as 3 1-2 to 1 or 4 to 1. Two low ratio transformers of about 4 to 1 will, however, give much better musical quality to the



reception, although perhaps with a little less volume.

In some cases better reception is obtained if a fixed mica condenser having a capacity of .002 M. F. is connected across the posts, the posts marked "P" and "B" positive side of the first transformer, but whether or not this will be of any use will depend upon the particular transformer used.

It is sometimes advisable to substitute a variable grid leak for one of the fixed type. This should be mounted as close to the detector tube socket as possible. This is important, as a difference of one inch in the length of the grid leak, after passing through the condenser, may cause the set to howl. No mistake will be made if it is soldered directly to the binding post.

The jack used to cut in on the detector tube should be of as good a quality as it is possible for the builder to obtain. This is usually considered by most builders as a most unimportant piece of equipment. However, this should not be so, as if the jack is of poor electrical construction, it is possible to burn out all the tubes.

How many times have you heard a fan complain that his audio frequency amplifier did not seem to work right? Cases of this kind can usually be traced

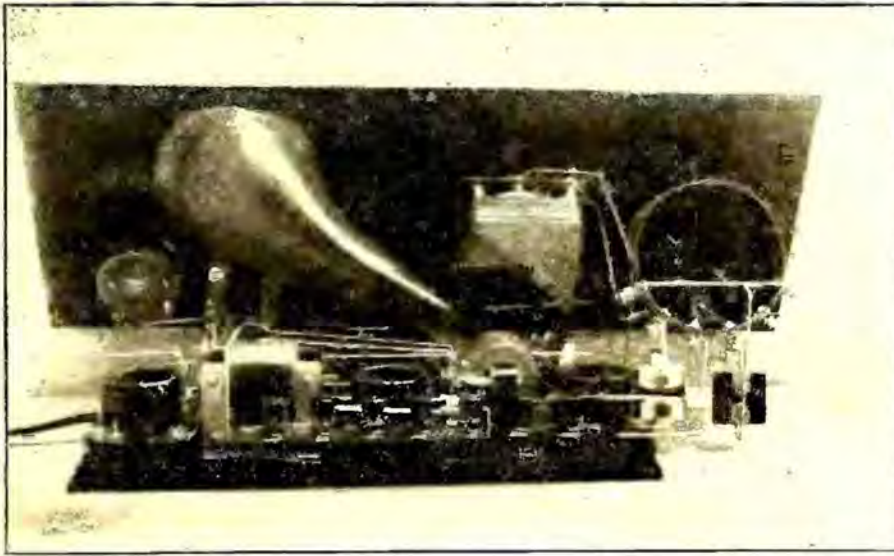
to the failure of the two inner prongs to make contact when the plug is withdrawn. By substituting a double circuit jack for the single circuit jack, employed in the last stage, it is possible to connect the loud speaker permanently to the circuit. To do this, the two outside prongs are

As the capacity change in a straight line condenser is so gradual, practically none of the low loss condensers is offered for sale with the usual vernier plates. This in itself is quite desirable, as it is almost impossible to satisfactorily log a set that employs condensers using vernier plates. It becomes necessary at times to use a device whereby the condenser can be adjusted finely.

For this purpose a vernier type dial is usually needed. One can be purchased from almost any first class radio shop. Be sure to obtain one that is free from play or back lash.

Probably less attention has been given to the aeri-als of receiving sets than any other part of the entire radio system, and a few suggestions to the reader concerning the type and general construction will not be amiss.

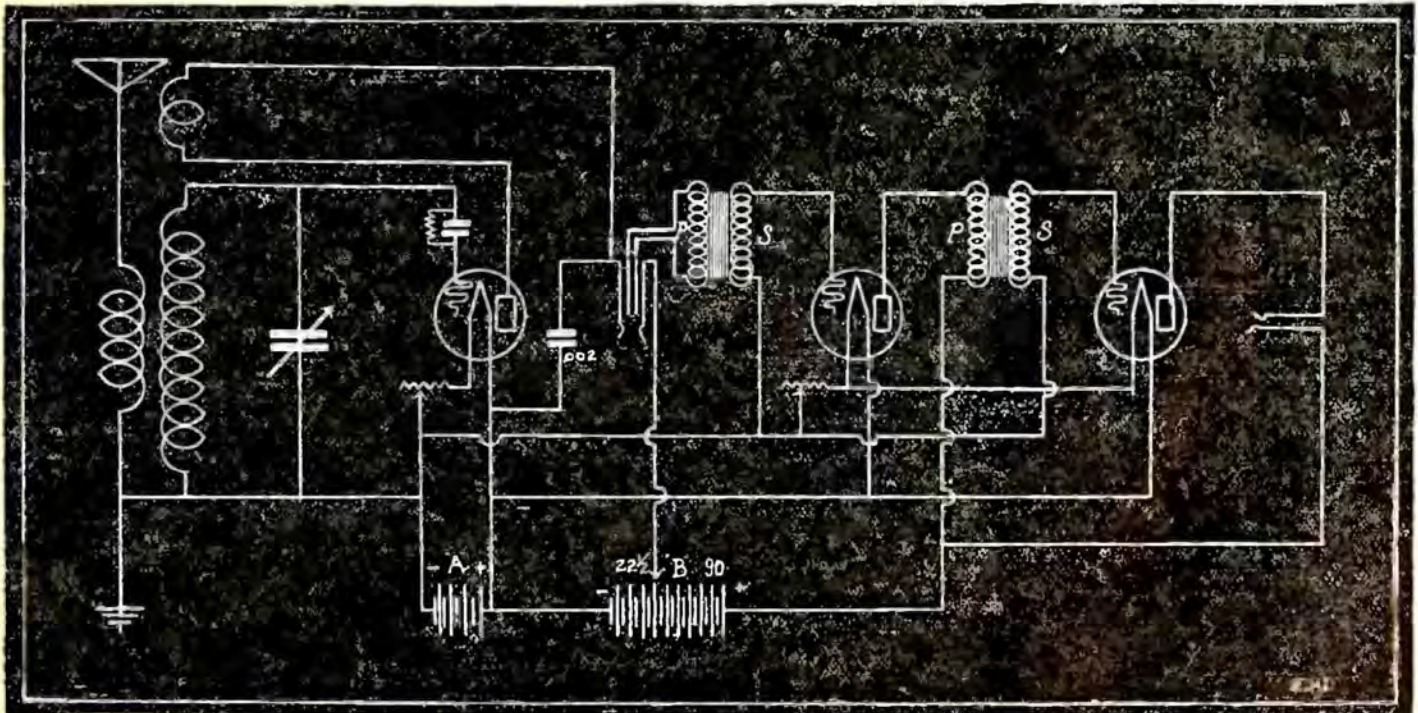
Due to the fact that many of the BCL'S were smitten with the radio bug in the Winter, and with the usual haste of a new fan threw up an aerial without any definite thought as to efficiency, appearance or practicability, just as long as it was elevated as high as possible and as long. Of course, it is not very nice to be climbing over gables with the thermometer around zero. But nevertheless, your set will prove more efficient if you but take a little care in hanging the aerial.



Sockets and transformers are placed on a separate sub-panel inside the set. Binding posts are mounted in a row on a separate strip of insulating material. Connections are made with bus bar wire and as little soldering as possible.

connected in the usual manner, while the two inner ones are connected to the loud speaker. The loud speaker is thus automatically put in the circuit when the telephone plug is removed from the last stage.

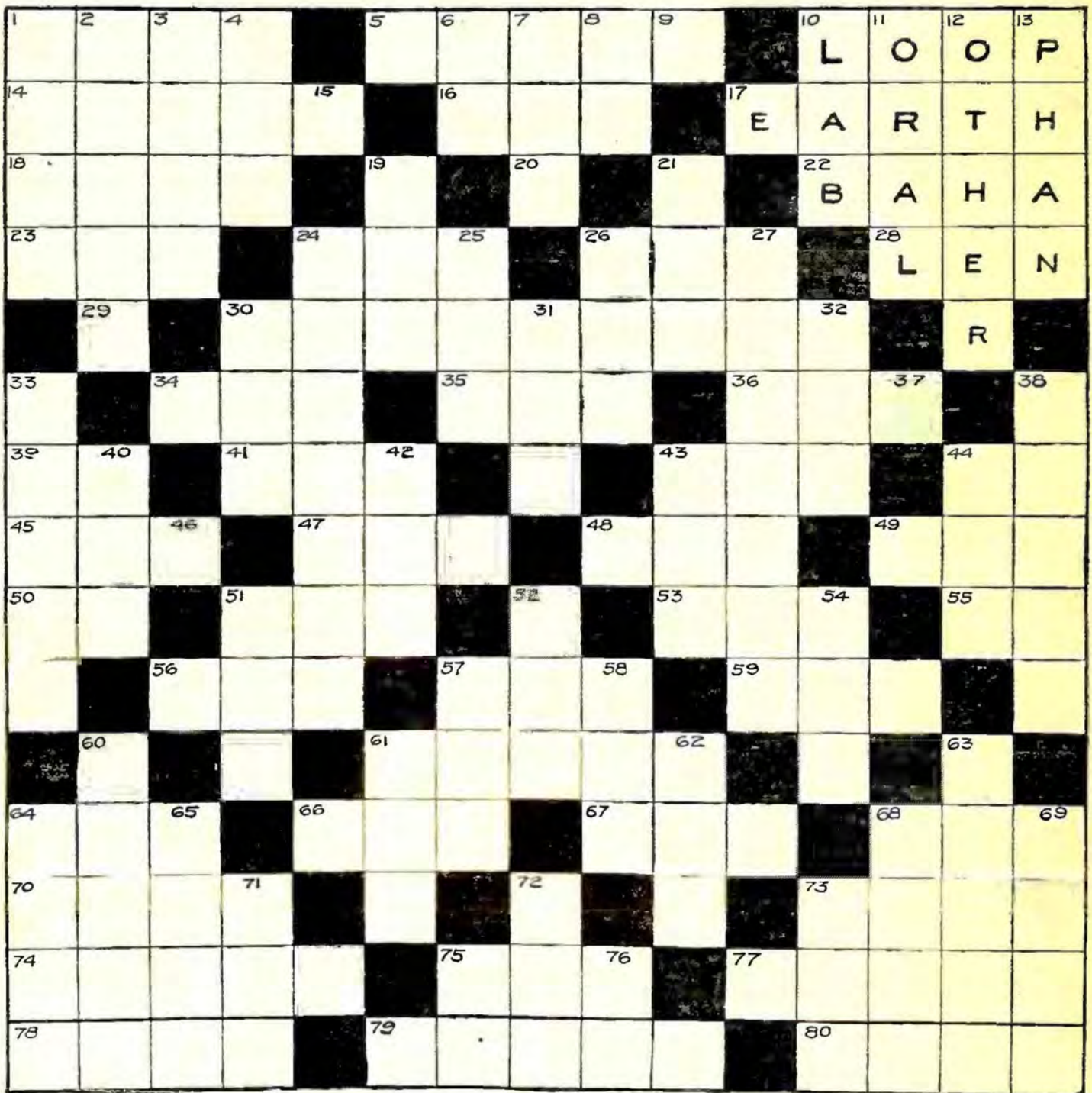
Regarding the tuning condenser, the builder is advised to use only the best obtainable, as this is one of the most important controls in the circuit. There are at present many good condensers on the market of the low loss type that will fit in this set very well.



The standardized three circuit arrangement is employed. One jack is provided for headphones and another for loud speaker. The grid return from the detector goes to the "A" minus unless a "hard" type of detector tube is chosen.



# Keeping Timely with a Radio CROSS-WORD Puzzle



By JOHN B. RATHBUN

**Y**OU fellows who have annexed Dial Twister's buttons will now have a further opportunity for distinguishing yourselves. Just sharpen up the old lead pencil and demonstrate your acquaintance with radio words by working our radio cross-word puzzle. You have all brought in DX; now let us see if you can tune in a word of three letters meaning "electronic disturbance,"

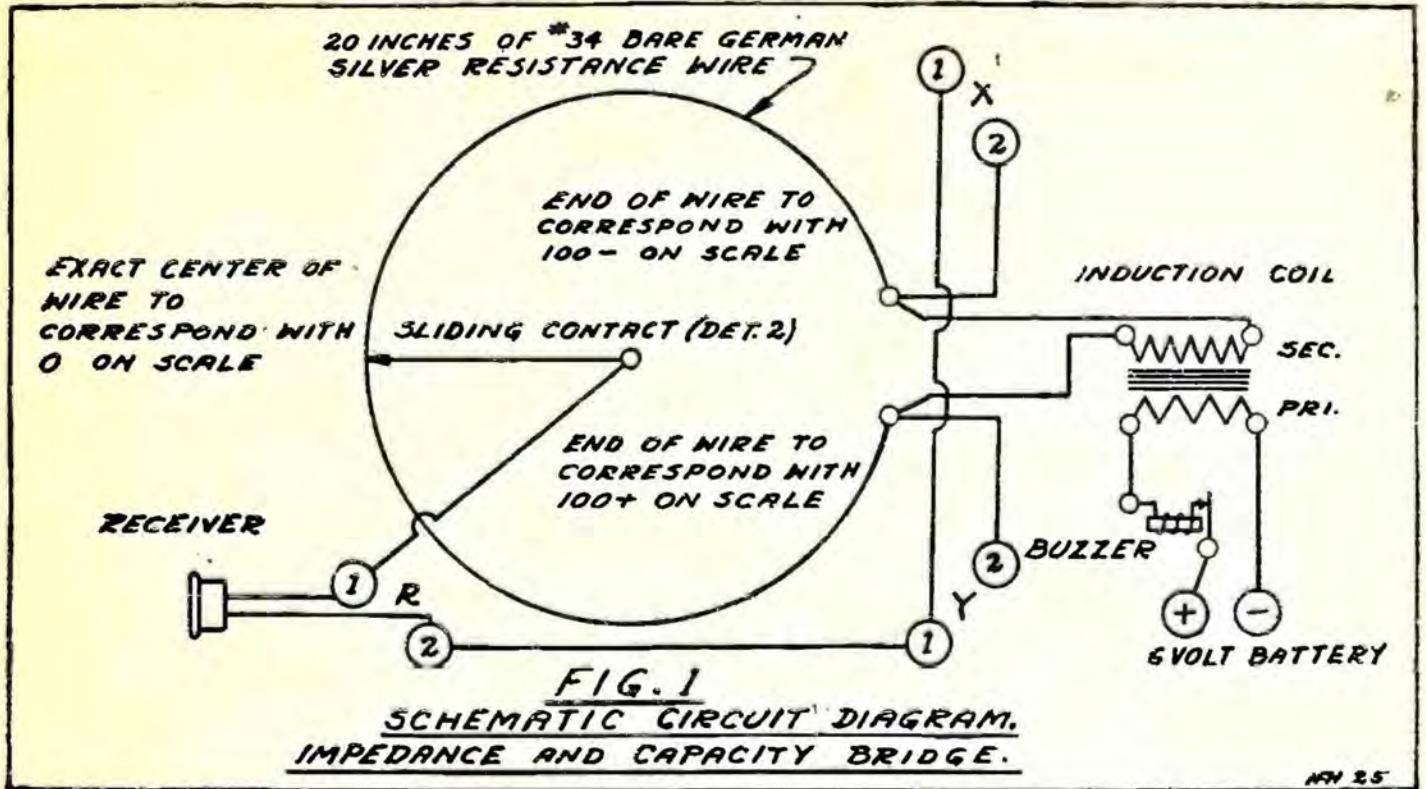
and make it fit into the little square checkerboard. At the same time we would like to know how long it took you to accomplish this feat, whether thirteen minutes or thirteen hours, so that we can be governed in laying out the cross-word puzzles of the future.

Not all of the words in the puzzle are strictly radio words. We have introduced enough everyday expressions to

make it easy for beginners, and further, there are no long or unusual words. Just plain, everyday words that have appeared dozens of times in issues of RADIO AGE. Roughly, we should say, about fifty per cent of the words are radio terms with the remaining fifty per cent as used in common conversation. Such words as "dinosaur" or

(Turn to page 71)





# Efficiency with MATCHED Parts

## A SLIDE WIRE BRIDGE FOR MEASURING CAPACITY AND IMPEDANCE

IT OFTENTIMES becomes quite a problem for the fan who delights in building his own receiving set to match his radio frequency transformers properly or to build transformers or condensers of the proper impedance or capacity, because of the difficulty in having them measured or matched.

Radio frequency transformers, as we all know, should be as near equal to one another as is possible, to obtain the most efficient results when placed into a set. This applies to the intermediate frequency transformers of the super-heterodyne type of circuit in particular and to a lesser extent to the neutrodyne and tuned radio frequency type of circuits. These transformers may be constructed exactly alike, to the turn of wire, and to the length of wire and spacing of turns, yet they may be one or two hundred meters apart, due to the variation of the wire or its insulation, density of winding or capacity between windings.

Take the condenser, a piece of equipment most important, yet usually very small, where capacity must be as near exact as possible to produce the best results. All one can do is either take the manufacturer's stamp as final, or he can figure it out with a long mathematical problem; but as the great majority of broadcast listeners and set builders are not radio or electrical engineers, this becomes too deep and complicated.

### Not So Complicated

The measuring and balancing of coils and condensers is not a hard or

By **H. FRANK HOPKINS**  
Assoc. A. E. E.

complicated operation; in fact, it becomes almost as simple as tuning his receiver when a circuit commonly known as a "slide wire bridge" is set up. This circuit is simple within itself, and can be built in the form of a portable instrument at small cost, as described in this article.

### WHY YOU NEED THIS UNIT

The success or failure of most radio receiving sets depends on whether or not the apparatus used is properly matched.

If your radio frequency transformers are not as equal as possible, your results will not be up to standard.

Here is a unit that enables you to determine the necessary capacity of your condensers, transformers, inductances, etc., and thus assure yourself that your set is properly laid out.

If you are in doubt about the procedure outlined in this article, do not hesitate to call upon the author for personal counsel.

### Material Required in Building the Instrument

- One maple disk 7" in diameter (Detail 1).
- One Induction Coil.
- One High frequency buzzer (900 to 1000 Cycles).
- One piece No. 34 Bare German silver resistance Wire 24" Long.
- Eight brass binding posts.
- One composition panel 8"x8"x3/16" (Detail 3).
- One 3-16" Ball bearing.
- One Composition knob and pointer.
- One piece spring brass 4"x1-2"x014".
- One brass rod, 1-4" Round 3" long.
- One piece thin bristol board (for scale).
- Miscellaneous screws, nuts, wire, solder and washers.

### Slide Wire Parts

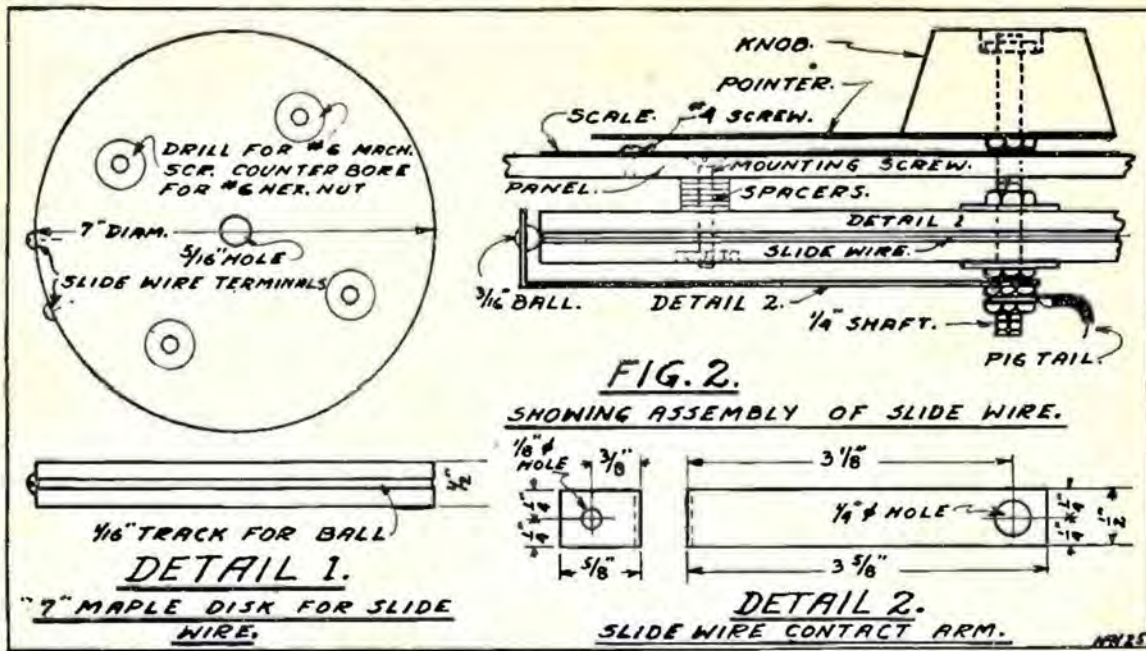
One disk, seven inches in diameter, one-half inch thick, will be required, (Detail 1). This will be turned from a piece of white maple, or other close grained hard wood. A groove, or track for a 3-16" ball, will be cut around the edge as shown in detail 1. This groove will be one-sixteenth of an inch deep.

One hole, five-sixteenths of an inch in diameter will be drilled in the exact center to pass the 1-4" shaft, and four holes will be drilled to pass a No. 6 brass machine screw, and counter-bored to receive a No. 6 brass hexagon nut. These four holes will line up with the four holes to be drilled later, in the panel (Detail 3) and will be used for mounting the disk to the panel.

One brass rod, one quarter of an inch

REV 25





top of the wax paper. Be careful to wind the wire in the same direction as was done on the primary coil. Six hundred turns of No. 30 double cotton covered wire will be necessary, bringing each end of the coil out through holes in the end piece opposite to the primary leads.

It would be well to splice a piece of heavier wire to the secondary coil ends, taking two or three turns and bringing out through the end piece, as No. 30 wire is rather delicate and hard to handle.

Ten turns of wax paper will then be wound around the coil and made fast,

in diameter and about three inches long, will be threaded to receive a one-quarter inch brass hexagon nut, over its entire length. Two brass washers and six, one-quarter inch brass hexagon nuts will be secured, to fit this rod.

One composition knob will be drilled and counterbored to receive the 1-4" shaft, and shall have a pointer, three or three and one-half inches long, fastened to the bottom, (see figures 2 and 3). A pointer can be made from spring brass .014 inch in thickness if required.

When all of the above parts have been made or secured, the next step will be to prepare the panel.

**Drilling the Panel**

A COMPOSITION panel 8"x8"x3-16", thick will be prepared, and the drillings centered as shown in detail 3. One hole 5-16" in diameter will be drilled in the exact center, to pass the 1-4" shaft. Four holes will be drilled and tapped to receive No. 4 Round head brass machine screws to mount the scale, and eight holes to pass No. 8 Machine screws will be drilled, two in each corner, to mount the binding posts X1, X2, Y1, Y2, R1, R2, Positive and Negative. Suitable mounting holes will then be drilled to fit the cabinet used, and the panel will be laid aside.

An induction coil or open core transformer may be purchased from any reliable electrical supply house, for about one dollar, or it may be made at an even smaller expense.

One bundle of soft iron wire having a total diameter of about three-eighths of an inch and a length of four inches will be securely tied, and wrapped with about ten turns of good wax paper. Two pieces of wood, one-

quarter inch thick and one and one-half inches square, will have a three-eighths-inch hole drilled in the centers, and the core ends made secure in these holes, making an iron core spool.

Shellac or glue may be used to fasten all parts, and it would be well to tie the windings with shellac or glue when each coil is completed.

The primary coil will be wound in even layers, directly over the core, on the wax paper wrappings. Two hundred turns of No. 20 double cotton covered magnet wire will be required and both ends of this winding will be brought out through holes in one of the end pieces of the spool, and the entire coil covered with about six turns of wax paper, thus completing the primary coil.

The secondary coil will be wound directly over the primary coil and on

completing the induction coil.

A high frequency buzzer (900 to 1,000 cycles) can be secured from any reliable dealer. It should be enclosed under a metal cover. A buzzer of this type is required to set up a current whose frequency is somewhere near the frequency of voice currents, to better balance and measure equipment subject to voice frequency currents.

**Assembly of the Parts**

THE first step in assembling the parts of the slide wire should be to fasten the No. 34 German silver resistance wire in place on the disk (Detail 1), but it would be well to assemble the parts to try them out for fit and performance first, and then remove such pieces as necessary to put the resistance wire in place, as it is very delicate and can be damaged easily.

The 1-4" shaft will be made fast through the center hole in the disk, (Detail 1) using two washers and two hexagon brass nuts, (Figure 2). When it has been adjusted so as to revolve freely, lock the nuts onto the shaft with a small center punch, so that they will not turn loose or tighten with the shaft when it is revolved. Then mount the disk, (Detail 1) to the panel, with No. 6 flat head brass machine screws and nuts, as shown in Figure 2, using washers to space the disk so that the nut on top of the disk will clear the panel by at least one-sixteenth of an inch.

When the disk is mounted to the panel, the contact arm (Detail 2) will be made fast to the shaft under a 1-4" brass hexagon nut, (see Figure 2) and the flange bent so as to exert a tension on the 3-16" ball, but not enough to impair the travel of this

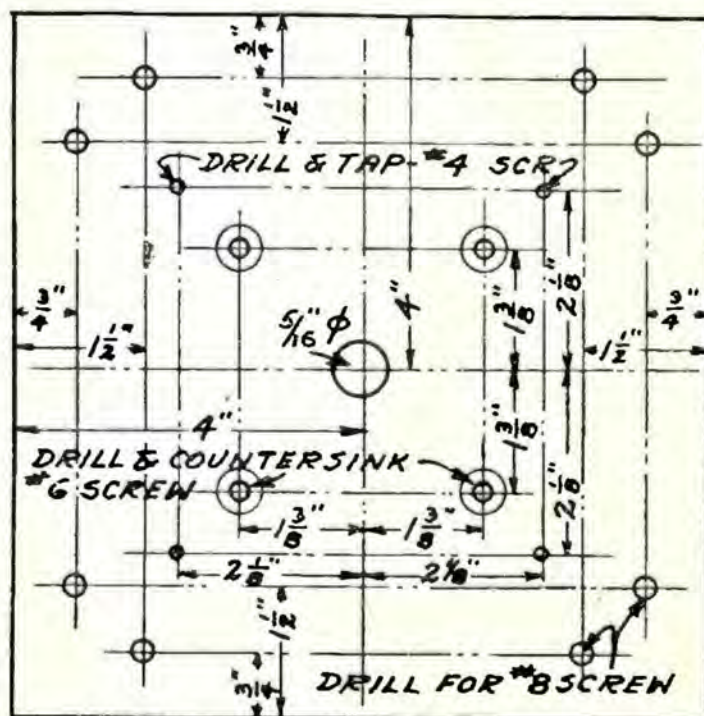


Fig. 2A—Showing the drillings in the 8"x8"x3-16" panel.



ball in the groove or track on the edge of the disk.

The panel and slide wire will now be laid aside and the induction coil and buzzer mounted into the cabinet as shown in Figure 3. When this has been done, the instrument is ready to be wired and will be set aside until the scale is made and mounted to the panel.

**The Scale**

The piece of bristol board for the scale will be cut into a disk seven inches in diameter, and will have a one-half inch hole directly in the centre to fit over the 1-4" shaft, when mounted on the panel. Four holes will be cut to pass the No. 4 brass machine screws for mounting, and the scale laid out.

Black India ink is the best to use on account of its being water-proof, and will stand wear better than other inks. Also, it will not blur once it is dry, and it will stand out clearly.

The scale will have one hundred sections on each side of "O" (See Figure 2). To lay this out, first measure the sections one inch long around the circumference of the disk each way, from a point to represent "O," then divide each of these sections into ten equal parts, and number from 0 to 100, to the left of "O" and from 0 to 100 to the right of "O."

A partial scale is shown in Figure 4, to exact size, and may be used as a guide in spacing all of the sections if desired.

When the scale has been completed it will be mounted to the panel by four No. 4 round head brass machine screws in the position shown in Figure 3.

**Wiring the Instrument**

TWO No. 4 round head wood screws will be put on the disk, one directly under the 100+ and one directly under 100- points on the scale. Placed so that when the knob is turned, as far as it will go in each direction, the ball will be directly under the end of the scale and the pointer will be at 100+ or 100-.

Three terminals will be put under each screw and the screw tightened to make a good contact. Now take the No. 34 German silver wire, and place it around the groove, laying tight on the bottom and make fast to one of the terminals on each screw.

A pig-tail connection will be made fast to the 1-4" shaft, as shown in Figure 2 and connected to binding post R1.

One lead from the primary of the induction coil will be made fast to one terminal of the buzzer, and the remaining primary lead connected to post -, using stranded wire. Now connect the remaining terminal of the buzzer to post +.

The secondary leads of the induc-

tion coil will then be connected, one to each stop screw on the disk (Detail 1) using one of the terminals.

Binding post X2 will be connected to stop screw under 100- on the scale and post Y2 to the stop screw under 100+ on the scale, using the remaining terminal on each.

Binding post Y1 and X1 will be connected to post R2 and the panel fastened to the cabinet, completing the instrument.

**Operation**

Connect a receiver to terminals R1 and R2 (Figure 1) and the positive side of a six volt battery to post + and the negative side to post -. Connect the transformers or condensers to be measured or balanced to posts X1 and X2 and to posts Y1 and Y2, as follows:

**Balancing R. F. Transformers**

Connect the inside terminal of one primary coil to post X1 and the outside terminal to post X2. Connect the inside terminal of the other primary coil to post Y1 and the outside terminal to post Y2.

Move the slide wire pointer until no hum is heard in the head phones. If the silent period is at "O," the coils are balanced; if the pointer is at 10- it will indicate that coil X has more impedance than coil Y, and it will be necessary to add turns to coil Y until the pointer shows "O" as the silent spot.

If the pointer shows 10+ as the silent spot, then coil Y has more impedance than coil X and to balance remove turns until the pointer shows "O" as the silent period.

Repeat the operation for the secondary coils of the transformer, connecting them in the same manner to posts X1, X2 and Y1 and Y2.

When three or more transformers are to be balanced, use the transformer connected to X1 and X2 terminals as the master and balance coils connected to Y1 and Y2 to equal. If the three transformers are thus balanced or matched, they will all fall within a few meters of one another and should work well together.

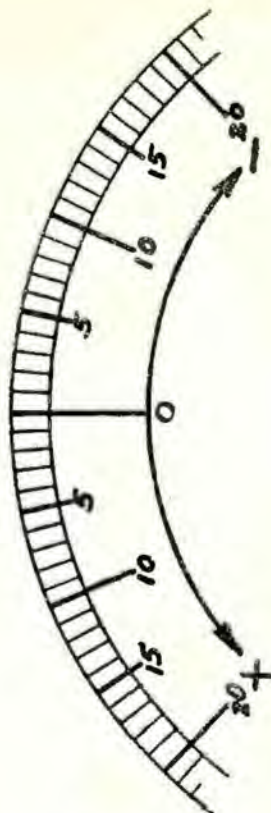
**To Measure Impedance or Resistance**

WHEN it is desired to measure the impedance of a coil, it will be necessary to secure a master coil or impedance whose impedance is known; say 1 henry for example. This master impedance coil will be connected to posts X1 and X2.

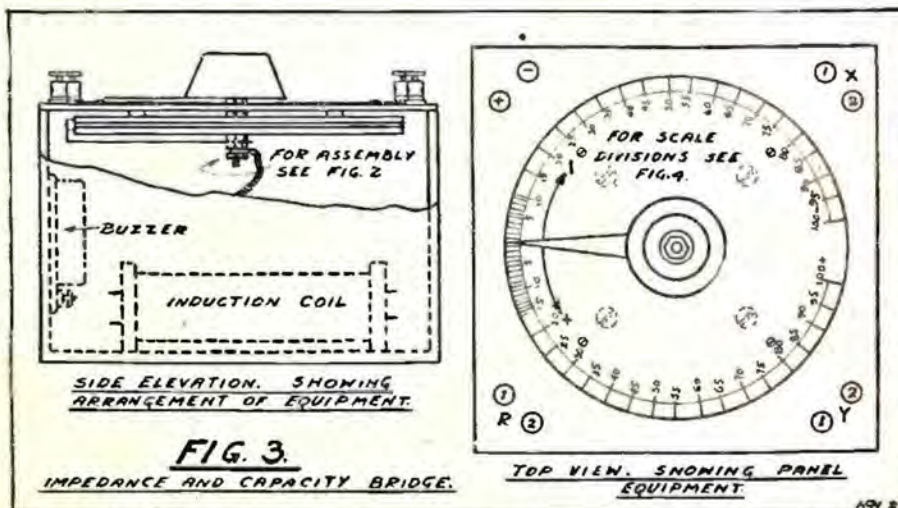
The coil to be measured will then be connected to posts Y1 and Y2 and the slide wire revolved to the silent point. If this should fall on 25- then the impedance of coil Y will be .25 less than 1 henry or .75 henry, or if it should stop at 50- coil Y will be .50 less than coil X or .5 henry, or wherever it stops on the - side of the scale, the reading will be direct. Thus, if it should stop at 86, the coil Y will be .86 less than coil X or 14 per cent of coil X.

When the reading comes on the + side of the scale, coil Y will be greater than coil X. Thus, if the pointer shows 25+, then the impedance of coil Y will be 1.25 of coil X or 1.25 henry, or if it should stop on 86, the coil Y would be 1.86 henry.

Resistance will be found in the same manner. Attaching a coil whose resistance is known to terminals X1 and X2, and the unknown to terminals Y1 and Y2, then the resistance in ohms will be proportional to coil or resistance (Turn to page 73)



**FIG. 4**  
**PARTIAL SCALE**





Exploding a Few Antiquated Theories

# Don't Worry about Antennas

By  
**ARMSTRONG  
PERRY**

believed. He spoke of the number of persons who wanted radio sets but who refrained from installing them because they believed that the antenna was dangerous, troublesome, and complicated. In fact, he said the antenna is none of these things.

The advertising of "antennaless" radio sets has caught the fancy of many customers. Dr. Dellinger says there "ain't no such animal," though not in exactly those words. He himself predicted long ago that there would be and, in one sense, they arrived, but every radio receiver must have an antenna of some sort, even though it may be but a few turns of wire concealed in the cover of its cabinet. To get power from the radio waves without an antenna is as impossible as getting lemonade from a lemon without some kind of a squeezer. Just as a cow may be milked by a milk maid, farm hand, vacuum suction outfit or a calf, so radiated electrical energy may be drawn from the ether by various means, but whatever the extractor is, it is an antenna.

### Antennas are Liberal

**M**OST anything will work," said Dr. Dellinger of antennas. "You can't go wrong. You can take directions, giving in minute detail the height, size, mode of fastening and insulating the antenna, and work a week following these directions, and then walk into the home of a friend and find him getting perfectly good results with a wire tacked up to the picture moulding. None the less, a fairly long and high antenna, out-of-doors, is the cheapest way to get loud signals with the simplest radio sets.

Have you worried about length, number of wires, insulated or bare wire? His suggestion, like that of the physician to the patient who had read the patent medicine ad and begun to feel the symptoms is: "Don't worry!" The neighbor's multiple-wire, flat-top or cage antenna probably has a transmitting amateur at the end nearest hell. A receiving antenna should simply be a wire running from the receiving set to as high a point as possible at the far end. A single, continuous wire is better than an out-door and an indoor portion joined together. It does not need to be hori-

zontal. Just let it take any angle that happens as a result of the height of the farther point of support.

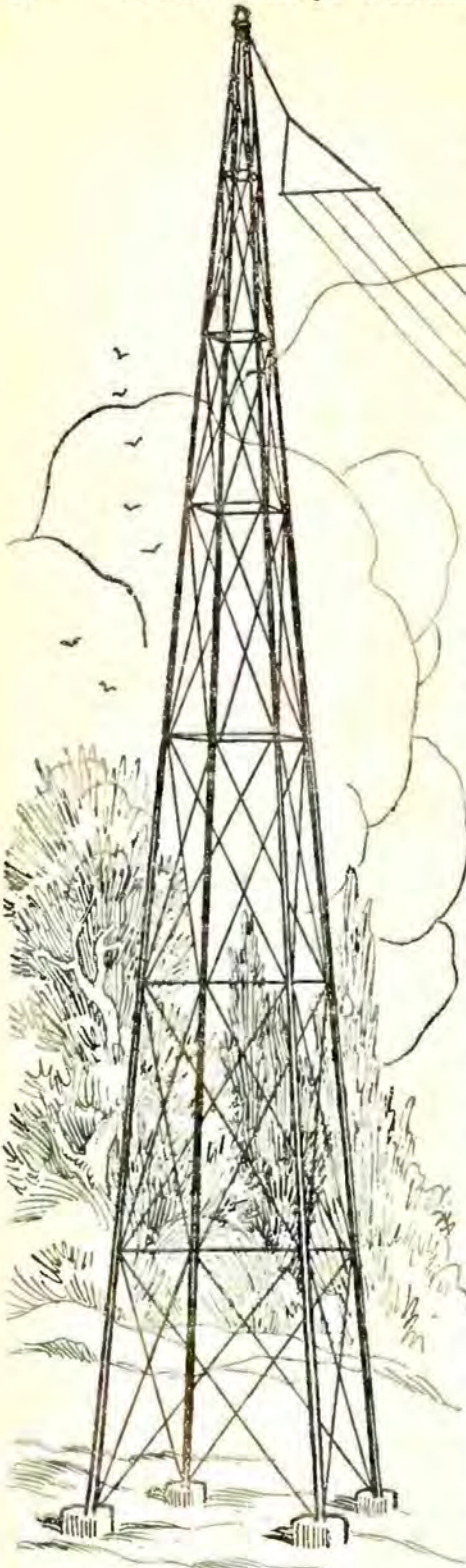
Some have believed that "directional effects" in an antenna affect results, in spite of the fact that ships at sea do not turn broadside on or stern to the shore station when sending and receiving messages. Dr. Dellinger says, comfortably, that the fears that our antennas will not receive signals from one direction or another are entirely groundless. Perceptible differences due to direction are obtainable only with special antennas much longer than those used for broadcast reception.

In discussing insulation, he confirmed some popular impressions and brought up other matters that are often overlooked. Porcelain or glass insulators should be used to support the antenna, he said, and it should be kept as far as possible from all other objects, such as buildings or trees. Its length should extend over clear, unobstructed ground. Except where it enters the building through a porcelain tube, and goes direct to the receiving set without touching walls or anything, it should be kept more than five feet from any object.

Stranded antenna wire has been advised many times because of its greater surface as compared with its size. Dr. Dellinger says it is not quite as good as solid copper wire, No. 14 or larger, because its resistance is higher. The object of all the effort to keep the antenna away from everything is to lower the resistance. The stranded wire, however, is stronger mechanically. Insulated antenna wire helps us to spend more money but not to secure more energy from the radio waves.

### Regulating the Length

**A**S TO length, this expert says anywhere from 50 to 150 feet gives good results. Lengthen the wire and  
(Turn to page 69)



**W**ISHING to know the up-to-date truth about antennas, and their relation to the new receiving sets and results, I asked Dr. Dellinger, Chief of the Radio Laboratory of the United States Bureau of Standards, for information. The experts at the Bureau of Standards are not in the business of making or selling apparatus. They have exceptional opportunities for testing theories, parts, sets and appliances. When they speak, they speak with authority and without such prejudice as a man with a dollar at stake may be inclined to yield to.

Dr. Dellinger promptly smashed several pet theories and erroneous notions about antennas that have been widely



# The WHY of Vacuum TUBES

*Knowing About Tubes Will Help Set-Builder Get Results*

*Frank Pearne Takes You Into Mysteries of New Types of Tubes*



**J**UST what part the vacuum tube plays in the working of a receiving set is well known to all radio enthusiasts; at least, they know that if it is to be used as a detector tube, it must be placed in one part of the circuit and if it is to be used as an amplifier tube, it is used in a different part of the circuit.

They also understand in a way that when used as a detector, its rectifying qualities are pushed to the limit and when they are used in the amplifying circuit, they must be so arranged that their amplifying qualities are brought to maximum.

Many fans have gone far deeper into the subject, but there are a great many who care only for the music and pleasure which the set affords and do not attempt to find the reason that a tube is necessary in the set, but where we find one of this type, we find a thousand of the other, who are eager to learn more about the mysteries of radio, thirsting for more knowledge and getting the keenest delight out of building their own apparatus and knowing just why it produces the results obtained.

It is for these hard workers and contributors to the radio science that this article is written, in the hope that it may be of some service to them. It will in a measure also serve to answer the many thousands of questions pertaining to the value of the many new types of vacuum tubes which have lately been put on the market.

**A Tube is Peculiar**

**T**HE workings of a tube are peculiar to say the least, as its action depends upon what is known as the evaporation of metal. Many will wonder at this statement, as the evaporation of fluids may be well understood, but it is hard to realize that metals may do the same thing although not in a molten condition. It is true that they evaporate very

slowly within the ordinary range of temperatures, but when heat is applied, this rate of evaporation increases rapidly.

Air, however, has an oxidizing effect upon this action, and when surrounded by air, it will usually oxidize before any great amount of evaporation can be noticed. If, then, the metal can be placed in a vacuum and heat applied in some manner, it will slowly evaporate until it disappears.

When an ordinary tungsten lamp begins to show signs of age and the

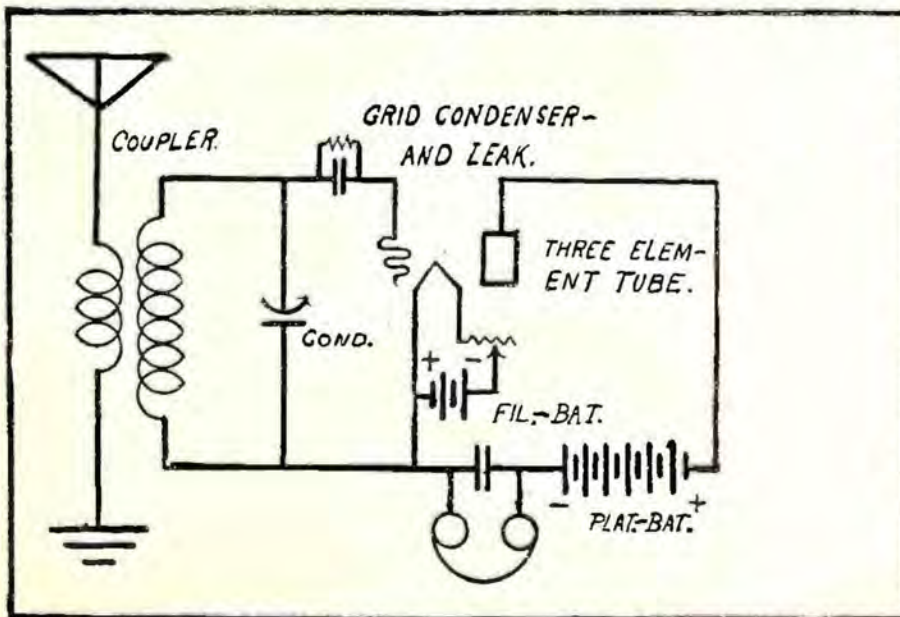
light becomes poor, a close examination will show that the inside of the glass bulb is coated with a dark material which is nothing more or less than the tungsten which has evaporated from the filament. In explaining the cause for this, it will be necessary to know something about the electron, which is the smallest known particle of matter. All matter is composed of atoms which are made up of electrons whirling in different orbits around a central nucleus of positively charged protons and negatively charged electrons, which cling together.

The electron is always negatively charged, and in fact is spoken of as the smallest possible quantity of negative electricity. The normal atom does not exhibit any electrical charge, the reason being that it has acquired enough electrons to neutralize the positive charge, which it has by nature of its structure; but if it loses one electron, then the positive charge asserts itself and if it gains one electron, it becomes a negative atom. In other words, the addition or subtraction of one electron changes it from a normal atom having no apparent charge to one having either a positive or negative charge. If the atom becomes positive because of the loss of one electron, it will again become neutral if it regains another electron.

Different kinds of matter are made up of atoms which have different numbers of protons and electrons for a nucleus and more or less floating electrons.

**The Hydrogen Atom**

**F**OR example, the hydrogen atom, which is the most simple of all, is composed of one single electron revolving around a proton, while the tungsten atom is much more complex as it consists of seventy-four electrons, whirling around a nucleus of about 200 positive protons tightly clinging to about 100 electrons. Now, un-



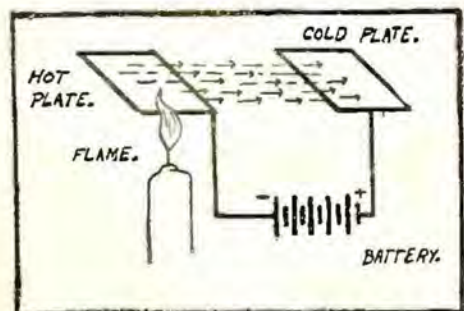
The three element tube used as a detector.



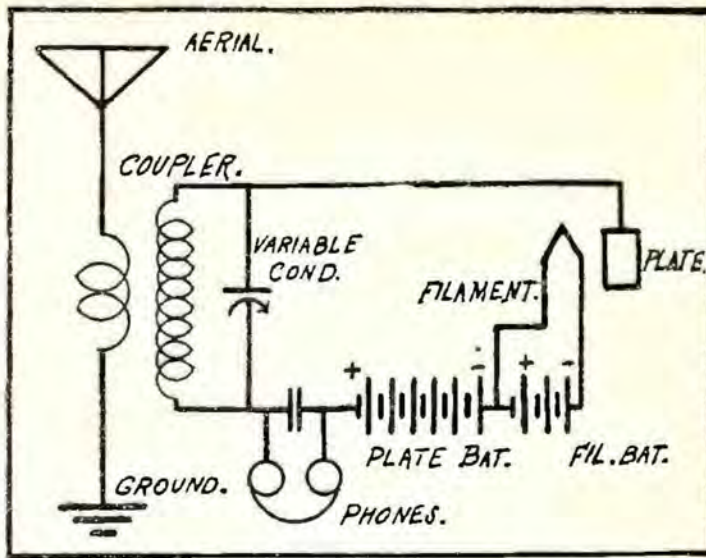
der ordinary conditions the electrons which go to make up one atom of a certain matter stay within their own orbits and do not fly off to join another atom, but it has been found that in those materials which are conductors of electricity, one electron in each atom is more or less free and will stray around among the other atoms, sometimes clinging to one and then to another, while in those materials which are known as good insulators, they stay within their own orbits and do not wander about.

If an electrical conductor is connected between some two points having a difference of potential, such as a battery or a dynamo, those electrons which are free, being really negative charges of electricity, will naturally be attracted toward the point which is positive (the carbon terminal of the battery, or the positive terminal of the dynamo) and will gradually work themselves along between the atoms from one end to the other, thus producing what is known as a flow of electric current. But it should here be noted that the slow movement of the electrons is in the opposite direction to that of which we consider the direction of the current.

Now, just what takes place in the vacuum tube? Some years ago it was discovered that if a piece of metal was heated in a gas flame and another piece of metal was placed near it and given a positive charge, some of these free electrons in the heated metal would be attracted from the hot metal to the cold positively charged metal through the intervening space, passing from this cold metal through an electrical conductor back to the heated metal. The emission of electrons from the heated metal, however, was not very great, because the metal became oxidized,



Electrons attracted to cold plate, when it is given a positive charge.

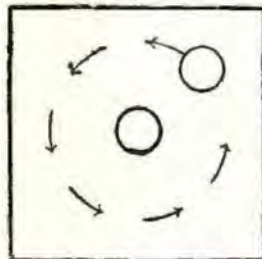


The two element vacuum tube used as a detector.

forming a coating over the hot metal, which served as a barrier to the flow of electrons and only a few of them could force their way through. When an electrically heated filament was used and was enclosed with the cold plate in a vacuum, the flow was greatly increased.

**Surface Freed of Coating**

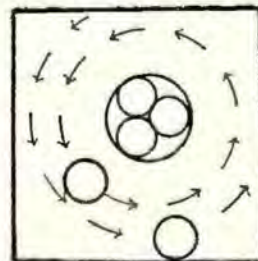
BY REMOVING all the air from the interior of the glass bulb, which contains the filament and the cold piece of metal (called the plate) the filament does not oxidize, thus leaving the surface free of any hard coating which might be difficult for the



Hydrogen atom, showing the electron whirling around the proton.

electrons to break through. It also removes most all of the gasses, which is another important factor, as the mass of the electron is so small that should it collide with an atom of gas as it moves outward from the filament, it would immediately bounce back to it and would never reach the plate. Then, too, the hot filament has a tendency to absorb gas, and too much of this absorption may stop the electron flow entirely.

One peculiar fact, however, has been proven. That is that although certain impurities in the outside surface of the filament have a tendency to prevent the escape of the electrons, certain oxides, when spread over the surface of the filament, will cause a great increase in the number of electrons emitted from it. Ordinarily a tungsten filament would have to be heated to nearly a white heat to throw off the maximum number of electrons, but with the proper coating of certain oxides, the same thing may be accomplished at a very low temperature. In fact, the temperature required is so low that it will sometimes hardly make the filament glow. However, great care must be used in the use of coated filaments, as too much heat will



An atom composed of several protons and electrons clinging together.

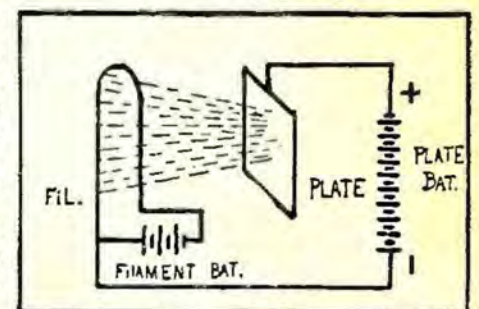
ruin the oxide coating and hence reduce the efficiency of the tube.

It must also be remembered that although many electrons may start on the journey from the filament to the plate, the number which finally reach it is few compared to the number which start. Those which do not cover the entire distance fall back into the hot filament for reasons which will be explained later. The coated filament, then, has proven to be a great improvement in the vacuum tube, and as this is a secret process, it is a question as to whether or not some of the new tubes which have appeared on the market since the expiration of certain patents are using it; but there can be no doubt about the results which some of them produce, as many of them make excellent detectors and amplifiers. But the question of their useful life is the most vital point to be considered and only time will tell.

**"The Edison Effect"**

NOW we have seen how the emission of the electrons from the filament flow to the positively charged plate, but nothing has been said as to why such an arrangement can be used as a rectifier of high frequency currents as used in the radio receiver, and also the low frequency currents which are used in charging batteries from the ordinary 60 cycle alternating electric lighting circuit. This is what is known as the "Edison effect" because Edison was the first to discover that if the positive terminal of a battery was connected to the cold plate and the negative to the filament, the electrons which came in contact with the plate would continue their travels through the plate, over the connecting wire and back to the filament, to be passed on again to the plate.

A galvanometer placed in this circuit showed that a current was flowing in the opposite direction to the movement of the electrons, but that if the terminals of the battery were reversed, no current would flow. Edison probably never realized the value of this discovery, as it remained for Dr. Fleming to make the first practical use of it some years later. The reason the current will only pass in one direction through the circuit is now quite plain, as the positive terminal of the battery connected to the plate



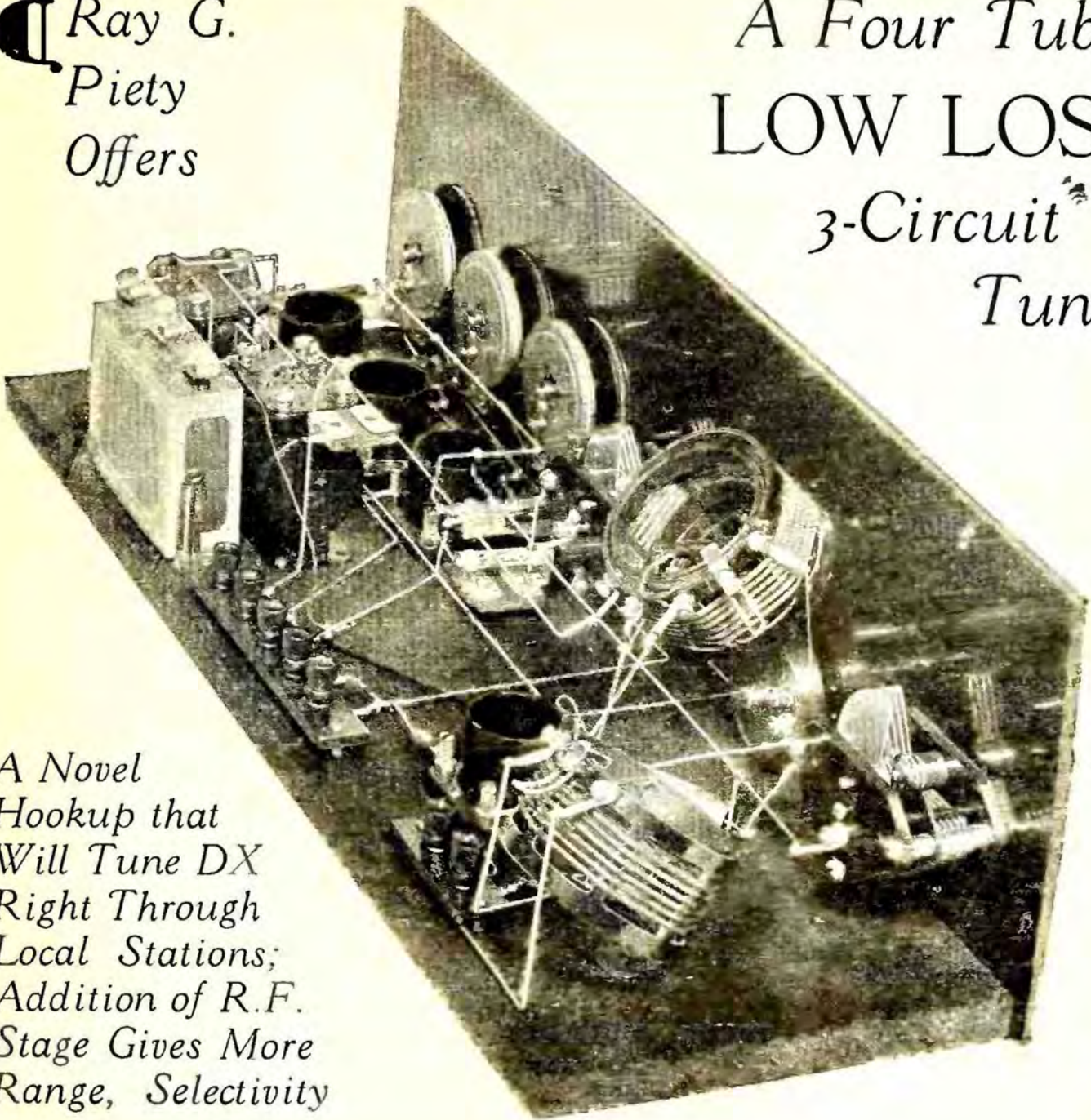
Electron emission from heated filament to cold positively charged plate.

(Turn to page 67)



**R**ay G.  
Piety  
Offers

# A Four Tube LOW LOSS 3-Circuit<sup>†</sup> Tuner



*A Novel  
Hookup that  
Will Tune DX  
Right Through  
Local Stations;  
Addition of R.F.  
Stage Gives More  
Range, Selectivity*

**W**ITH the steady increase in power of the broadcasting stations, the demand for an economical and sensitive receiver has become more and more urgent. At first the stations were of limited power and few and far between. Today our large cities usually have several stations operating at the same time.

The degree of selectivity, even though the apparatus is of the best design possible, is limited when operating under these conditions.—If a station is using sufficient power, it can spread itself over the dials of any set using only one or two tuned circuits. If the coupling is made weak enough to make the nearby stations sharper, the volume on the weaker and more distant stations falls

off to such an extent that reception is difficult and unsatisfactory.

The "trick" circuit has passed on and the three-circuit tickler feedback arrangement using low-loss apparatus is probably the most popular set today. It justly holds this position, for it has a high degree of sensitivity with good volume and selectivity. The popularity of low-loss three-circuit tuners satisfies the greatest numbers as possessing most of the qualities necessary to a good receiver. Unless the owner of such a receiver is particularly fortunate in his location, even the best apparatus will not enable him to cut out nearby stations. For him who cannot change his location, about the only thing that can be done is to change his circuit.

**A**MONG the better grade of low-loss tuners on the market the degree of selectivity is not very different. The fundamental regenerative may be used with the majority of such tuners; circuit shown on page 25. This circuit has a great many desirable characteristics and is as good as any, all things considered, for a one, two or three tube set.

### Only Two Controls

There are only two controls, one for regeneration and one for wavelength. The primary is untuned and may be adjustable, permitting a reasonable balance between volume and selectivity. Now, if we take an efficient detector and add to it a stage of radio in such a manner that its original characteristics



are retained, we should materially increase the most desirable properties of the set, without adding complicating and undesirable features. In adding this stage of radio frequency amplification, we will at one and the same time make the set more selective, more sensitive, and decrease the amount of objectionable radiation to a negligible quantity.

The circuit shown below is adapted to practically any type of tuner using the regular three circuit hook-up. It is shown on a panel 7"x24", although any reasonable layout may be used. It is best, however, to line up your set somewhat as illustrated, making sure that the air-core transformer T-1 is placed at right angles to the tuner T-2.

In wiring the set, all the wires were run direct, making considerable shorter leads than would be obtained if it were constructed in the conventional manner. Direct leads are always more desirable, although not so neat in appearance. The undesirable capacity feedback between leads is cut down by shortening them in this manner.

No jack was used by the writer in the detector circuit, as this is not generally of value to anyone of reasonable experience, as on very weak signals it is best to listen in on the first stage of audio. This eliminates the difficulty often experienced in a regenerative set of tuning in on the detector and have the signal disappear when placed on the loud speaker. The change in feedback in the detector circuit caused by changing from phones to loud speaker is generally eliminated by using a large

fixed condenser across the phones. However, this very often will cause the detector to oscillate too readily and thereby make tuning more difficult. The first stage of audio may also be used for loud speaker reception on local signals in cases where extreme volume is not necessary.

**Exact Settings Necessary**

THE regular type of low-loss condenser was not used, as the writer



A panel view of the three-circuit regenerative. There are three tuning controls, and three rheostats. Tuning is very selective, KGO, at 312 meters, being brought in while WSAI, at 309 meters, was going full blast. And there was no interference.

could not find any with the positive vernier action absolutely necessary in this circuit. It is doubtful whether the difference between good average condensers and the most efficient condensers possible would compensate for the loss of a good vernier action. Geared arrangements having back-lash are worse than none at all. The tuning is so sharp that exact dial settings are an absolute necessity to good reception. The inductance coils used require a 250 M. M. F. condenser at C1 and C2:—if any other type of apparatus than that shown is used, condensers of the proper size to cover the broadcast wave-band should be substituted.

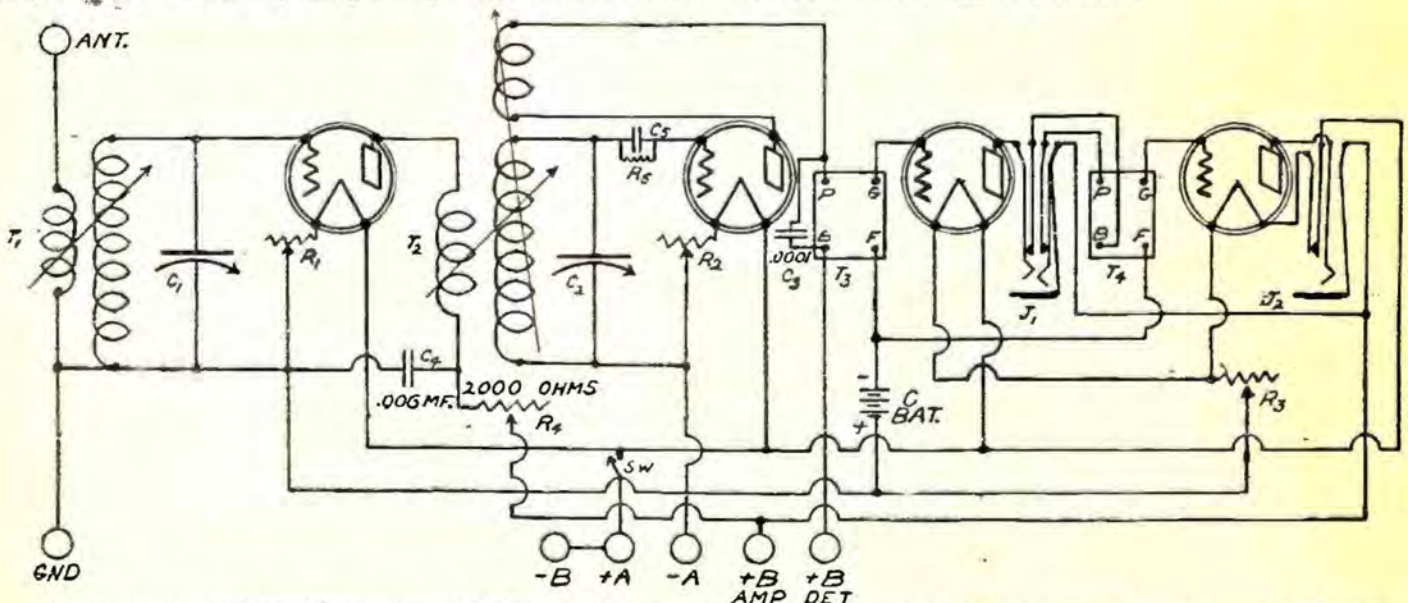
The 2,000 ohm resistance in series with the B-battery lead on the radio frequency amplifier is used to hold this tube below the point of oscillation. If this is omitted, it becomes necessary to turn the R. F. rheostat down on the

lower wavelengths. This is less efficient than inserting resistance in the plate circuit. The writer used a 2,000 ohm potentiometer, connecting one lead to the center and the other to one of the outside terminals; either terminal gives the same result.

After the set is wired, the results obtained will depend a great deal on the adjustment of the constants of the circuit. The use of an air-core transformer, with a variable primary, permits the set to be adjusted for varying receiving conditions, length of antenna, and proximity to the broadcasting stations. As the primary is raised the set becomes more and more selective, and at the same time the volume slowly drops off. By properly setting

this primary, the best balance between selectivity and volume may be obtained. The primary on the tuner will generally work best when used with fairly loose coupling to the secondary. This reduces the tendency of the radio frequency amplifier to oscillate and prevents the detector circuit from causing it to go into oscillation when the tickler coil brings the detector up to the point of maximum regeneration.

The 100 M. M. F. fixed condenser across the audio frequency transformer may be omitted in a great many cases, as the distributed capacity in the primary is often sufficient to permit the detector to oscillate. By trying various values from 1000 M. M. F. to 100 M. M. F., an adjustment may be obtained such that the tickler will cause the detector to oscillate when it is set at about fifty on the dial. This is about the right setting for easy control.



A regenerative receiver with one stage of R. F. amplification. One of the advantages is that the primary tuning can be adjusted to the signal strength received. The addition of a stage of R. F. amplification makes this set more selective, more sensitive and decreases annoying radiation to an unnoticeable degree.



If a U. V.-200 is used as a detector, a six ohm rheostat should be used at R2 and a 250 M. M. F. grid condenser with a two-megohm grid leak. If a U. V.-201-A is used a twenty-ohm rheostat should be used the same as at R1 and R3, with a three or four megohm grid leak.

The constructor should have absolutely no difficulty in building this set, as it is in no way critical. For maximum results only the best type of low-loss transformer and tuner may be used. The minor details have been left to the judgment of the constructor, as he can hardly go wrong if he employs neat and careful workmanship in the building of his set.

Separating KGO and WSAI

IN tests a set of this type has brought in distant stations with good volume and excellent tone quality. The selectivity is such that Stations KGO at 312 meters could be perfectly separated from WSAI at 309 meters with absolutely no interference between them. By raising the adjustable primary on T-1, the set can be made so sharp that tuning is almost impossible on weak signals.

The stations are always very easy to locate, as the detector may be made to oscillate and the stations found by the beat note or whistle, with which you are all familiar. A selective receiver often gives the novice difficulty in tuning, as the stations cover such a small portion of the dial that locating them is to him somewhat like trying to find the combination of a safe by turning the lock. When the stations are easy to find he complains that the set is too broad. When it is sharp he cannot tune them in. So there you are!

In the illustration of the set herewith, the adjustable primaries are set down close to the secondaries. This gives the broadest possible tuning and is the best position for tuning the set until the constructor is familiar with it. After learning to tune it this way, he should raise the primaries until the desired degree of selectivity is obtained. Another good characteristic of this set is that the stations may be found with the detector tube oscillating without causing any interference to your neighbors, as the first tube reduces the amount of radiation to a negligible quantity.

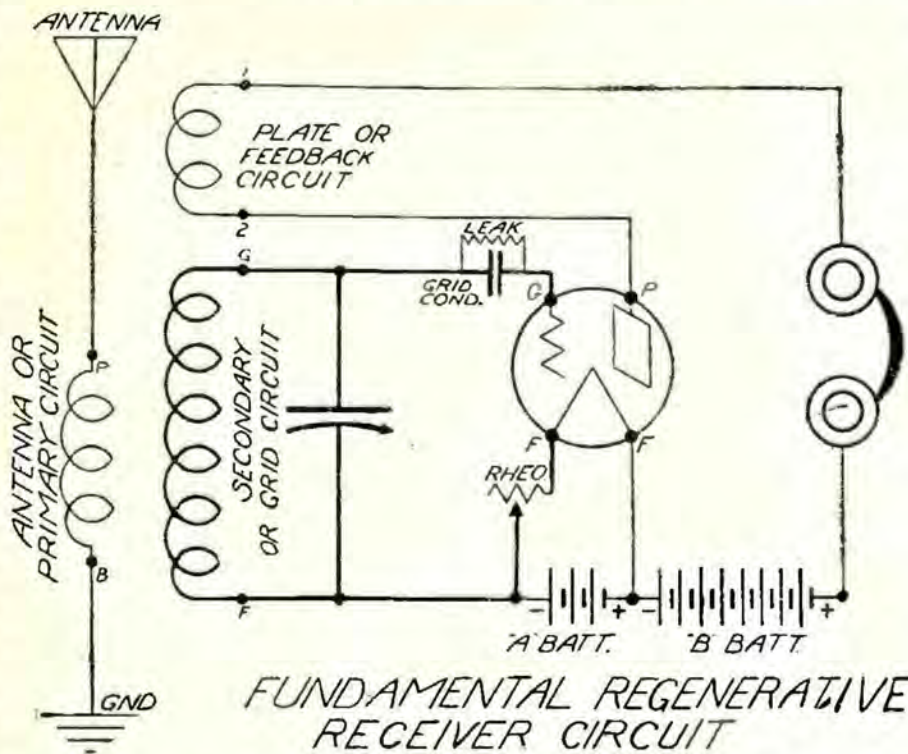
Stations will always come in at the same dial setting, providing the batteries

and filament rheostat of the detector remain the same. In tuning, the detector rheostat should be set at the best point and not disturbed by further adjustments.

For anyone wishing to increase the sensitivity and selectivity of his three tube set, or to construct a medium sized receiver, it is the opinion of the writer that he cannot go wrong if he follows a circuit of this type.

PARTS REQUIRED

- Y-1 Air core transformer (low-loss)
- T-2 Tuner (low-loss)
- C-1 and C-2 Vernier Condensers
- T-3 and T-4 Low Ratio Audio transformers (2-1 or 3-1)
- R-1 and R-3 20 Ohm Rheostats



Above is the fundamental regenerative receiver circuit of the hookup described in this article by Mr. Piety. On the opposite page is shown the same circuit with one stage of radio frequency amplification added to the original hookup.

- R-2 6 Ohm Rheostat (20 Ohm if a U. V. 201-A is used as a detector)
  - R-4 2,000 Ohm Potentiometer
  - R-5 1-2 Megohm Grid leak (3 or 4 if a 201-A is used as a detector)
  - C-3 .0001 Fixed Condenser
  - C-4 .006 Fixed Condenser
  - C-5 .00025 Fixed Condenser
  - J-1 4 Prong Jack
  - J-2 2 Prong Jack with Filament Control
  - 7 Marked binding posts
  - 1 4½ Volt C Battery
  - 1 Panel size 7"x24"
  - 1 Baseboard size 7"x23"
  - SW Filament Switch
- Screws, wire, solder, dials and other small accessories.

IF THE builder so desires, he may install a jack that will permit him to listen on the detector tube only, by purchasing another two circuit jack and hooking it into the circuit just before the first audio frequency transformer.

To do this the top prong is soldered on to the connection that comes from the rotor of the "low loss tuner," the second prong is connected to the plate side of the audio frequency transformer, the third prong to "B" positive side of the audio frequency transformer, and the bottom prong to the "B" battery, positive 22 and one-half volts.

The fixed condenser across the primary of the first audio frequency transformer is connected across the top and bottom prongs of the jack.

It sometimes is advisable in a circuit of this type to substitute a variable grid leak for one of the fixed type. The selection of this article will be left to the desire of the builder, but he is cautioned against mounting it in such a position

that the lead to the tube socket will be exceptionally long. There are at the present time several variable grid leaks on the market with long bakelite (or other insulating material) shafts that permit the resistance itself to be mounted directly to the tube socket, but by means of a small knob the adjustment is controlled from the panel. If you have one that is not of the type mentioned, it would be best to sacrifice the convenience of adjustment and mount it inside the cabinet, right on the socket itself.

The builder is reminded that it is not advisable to omit the potentiometer when building the set. Many fans argue that the inserting of a potentiometer is adding

another control that is very seldom used and does not increase selectivity to any great extent. This might be so in some circuits, but it is of very great importance in this particular one, and to get maximum results it should be included.

In closing I might suggest that the builder remember that this is a very selective receiver. And as such he might have a little bit of trouble regarding the reception of really distant stations, until he has properly learned to handle the set.

If he will but remember to set the primary coil close to the secondary until he has become quite proficient in handling the circuit, then he will be sure to get the results for which we all so eagerly try.

With the coil in this position, the tuning will be quite broad, of course, but then as he becomes more and more experienced he can gradually increase the separation between the primary and the secondary.



# Discussing the Pro and Con of Regeneration for The Fan



A view of the panel of Mr. Eitel's "DX regenerator."

THREE radio systems—regeneration, radio frequency and the superheterodyne—are now competing for supremacy.

In this article, the concluding one of the "Beginners' Series" which began in the October RADIO AGE, we will discuss regeneration *pro* and *con*, and will give an example of regeneration at its best so the beginner who has reached the multi-tube stage may decide whether he shall choose that type of reception.

If you have followed this series, from the crystal hookup to the one-tube set, you are now ready for the next step—three tubes or more. For those who are still uninitiated into the first principles of radio, the writer refers them to the comprehensive, explanatory articles which began in October and progressed by easy stages to the present status.

### Regeneration

BRIEFLY, the "pro" of regeneration is this. Why use five to eight tubes to do the work of three? The answer is—to get greater selectivity; to avoid radiation and to secure greater amplification.

A single circuit regenerative set, like the ultra-audion, becomes a broadcasting device whenever the feedback is increased until the set whistles. That whistle has been picked up by receivers within ten miles.

Regenerative sets were "convicted" of being a nuisance and aroused intense public indignation when they seriously impaired results during International Radio Week, late in 1924. The squeals and howls they sent forth made it impossible for many to hear Europe at all. Many who tuned in the foreign stations were unable to distinguish the messages because of radiating sets.

Many inventors, including Carl Pfantstiel, have conducted laboratory experiments in radia-

tion. A low loss, three-circuit tuner for regenerative sets has been designed that practically eliminates howling. This is accomplished by the use of an aperiodic primary or untuned antenna circuit leading to the ground. This circuit "accumulates" all signals on the air. A secondary coil for the grid circuit is tuned for the wavelength desired and inductively selects the signal wanted.

The plate circuit makes use of a tickler coil—for inductive feed-back or regeneration. Therefore, you have in this three circuit device a non-radiating, selective tuner. How about more amplification? If you are content to use your outdoor aerial, you can have coast-to-coast reception with this tuner.

LOW loss is a feature of the accompanying set described in this article. It is a well known fact that of all types of inductance, the stagger wound coil is efficient.

The two coils shown in this set are lumped inductances. They can be coupled to within a thousandth of an inch and the coupling can be varied at will by means of a nut.

### Strictly Low Loss

Another feature of this hookup is that the magnetic fields are flat and compact, thereby preventing inter-circuit interference, which would produce howls and distortion. An added advantage lies in the mechanism for varying the relation for secondary and primary coils. This

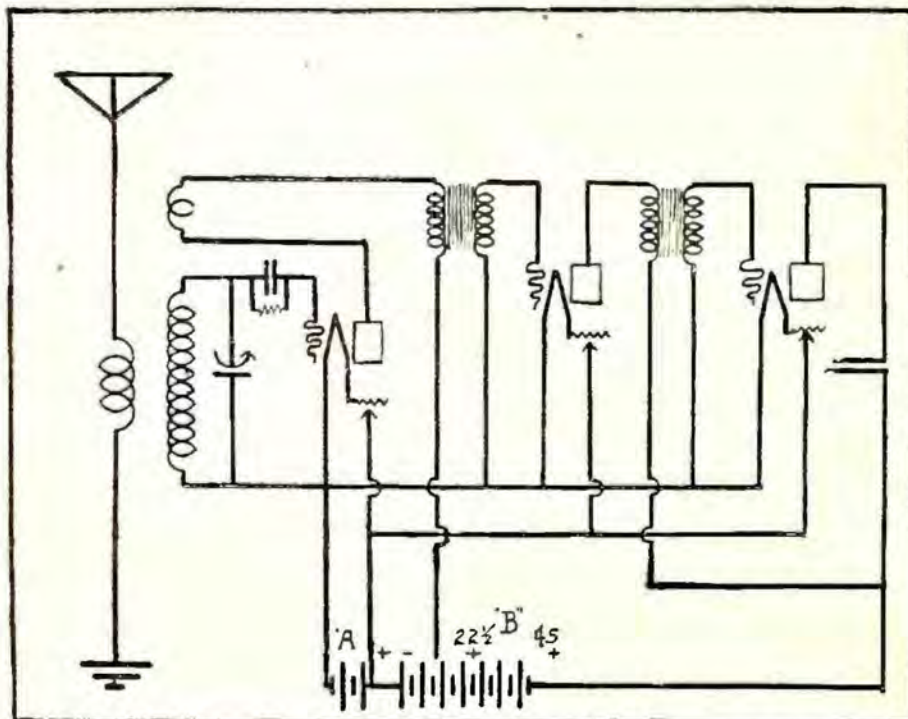
is a vernier arrangement that passes the coil back and forth behind the secondary with gearing that permits the finest adjustment.

These low loss receivers have been tested all over the country, including special experiments in Canada last Summer. This receiver is an all-around distance getter and in this it differs from some sets, which, because they are not thoroughly low loss receivers, sustain a special handicap during Summer due to static conditions.

Not only will this set get the distance, but it will tune through locals with ease. In Chicago, while the powerful stations are pounding the air, it has cut through to distant stations at will.

# Up The Ladder with A REAL LOW LOSS REGENERATOR

### HERE'S THE HOOKUP



Here's the hookup. There's not a lot to it, but the builder tuned through powerful Chicago stations to get California and other distant stations. And on some faraway stations, loud speaker volume was secured on one tube! Try it and be convinced.





A rear panel view of the set, showing simple layout.

# Why Use a Five or Eight Tube Set When 3 Will Do?

## the Radio Beginner

FOR DX RECORDS, BY E. H. EITEL

KGO, at Oakland, Calif., was heard on three consecutive nights on one tube with the head-set. Hastings, Nebr., Kansas City, Elgin and Zion were heard on silent night on a loud speaker with one tube, with sufficient volume to be heard plainly over a single room.

This set also logs all stations within a fraction of a degree. It is the ideal regenerative receiver for the beginner.

### Some Real Results

HERE is a list of stations, in the order given, that were received in Chicago while strong locals were booming:  
(With the dial readings.)

- WCK,
- St. Louis, 21;
- WTAS,
- Elgin, Ill., 26;
- KFI,
- Los Angeles, 60;
- WEBH,
- Chicago, 41;
- WBZ,
- Springfield, 37;
- WQJ,
- Chicago, 57 1/2;
- KYW,
- Chicago, 75;
- WDAF,
- Kansas City, 49 1/2;
- KGW,
- Portland, Ore., 65.

In addition to these stations, in between WDAF and KGW, 10 w power stations at Tallahoo, Texas, New Orleans, Fort Smith, Ark., Monroe, La., Madison, Kans., Bedford, Ind., Peoria, Ill., and Tulsa, Okla., were also brought in on the loud speaker.

On one occasion this receiver was supposed to be operating on a long, outside

aerial. This antenna system consisted of a special, four-cage, seven-stranded enameled wire aerial, 100 feet long, with a similar cage lead-in of thirty-five feet. The aerial naturally was a broad-tuning one. This meant that the receiver, to give good results, must naturally be a sharp-tuning set.

With a combination of this type—long aerial and sharp tuning—greater distance and greater volume without sacrifice of selectivity can be obtained.

Now, the queer thing about this occasion was that while the operator thought he was using this long outside aerial, as a matter of fact he had con-

nected the set to a second aerial which was an inside one and only fifty feet in length. It was fully half an hour before the discovery was made that the short, inside aerial was in use. Already he had brought in the St. Louis, Los Angeles and Springfield stations on the loud-speaker.

The set will be easy to construct through referring to the diagram and pictures accompanying this article. Following are the parts needed:

1. One three-circuit, low loss tuner.
2. One single hole mounting rheostat. If you use UV 200 or C300 detector tube, make this a vernier rheostat.
3. One .00035 variable condenser, low loss type.
4. One fixed condenser, .00025 mfd, combined with grid leak of a resistance in accord with tube used (See table for tubes with this article). For simplicity, UV201A or C301A tubes are recommended throughout; variable grid leak, 0 to 5 megohms, may be used.
5. One shock-proof socket.
6. Audio transformers.

7. UV201A or C301A tubes with socket for same.
8. One panel, (6"x18", or 8" by 15".)
9. Jacks, binding posts, etc.
10. Single Circuit Jack.

To construct the set, mount the parts on the panel in the arrangement as shown in the accompanying photographs, and hook up with flexible copper wire, making connections direct from terminal to terminal, which is the only true low-loss method. Be sure, of course, to solder all connections firmly.

Adding amplification is a comparatively simple matter. The most essential feature is to use low ratio transformers if you wish good music. The pictorial and (Turn to page 77)

## VACUUM TUBE DATA

Make	Type	FILAMENT			PLATE			Amplification Factor	Mutual Conductance
		Voltage	Current	Battery	Voltage	Milli-amperes Current	Impedance		
Cunningham	C300	5.0	1.00	Six Volt Storage	15-24	25 1 00	9000	6.5	465
Cunningham	C301	5.0	1.00	Six Volt Storage	45-101	1.00 5 00	14000-24000	8.0	485
Cunningham	C301A	5.0	0.25	Storage or Dry	40-124	1.0-7.5	12000-16500	6.25	340
Cunningham	C299	3.0	0.06	Three Dry Cell	40-80	0.25-4.00	16000-18500	6.5	340
Cunningham	C12	1.1	0.25	One Dry Cell	20-90	0.25-4.00	17000-19000	6.5	340
DeForest	DV1	3.0	0.06	Three Dry Cell	20-80	0.25-4.00	20000	5.0	350
DeForest	DV2	5.0	0.25	Storage or Dry	40-130	.....	9000	6.5	650-800
DeForest	DV6A	4.0	0.25	Storage or Dry	20-100	.....	20000	5.5	450
Moorhead A. P.	.....	4.0-5.0	0.6-0.7	Six Volt Storage	30-100	1.00-5.00	15000	.....	.....
Mullard	.....	4.0-6.0	.....	Six Volt Storage	.....	.....	.....	.....	.....
Myers	RAC3	4.0	0.8	Six Volt Storage	20-300	.....	30000	25.0	.....
Myers	.....	2.5	0.25	Two Dry Cells	20-150	.....	.....	.....	.....
Radiotron	UV 200	5.0	1.00	Six Volt Storage	15-24	0.25-1.00	9000	.....	.....
Radiotron	UV 201	5.0	1.00	Six Volt Storage	45-100	1.00-5.00	14000-24000	6.5	465
Radiotron	UV 201A	5.0	0.25	Storage or Dry	40-120	1.00-7.50	12000-16500	8	485
Radiotron	CV 199	3.0	0.06	Three Dry Cell	40-80	0.25-4.00	16000-18500	6.25	340
Radiotron	WD12	1.1	0.25	One Dry Cell	20-90	0.25-4.00	17000-19000	6.5	340
Radiotron	WD11	1.1	0.25	One Dry Cell	20-90	0.25-4.00	17000-19000	6.5	340
Western Electric	215A	1.1	0.25	One Dry Cell	40-60	0.50-1.50	25000	6.5	260
Western Electric	203B	2.5	1.10	Storage	20-45	0.50-2.00	10000-20000	6.5	650
Western Electric	VT1	2.5	1.10	Storage	20-45	0.50-2.00	10000-20000	6.5	650
Western Electric	J	2.5	1.10	Storage	20-45	0.50-2.00	10000-20000	6.5	650
Western Electric	216A	6.0	1.00	Six Volt Storage	120	7-9	5000-6000	6.0	1000

Make	Type	DETECTOR			AMPLIFIER			Base
		Rating	Grid Condenser	Grid Leak	Audio	Radio	"C" Battery	
Cunningham	C300	Excellent	.00025-.0005	0.25-2.50	Fair	Poor	.....	Standard
Cunningham	C301	Fair	.0005	3-5	Very Good	Good	1.5-4.5	Standard
Cunningham	C301A	Good	.00025	2-6	Excellent	Fair	1.0-6.0	Standard
Cunningham	C299	Good	.00025	2-6	Fair	Good	1.0-4.5	Special
Cunningham	C12	Very Good	.00025	2-3	Good	Good	1.5-4.5	Standard
DeForest	DV1	Fair	.00025	2-3	Fair	Fair	.....	Standard
DeForest	DV2	Fair	.00025	.....	Very Good	Fair	.....	Standard
DeForest	DV6A	Fair	.00025	.....	Good	Good	.....	Standard
Moorhead A. P.	.....	Very Good	.00025	2.0-4.0	Good	Good	.....	Standard
Mullard	.....	Good	.00025	.....	Good	Very Good	.....	Special
Myers	RAC3	Good	.00025	1-3	Good	Good	.....	Special
Myers	.....	Good	.00025	1-5	Good	Good	.....	Special
Radiotron	UV200	Excellent	.00025-.0005	0.25-2.5	Fair	Poor	.....	Standard
Radiotron	UV 201	Fair	.0005	2-5	Very Good	Good	1.5-4.5	Standard
Radiotron	UV 201A	Good	.00025	2-6	Excellent	Fair	1.0-6.0	Standard
Radiotron	UV 199	Good	.00025	2-6	Fair	Good	1.0-4.5	Special
Radiotron	WD12	Excellent	.00025	2-3	Good	Good	1.5-4.5	Standard
Radiotron	WD11	Excellent	.00025	2-3	Good	Good	1.5-4.5	Special
Western Electric	215A	Good	.00025	2-5	Fair	Fair	1.0	Special
Western Electric	203B	Excellent	.00025-.0005	0.5-3.0	Good	Fair	1.5	Standard
Western Electric	VT1	Excellent	.00025-.0005	0.5-3.0	Good	Fair	1.5	Standard
Western Electric	J	Excellent	.00025-.0005	0.5-3.0	Good	Fair	1.5	Standard
Western Electric	216A	Fair	.00025	1-5	Excellent	Good	9	Standard



# Converting the SINGLE Circuit

By C. HAROLD DILLON

## How the Single Circuit May be Changed to An Efficient Reflex Set



Fig. 1. A front view of the "converter." The dial is used for varying the capacity of the condenser, permitting the reception of the lower and higher wavelengths.

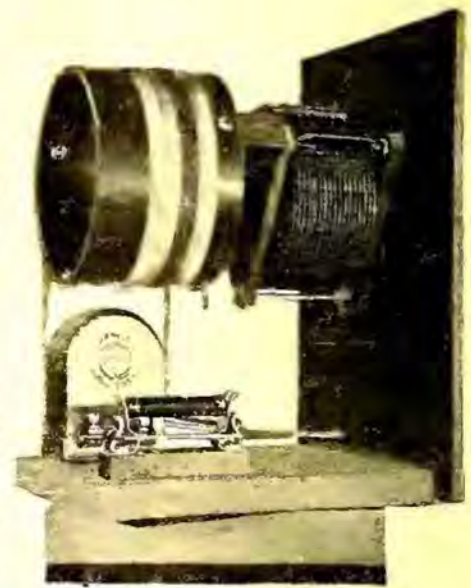


Fig. 2. A side-view of the single-circuit converter, showing the R. F. transformer, the condenser, the A. F. transformer and the crystal detector.

**D**URING the past year much has been said condemning the single circuit regenerative receiver. In fact, it seems as though everyone has deserted this old time favorite, which in a short space of time has fallen into almost complete disuse.

Such is the way of the world. Looked upon at one time as one of the greatest wonders of modern science, the single circuit regenerator is today cast into the scrap heap of the despised and detested things of this earth. Regardless of the faults of the single circuit tuner, and the sincere desire to remedy them, the propaganda against them has been more of a destructive nature. Very few persons have attempted to devise methods of curbing its one fault, that of radiation. But there are many of us who invested our entire radio pocket-book in single circuit receivers and who must necessarily pause and consider before scrapping the old "stand-by" and purchasing the newer types.

### To Eliminate Radiation

**F**ROM time to time various schemes have been forwarded that would permit the operation of these sets and at the same time eliminate the undesirable radiation. These schemes have been mostly in the form of radio frequency amplifier units, to be added before the detector tube of the

single circuit set. Considering these devices from an economic standpoint, they have proven to be very undesirable.

In the search for something that would give really good results, it was found that by making use of the reflex principle, the single circuit receiver could be modified to quite an advantage. Indeed, I think I can be safe in saying that in making this change you will find it to be a genuine improvement.

To secure the satisfactory results obtained from a reflex circuit, it is not necessary to throw away your present single circuit set. By simply changing a few connections on the receiver and installing a few new pieces of apparatus, your once despised "single" becomes an ultra-modern set that will prove a revelation as far as signal quality and strength are concerned. Figures 1 and 2 will enable you to get a detailed photographic view of the apparatus required, and you will see upon closer inspection that the wiring is not at all difficult. I might state here that this unit can be used on any single circuit receiver regardless of the slight mechanical changes the circuit may employ. The parts necessary to reflex a single circuit tuner can usually be found in the experimenter's laboratory or can be purchased from any first class radio shop for a nominal sum.

Below is a bill of the materials required.

### The Bill of Materials.

- One crystal detector, fixed.....\$1.00
- One audio transformer..... 4.00

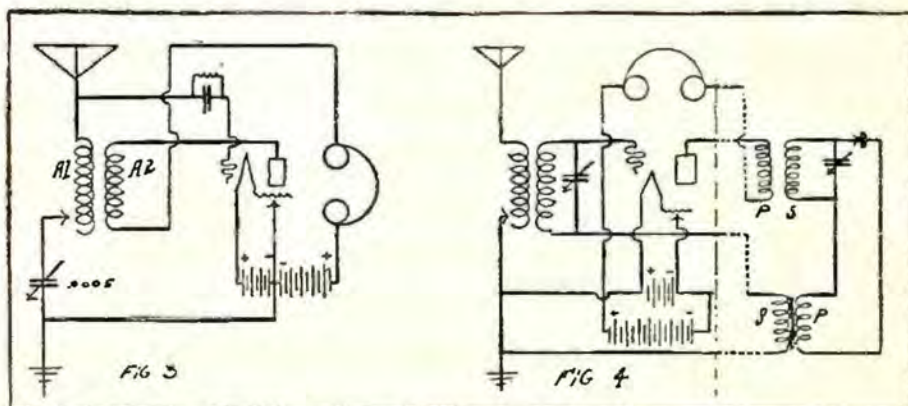
One variable condenser cap., .0025.....	3.00
One piece cardboard tubing.....	.20
1-6 pound No. 22 DCC wire.....	.30
One panel, about 6"x6".....	.40
Dial.....	.60
Incidentals.....	.50
<b>Total.....</b>	<b>\$10.00</b>

### Is Your Set Like These?

**F**OR the sake of making this article as clear as possible, I will choose the type of single circuit tuner in most common use today. If you will compare your present set with figure 3, you will find that A1 and A2 are primary and secondary windings of your vario-coupler. In some sets that have been sold, you will find that a variometer has been substituted for the coupler. In that case, A1 is the stator and A2 the rotor. The condenser in the ground circuit is usually one having a capacity of .0005

M F (23 plate). Figure 4 is the completed wiring diagram of the rewired single circuit receiver, showing the added apparatus to the right, indicated by the dotted lines. You will notice that the only wires that have not been changed are the lead from the antenna and the filament.

Whether to mount the apparatus on a small panel or install it right in the set (Turn to page 64)



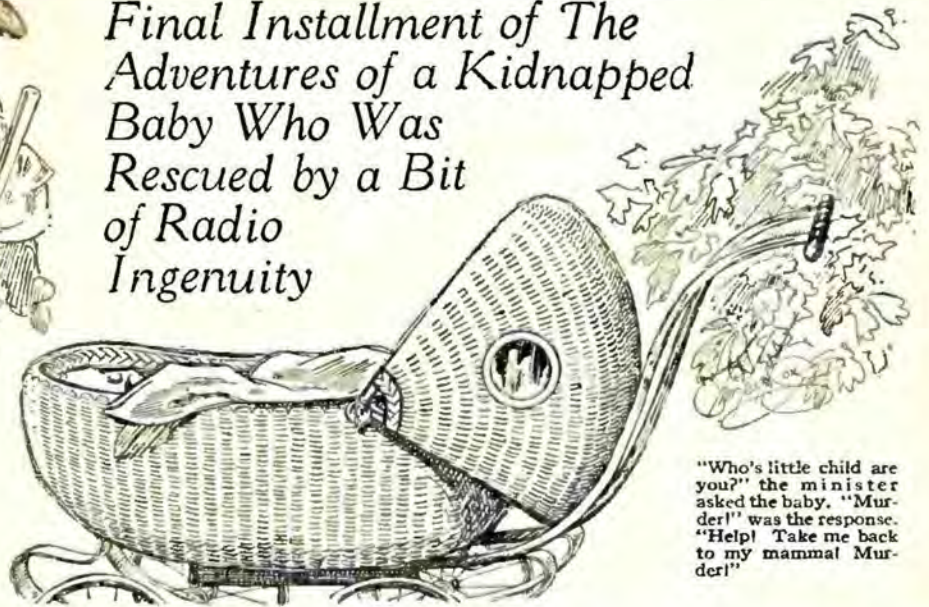
Figures 3 and 4. Fig. 3 is the single circuit receiver as most generally known, while Fig. 4 shows the same circuit converted into a single-tube reflex.



# The Hidden Voice

By FRANK HONEYWELL

Final Installment of The  
Adventures of a Kidnapped  
Baby Who Was  
Rescued by a Bit  
of Radio  
Ingenuity



"Who's little child are you?" the minister asked the baby. "Murder!" was the response. "Help! Take me back to my mamma! Murder!"

## Chapter II

### "The Baby's Stomach."

(Continued from January Radio Age)

"Drat the kid," muttered the woman. "Who ever heard of such a thing? How did he ever learn to talk like that? Talks like a man. I must get rid of him mighty quick, or I'll drop. Ah, there's the park. I'll get rid of him there."

A block further she pushed the carriage into one of the city's big parks, plentifully supplied with trees, bushes, duck ponds, golf links, and baseball diamond. Into some bushes near the ball grounds she pushed the carriage and there abandoned it with a great sigh of relief.

### What's Wrong Here?

A FEW moments later a ball struck by one of a group of boys hit the ground a few yards away and rolled into the bushes near the carriage. A fielder, chasing the ball, heard a cry of "Help, help, murder!" and raced back in affright. "Oh, kids," he yelled, with the pallor of fear on his face; "somebody's being killed in those bushes."

In a few moments all the other ball players were gathered around him, listening to his story. Some of them scoffed at it; others were disposed to take it seriously. At length they agreed to approach the bushes in a body and make an investigation.

They were almost at the edge of the thicket before they could distinguish a sound. Then a faint, "Help, help!" reached the ears of all.

"There's sure somethin' going on in there," one of the older boys vouched. "Now the question is, who's going to go in and rescue him?"

"Not I," declared one.

"Nor I," chimed another.

"Let's holler to the guy 'at's killin' him and tell him we'll come in and beat him up with clubs if he don't stop," proposed another ball-player scarce above a whisper. He held his club dangerously.

"I see something in there," announced a youth who had not spoken thus far. "It looks like a big basket. I can almost reach it with my hand. No, it's a baby

buggy. Here, Ted, take hold of my hand and give me a jerk back if I get in trouble. I'm goin' to see if I can't drag it out."

Ted seized his hand, and he reached into the bushes with the other, and presently, sure enough, out came a very respectable looking baby carriage, with a real live infant less than a year old in it, screaming in a half-choked voice, it seemed:

"Help! help! murder! I'm kidnapped. Police, police, arrest my kidnapper."

"Jimminy crickets!"

"Gosh all fishhooks!"

"Gee-mently!"

That's about all the flabbergasted boys could say as they gawked at the infant, who bit viciously at his zwieback and yelled in sepulchral tones:

"Help, help! Rescue me. Don't let them murder me."

"What's the matter, boys?"

It was Mr. Benson, pastor of a church nearby. He was taking a walk through the park and seeing the strangely-acting group of young ball players, he advanced to investigate.

"Matter!" exclaimed one of the youngsters. "Just listen here. Did you ever hear anything like that?"

"A baby not more 'n a year old, talkin' like a grown-up," put in another of the flabbergasted group.

"Let me see," proposed the minister, stepping beside the carriage. "What's the matter, baby?" he asked in a tone of sympathy that expects no answer. "Whose little child are you?"

"Murder!" came a responsive screech from the pillows and quilts. "Help, help! Take me back to mamma. Murder!"

"Astonishing!" exclaimed the minister, throwing up his hands. "Sounds like ventriloquism, as if the voice comes from its stomach. Remarkable, very remark-

able. This must be investigated. I'm going to wheel this carriage home and call up the police."

Followed by a score of ball players, who by this time had lost all interest in their game, the Rev. Mr. Benson pushed the carriage across the neatly mowed lawn toward his home. As he was crossing a driveway, a motorcycle policeman raced up and blocked further advance.

"Whose baby is that?" demanded the "cop," who did not know the minister.

"I don't know," the latter replied.

"I—"

"Help, help!" came a cry from the carriage. "I'm being kidnapped. Help, help! Police!"

### Stumping the Law

THE policeman nearly lost his grip on the motorcycle.

"What in blazes does this mean?" he demanded.

"Blessed if I know," answered Mr. Benson. "These boys just found this baby in the bushes over there, and I'm taking it home with me to see if I can't find out whom it belongs to."

"I think I know whose baby it is," said the officer. "We had a call that a baby was stolen from Mrs. Stansbury on Marcey Avenue. Come along with me, and we'll find out if it isn't hers."

The cries for help continued at short intervals all the way to the Kinney home. The policeman drove his motorcycle slowly, Mr. Benson pushed the carriage swiftly, and the youthful ball players trailed along behind, eager for a solution of the mystery. As they approached the house, out flew the hysterically joyful mother, who seized little Edward in her arms just in time to receive a string of "Help, help, murders" in her ears.

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# What the Broadcasters are Doing



## KOA on the Air at Denver, Col.

ANOTHER national radio voice, KOA, the Rocky Mountain broadcasting station of the General Electric company at Denver, Colo., is now on the air. The wavelength for the present will be 323 meters and the power rating 1,500 watts.

Opening of KOA marked the completion of the General Electric chain of three broadcasting stations across the United States, WGY at Schenectady, N. Y., and KGO at Oakland, Calif.

KOA, it was pointed out, is the half way point between the Mississippi and the Pacific and Canada and Mexico, and will be heard by millions from one end of the American continent to the other. Already hundreds of letters, telegrams and long distance telephone calls have been received at the station in response to initial programs.

A public reception at the station took place December 18, and was attended by a number of prominent state and city officials. Invitations were extended to numerous radio officials in the East and on the Pacific coast.

"From foundation to roof, this station has been designed and built for the sole purpose of radio broadcasting," declared Martin P. Rice, director of radio broadcasting of the General Electric organization, who supervised arrangements for the opening.

"It embodies all the technical and mechanical improvement suggested by the experience of our other broadcasting stations.

"While KOA will be operated at 1,500 watts, the equipment has additional capacity available for testing. As a result, tubes and rectifiers will not be subject to over-loads and transmission will be marked by greater reliability and excellence of quality. Additional power is afforded also, for experimental purposes.

"Use of broadcasting pick-up circuits will permit public events, addresses, concerts and the services of many churches to be placed on the air. The station is surrounded by a rich field of talent from which to select music, entertainment and educational features in addition to the KOA staff artists."

Cost of construction approximated \$175,000 and it was estimated the annual cost of maintenance will reach \$100,000. The KOA staff, when completely organized, will number twenty members, including a resident engineer in charge of technical operations, program manager, operators and announcers and mem-



Above is F. A. Hill, one of the experts on the engineering staff of KYW, Chicago, whose article on "The Outside Man," to be found at the column to the right, will prove interesting to the fans who often wonder what goes on behind the scenes when an event of importance is broadcast. Mr. Hill tells all about it.

bers of the news bureau and the office personnel.

KOA's antenna system, 120 feet long, is 150 feet above the ground and is supported by two triangular steel towers, 260 feet apart. Directly beneath is the two-story studio building in which is housed a large reception room, waiting room for artists, general offices and a concert studio and auxiliary or speakers' studio. In the rear and adjoining is a one-story power-house and generator room.

For the present, programs are broadcast three nights a week, the dates to be announced later, in addition to Sunday features. Harry D. Randall, Rocky Mountain district manager of the General Electric company, has local supervision of the station.



Gladys Frazin, of the "White Cargo" company in Chicago, established a radio reputation as an actress when the play, in which she is the star, was broadcast from KYW. Microphones were placed at advantageous points in the Cort Theater, Chicago, and the audience was told that the play was to be sent over the ether to untold thousands of listeners. Then the play began, and hundreds of listeners, after hearing the melodramatic moments, went to see "White Cargo" afterward. Experts reported the play was unusually suited to radio broadcasting.

## "Brunswick Hour" New Radio Feature

THE third National Relay program—the "Brunswick Hour of Music"—went on the ether on Tuesday, December 23rd, at 9:00 p. m. Central Standard Time.

This program is broadcast by WJZ, New York, picked up and re-broadcast by KYW, Chicago, KDKA, WGY, WRC, KFKX and KGO. The artists appearing on these programs are of world-wide fame and the purpose of the National Relay program is to give the radio public of the country an opportunity to listen in on a rare one hour's entertainment.

The first program, on Tuesday, Dec. 9th, included selections by the Cleveland Symphony Orchestra, under the direction of Nikolai Sokoloff, a musician of international reputation. Mme. Elly Ney, Miss Florence Easton, Mario Chamlee and others, who are leaders in the musical world, also appeared on the initial program.

On Tuesday evening, Dec. 16th, at 9 o'clock, the second national relay program was given. Among those who appeared on the program were Miss Margaret Young, Miss Marion Harris and Ray Miller and his orchestra.

The program for Tuesday, December 23rd, brought with it such celebrities as Miss Claire Dux, John Charles Thomas, Leopold Godosky, pianist, and the Elshuco Trio.

"The Brunswick Hour of Music" is a new departure in radio activity, in that several stations co-operate in its broadcasting. With the rapidly growing improvements in the re-broadcasting art, this promises to become a popular feature, the intention being to promote a greater appreciation of good music.

## "The Outside Man"

By F. A. Hill, (Engineering Staff, Westinghouse KYW)

PARADOXICAL as the above caption may sound, the outside man is on the inside of everything, at least as far as Westinghouse and radio broadcasting are concerned in Chicago. For the outside man is the one that does the physical and electrical work to make a success of the many pickup jobs which KYW has taken on its shoulders since its inception.

These outside jobs are first spotted by the publicity department and then turned over to operations for fulfillment. And that is where the work is crowned either with grief or success. It is one

(Turn to page 60)



# Radio's Effect on the Popular Song

By TED FIORITO



Ted Fiorito and Dan Russo, co-conductors of the Oriole Orchestra from Station WEBH. At the right is the entire orchestra, which has gained fame through broadcasting for the radio.



**T**ED FIORITO, the author of this article, is one of the best known and most accomplished pianists in America. He is one of the co-conductors of the famous Oriole Orchestra, which appears regularly over Radio Station WEBH, Chicago. He is the author of such famous songs as "No, No, Nora," "Charley, My Boy," "When Lights are Low," "Dreamer of Dreams," "Eli-a," and many others. Herewith he tells how radio, in his estimation, has affected the status of music in America.

**I** HAVE been asked whether I believe radio is a good vehicle for the promotion of popular songs, and being both a composer and a constant radio performer, I am placed in a rather peculiar position.

I have always considered the radio a happy invention that makes for more happiness in the home, and accordingly I have been most enthusiastic with regard to broadcasting songs through the air. Naturally, I also considered it a good medium for the popularization and advertising of songs, and so I felt that every time the Oriole Orchestra broadcast a number, it was to a certain extent helping the publisher of that number to achieve widespread publicity for his piece.

And everyone else, coming to the same conclusion, started a great campaign to popularize his own numbers.

## And Radio Fans "Took" It

**W**HAT was the result of this? The public was treated to an army of songs, some of which were good, some indifferent and some pretty poor—and you can easily see how the good selections could be lost in the shuffle, and that the radio loving public were given rather a hard dose to swallow.

Now suppose a number had come quite

in favor and was in great demand. Stations all over the country broadcast it continually in answer to the requests of the people, and radio "fans" heard it so often that the tune and words were soon learned, and there was no necessity to buy the sheet music or records. The result of this was that the publishers and writers who had gone to great pains and expense lost out and were not given the fruits of their labor. In fact, some songs that would have naturally achieved a million copy sale made just a little money for the interested parties because they were "broadcast to death."

These arguments might tend to make you believe that I am a firm opponent of radio, especially with regard to its influence on the popular song; but still a consideration of other points that I will bring to your attention helps combat the foregoing arguments.

There are a number of people who never appreciated popular songs and would never have enjoyed this particular kind of pleasure were it not for the radio. Constant listening in has trained them to the value of ballad, fox trot, and waltz pieces as an important part of our life today, for they certainly are factors that help to dispel gloom and bring happiness by creating a train of thought that has no room for trouble.

## Radio Helps Many

**T**AKING the financial view of the matter, there are numbers which are really excellent ones and which would never enjoy success were it not for the impetus given them by the radio.

My conclusion, therefore, is a sort of fifty-fifty proposition.

Radio is a good medium for acquainting the public with popular songs, provided the station directors specialize on the good ones as a general rule.

But radio, on the whole, has a bad

financial effect on the publishers and writers who do not receive all that is coming to them. Legislation will probably soon remedy this evil, however, and give these individuals their just profits.

## Some Xmas Greetings

**A** NOVEL plan that other leaders of orchestras broadcasting melodies through the air can do well to emulate was inaugurated by the Oriole Orchestra over WEBH Christmas Eve. Realizing that thousands of "listeners-in" who heard their tunes nightly have often had a desire to become acquainted with the personnel of the station and the orchestra, they did their bit by personally broadcasting Christmas greetings for the orchestra, and by giving the people a brief talk regarding the work they do and what they have accomplished.

Radio "fans" all over the country were informed of this event and "tuned in" at the stipulated time when Russo and Fiorito gave their talk. As a prelude, a series of popular numbers written by members of the orchestra was given, and this included "Toot, Toot, Tootsie," by Russo, "Dreamy Melody," by Naset, and "No, No, Nora," "Charley My Boy," and "Dreamer of Dreams," by Fiorito. The composers themselves "soloed" the songs, so those fortunate enough to be listening in were given a treat indeed.

Not only do these famous syncopaters broadcast popular songs in a manner most inspiring to dance lovers, but they are proficient in concert numbers as well, and constantly regale the public with classical treats.

No other orchestra has done so much to raise the standard of musicianship in dance aggregations as has this group.

WEBH is located on the Edgewater Beach Hotel.



# Still Laughing In His Dreams

**Jack Nelson, a Pioneer Radio Star, Spurs Ahead in Our Contest**

By Harry Aldyne

**Unique Shield is To Be Awarded the Final Winner Very Soon**

**T**O Jack Nelson, Director of Station WJJD, goes the credit for having received the greatest number of Popularity Ballots during the period from November 16 to December 15.

Jack Nelson is a real Chicago product, having been born, raised and educated there. At the age of seven his mother was able to keep him at the piano for part of an hour each day in spite of the, "Yoo Hoo, Skinnay's," which penetrated the quiet of the parlor. The lure of the baseball, bicycle and the skates was much greater than that of the ivories, but in some way or other he managed to continue his study of classical music.

His father died when he was ten years old and later, when in high school, Jack began to forsake the realms of classical music, as the playing of dance music began to be of assistance financially.

While a junior at Lane Tech High School, he composed the words and music for "Go, Lane, Go" which is the official song of that High School and is still sung with great enthusiasm by the 3,500 boys there. He was awarded a scholarship at Northwestern University for excellence in studies at Lane and surprised the Campus when, as a freshman, most of the songs for the annual Musical Comedy were written by him.

Before he left the University, Jack had written or collaborated upon four annual musical shows given by the Men's Dramatic Organization, Hermit and Crow, one of which was so popular it is being reproduced this year. In his Senior year at Northwestern University, he was awarded a diamond and platinum Sigma Nu badge for writing the official national song of that fraternity, "The White Star of Sigma Nu." In his Senior year, also, he was Director of the Glee Club which was sent by the United States Government to entertain the residents of the Canal Zone, being royally entertained by officials of the Haitian Government, the Panama Government and the Americans in Panama.

**On The Upward Climb**

**A**FTER he left College, Jack was a salesman for a jewelry house and later



(Photo by Drake Studio)

Jack Nelson has been photographed just as much, if not more than any other star in the radio business. He likes the picture above best. Of course, he doesn't try to appear so serious when he's singing a new ditty at Mooseheart, Ill., where WJJD is located.

for the Bissell Weisert Piano Company of which J. Elliott Jenkins was a member. Upon hearing Jack play, Jenkins, who was one of the owners of WDAP on the Drake Hotel, invited him up to play and sing and the requests that flowed in following that first appearance predicted great things for him in a radio way.

At that time Ralph Shugart, better known as "The Sheik of the Drake," was the operator and announcer and a very popular one at that. The Radio fans wondered at that time about the sudden disappearance of the "Sheik" and Jack tells us that this is the first time any explanation has appeared in print. We do this knowing that it is now become a great joke between the team of Nelson and Shugart, and there is many a laugh over it. It seems that Thorne Donnelly, the other owner of the station, was very

anxious for some word to come that the station had been heard over-seas. As a joke, Ralph fixed up a cablegram, stating that WDAP had been heard at such and such a time by the operator at Burndept, London. Immediately upon receipt of it Donnelly communicated with all the newspapers and a good story was started before Ralph had a chance to tell him it was a joke. Donnelly could not see the joke, however, and Jack Nelson was put on the pay-roll as Announcer. It was not long, however, before Ralph was back in the fold, later becoming Chief Operator and Engineer of WGN, which position he resigned to become engineer of WJJD, to retain the fanciful double-play combination, Nelson to Shugart to the World.

While at the Drake, Jack Nelson became more and more popular for his announcing, his playing and his singing and several popular songs added to his fame. "Foolish Child," "I've Got A Song For Sale," "After The Storm," "You're Too Sweet For A Dream," and "May You Laugh In Your Dreams," are the better known of his compositions.

Jack Nelson's own story of Mooseheart appeared in a recent issue of RADIO AGE and he assures us that by the time this story is in print he will be presenting programs from the Garod Studio in the Palmer House, Chicago, every night, beginning at 10:00 o'clock, so that radio fans will again hear him as he signs off every night, singing in his own way, his own song, "May You Laugh In Your Dreams!"

**THE WINNER FOR DECEMBER**

Jack Nelson.....	Announcer.....	WJJD, Mooseheart
<b>WINNERS OF PRECEDING MONTHS</b>		
July.....	Duncan Sisters	
August.....	Bill Hay	
September.....	Karl Bonawitz	
October.....	H. W. Arlin	
November.....	Bert Davis	

**STANDING TO DECEMBER 15th**

Name	Classification	Where Heard
Karl Bonawitz.....	Organist.....	WIP, Philadelphia
H. W. Arlin.....	Announcer.....	KDKA, Pittsburgh
Bill Hay.....	Announcer.....	KFKX, Hastings
Bert Davis.....	Entertainer.....	WQJ, Chicago
Jack Nelson.....	Announcer.....	WJJD, Mooseheart
Duncan Sisters.....	Entertainers.....	KYW, Chicago
Lambdin Kay.....	Announcer.....	WSB, Atlanta
J. Remington Welsch.....	Organist.....	KYW, Chicago
John S. Dagget.....	Announcer.....	KHJ, Los Angeles
E. L. Tyson.....	Announcer.....	WWJ, Detroit
Ford & Glenn.....	Entertainers.....	WLS, Chicago
Harry M. Snodgrass.....	Entertainer.....	WOS, Jefferson City
Fred Smith.....	Announcer.....	WLW, Cincinnati
Jerry Sullivan.....	Announcer.....	
Nick B. Harris.....	Entertainer.....	WQJ, Chicago
Art Linick.....	Entertainer.....	KFI, Los Angeles
Hired Hand.....	Announcer.....	KYW, Chicago
Edw. H. Smith.....	Announcer.....	WBAP, Fort Worth
	Director.....	
	Player.....	WGY, Schenectady
Wendell Hall.....	Entertainer.....	WDAF, Kansas City

**Others Gaining Too**

**I**T will be noted from the above that in addition to Jack Nelson, substantial gains were made by Nick B. Harris and Art Linick. Remember, it is not necessary to (Turn to page 73)

**POPULARITY CONTEST COUPON**

Harry Aldyne, Contest Editor,  
RADIO AGE, 500 N. Dearborn St., Chicago.

I wish to cast my vote for:

Name of favorite.....

Classification.....

Station..... Date Heard.....

Name [optional].....

Address [optional].....



# MEET our "RADIO MOTHER"

By NENA WILSON BADENOCH

*From Coast to Coast, America's Housewives—and Hubbies too, Look to This Amiable Home Expert for the Latest in the Culinary Art*



*The "radio mother" herself, Anna J. Peterson*

**G**OOD morning, girls and boys." A half a million listeners look forward to that cheery phrase at 11:35 a. m., every day from KYW, Chicago. It comes from Anna J. Peterson, broadcasting menus and recipes for the day from the Home Service Department of The Peoples Gas Light & Coke Co.

Seated in her private office before the microphone, Mrs. Peterson is within sight and sound of her Home Service efficiency kitchen where every recipe she gives is tested and tasted. As she talks about the fragrant odor of the cooking food it seems as if you could almost smell it. When she says "delicious" in that effective way of hers, your mouth fairly waters. Thousands of her radio pals have told her so.

"Why say 'good morning, boys'? I know thousands of girls are listening but I doubt the boys," a listener-in said. But Mrs. Peterson knows from the hundreds of letters received from older men who no longer go to business, from crippled men who have turned housekeepers while their wives have become

wage earners—from young fellows convalescing, that she has many "boys" jotting down the menus and recipes for family use. In her big-hearted, motherly way, she feels they are a very important part of her radio family.

Many a young man brings his bride-to-be to meet Mrs. Peterson.

"How did you happen to come?" she asks them after she has taken them around her wonderful department and shown them her spacious auditorium where daily cooking classes are held.

"I have noticed the improvement in Mother's cooking since she has been listening every day over the radio," is the invariable reply.

"Ma said she would live to be a hundred if she had had this service when she was young," one young fellow said, and so I brought Mary in to get started right."

### All the Way from Maine

**A** PASTOR from Portland, Maine, while passing through Chicago, made a point of coming in to meet Mrs. Peterson. "I would know your voice anywhere," he said after the first greeting,

"for I have heard you almost every morning for a year. My wife and I feel so grateful for the good things you have brought to our table and for the money you have saved us, that I promised before I left home that I would come in and tell you so."

So generally had this feeling been expressed that Mrs. Peterson decided to give a radio tea. She broadcast her invitation and was overwhelmed with pleasure at the response which she received. Six thousand men, women and children filled the large auditorium adjoining rooms of the Gas Company, so that late-comers had to be turned away.

*(Turn to page 56)*



*Miss Grace Haight, one of Mrs. Peterson's radio assistants, preparing for a demonstration of "Canning of Fruits and Vegetables." Everything is tested before being broadcast.*





Drake Photo

A new photo of Rosemary Hughes, winsome soprano who keeps the telegrams flowing regularly into Station WGN, Chicago.

## "Listening In" from Coast to Coast

Let's  
Take a  
Turn  
of the  
Dials and  
See  
What's on  
the Air  
Tonight  
at Your  
Favorite  
Station

going full blast from KDKA, East Pittsburgh. This orchestra is a pleasure at dinner hour. The only trouble is, we have to wait too long between announcements of numbers. We must pass on, even at the expense of hearing KDKA's superb music.

Remember a while back we said WBZ was probably broadcasting good Eastern symphony from Boston? We weren't far wrong. This station is coming in strong, with a fine male quartette singing old-time love melodies. By the way requests are coming in, the Easterners like the old favorites. Can't other stations take the hint?

We must hurry. Here's WGN, with its unparalleled dinner music by the Drake Hotel Concert Ensemble and the Blackstone Hotel String Quintet, Chicago. Perhaps the best string

**L**ET'S SEE. It's Tuesday night. A good night for Radio. Ready for a spin over the dials? All right, folks; let's see who's on the air.

Here's the Boston Symphony Orchestra from WEAN, broadcasting from Boston through Providence. Fine, uplifting programs may always be heard from this station. The cream of the Eastern music world filters from Boston through WEAN. But wait, WBZ, at Springfield, is probably getting in on Boston's orchestrations. Remember them farther up your dial.

What's that? WMAK—Lockport, N. Y. Talk about jazz! This station is running a close second to—

WTAS—at 286 meters, only a couple of points up from WMAK. A jazz orchestra—a jazz singer—any time of the evening. Can't you see the syncopation fairly dripping from WTAS' aerial? But that gets tiresome. Let's go up the scale, fans.

Here's 309 meters—and a fine station. It's WSAI, of the U. S. Playing Card Co., at Cincinnati. That announcer, E. S. Mittendorf, is distinctive. We can hear every word he says. And if he isn't announcing the Duncan Sisters! They seem to be having a rollicking time in the studio. Lots of fun, but we must pass on . . .

Here we are at 319. The Hotel Statler Orchestra from WGR, Buffalo, announced in clear, crisp tones. Followed by an educational talk. Good stuff—that mixing the music and the serious. Interesting data on the growth of New York State—we digest a few morsels and turn the dials.

The Westinghouse Little Symphony Orchestra, one of the best to be heard from radio, is

music on the air. And then Rosemary Hughes varies the early evening program with a soprano solo. A dependable radio star—is Rosemary.



Here is Maj. J. Andrew White, "most popular announcer" from WJY—WJZ, New York.

What's this? All over the house and the volume only half on? Not Chicago. The announcement tells us it's the Willard Battery Station, WTAM, at Cleveland.

Oh, yes, that's the first super-power station. But it's easy to tune out—five hundred miles away. See? A twist of the dial and it's gone. But get WTAM back. Realizing that increased power means more listeners, voluntary or otherwise, WTAM is giving us some wonderful programs. Some fine orchestra music—some really trained voices. Not on the air too much, either. Here's more power to super-power if they're all like WTAM!

It's time to close, so we'll hurry up the scale to WOS, Jefferson City, Mo. Yes—there's Harry Snodgrass, with his beloved piano, singing from his "guest cell" in the Missouri state penitentiary. Well, he'll be a free man January 16. And the gifts he's getting! Hundreds of dollars in cash—thousands of personal mementos. Hundreds of offers of employment. We wish they'd let us know where Harry'll be after he leaves confinement. For he certainly must stay on the air.

And fans, did you know Harry is still one of the leaders in the RADIO AGE Radio Favorite Popularity Contest? The votes are still coming in, so the announcement Harry was a convict didn't harm his popularity. Rather, it augmented it. More power to him. And here's hoping he's among the winners in the final RADIO AGE contest.

If you haven't voted in the contest yet, there's a coupon in this issue.

Signing off—we'll continue our journey in an early issue.



Miss Edith Bennett, acknowledged the woman with the "perfect feminine radio voice." Ever hear her?





## Who's the RED-HEADED Girl?

An Attempt to Identify WFAA's "Mystery Woman"

By LERA MCGINTY

**T**HE "Red-Headed Girl" who entertains you over Radio Station WFAA, Dallas, Texas, steadfastly maintains that she has no other name.

This is not true, however. She has such a pretty name I am tempted to tell you what it is; but she threatens never to appear on the radio again if I do.

Therefore, I am not going to tell and deprive you of the pleasure she has so generously given her audience heretofore.

"Why do you refuse to give your name?" I asked her.

### She Loathes Publicity.

"I do not like publicity. Of course, as long as I can hide my real identity, I do not mind it so much," she answered.

Miss Red-Head was surely born under a lucky star, as nice things seem to hap-

pen to her daily. Don't you think it is lucky to have beautiful red hair and not the remotest sign of a freckle?

Her complexion has not been accomplished by lemon lotions or by sitting in the shade, for she plays golf every minute that she can spare. That also accounts for the sparkle in her deep brown eyes.

Contrary to the general opinion formed of red-headed people, this young lady has a charming disposition. True, I was not with her long, but she had a cold—a bad cold—yet she was as jolly as a fat man. (Don't get the impression that she is fat. She isn't; and she is little but not *too* little!)

**W**HEN she was asked how her radio popularity came about, it brought forth this story of three years ago.

"A friend of mine was society editor on a large Texas daily, and she had to be away for a few weeks. She asked me to work for her, but I did not dream of really doing it. I knew nothing about newspaper offices and I had never used a typewriter, but she insisted that I could do it. With a rented typewriter and her help I was able to impress the editor at the end of three weeks that I was just the person he needed."

### Her Past—Shh!

That was three years ago, and in that length of time the "Red-Headed Girl" has made a place for herself in newspaperdom.

(Turn to page 58)



At the right is Detroit's newest pride, the Book-Cadillac Hotel, the world's tallest hotel and home of WCX's new studio. In the circle is the ever-popular Edgar A. Guest, whose verses helped inaugurate the new studio last month.



## Detroit Pauses Impressive Ceremonies

By MILTON

**P**ERCHED thirty-two stories up in the air, Radiophone WCX of the Detroit *Free Press* broadcast to the world the opening of the world's tallest hotel on December 8. It was the Book-Cadillac Hotel, Detroit's latest pride.

The whole city had been waiting for the *Free Press* station to open again, for it had shut down for the week while the apparatus was being moved from the *Press* building to the magnificent hotel. But the opening was worth it, as all the celebrities of the city were present, and John Smith, mayor of Detroit, and Edgar Guest, the famous poet, stood before the microphone and let the city hear their voices.

Just at this time it would not be amiss

to tell a bit of my experiences in getting at this station to report it for the readers of RADIO AGE. Don't think it was a cinch.

### Everybody Aglow

**Y**OU see, the whole city had been waiting for months and months to see the famous hotel in its completion, and hear the station. The Book family and the Cadillacs are very well known citizens and consequently there was a great deal of interest attached to their venture. (As a matter of note, it may be mentioned that this project broke the pocket-books of neither the Brooks nor the Cadillacs. After being in the city for a day, I discovered that these

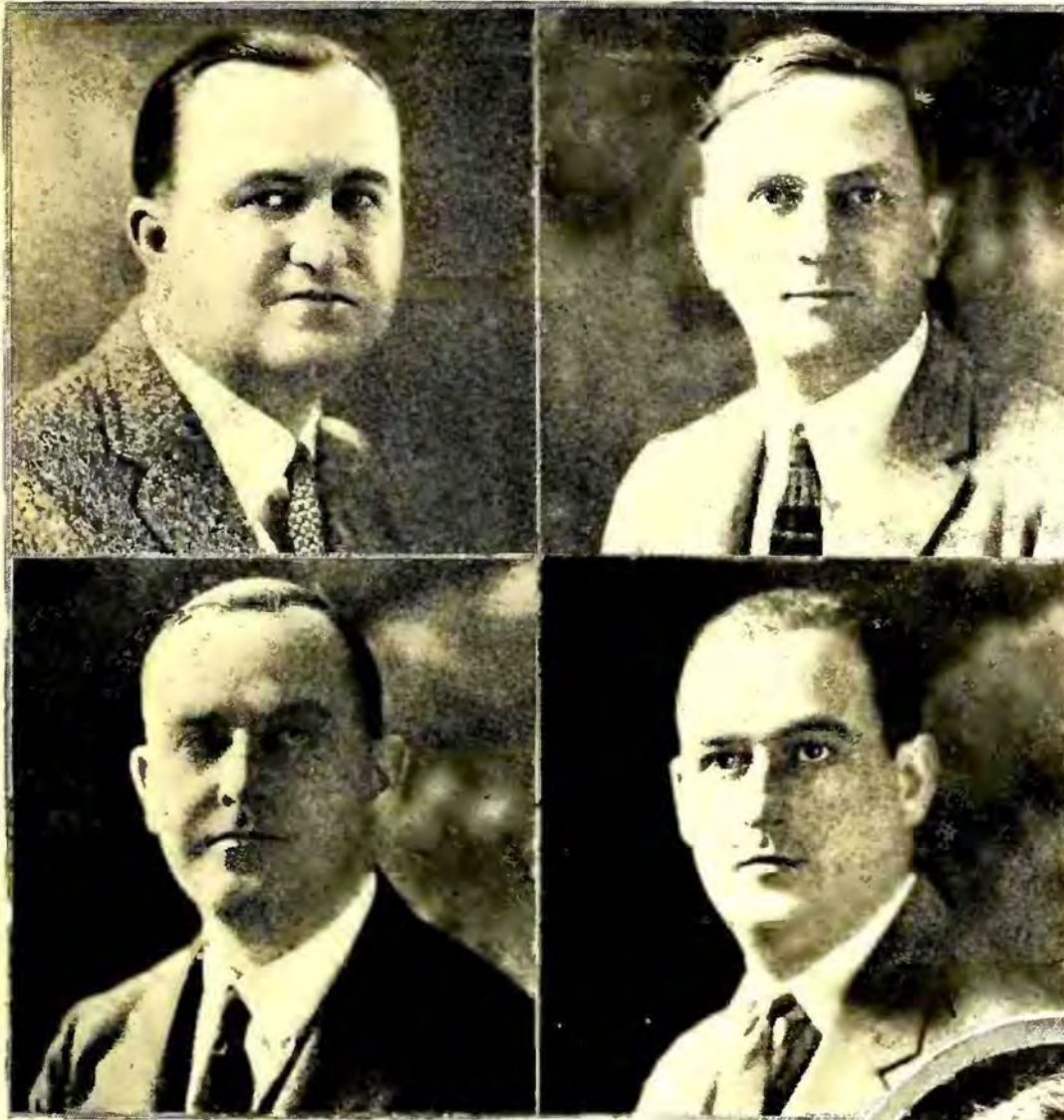
capitalists own half the town and have enough money to snap their fingers at Henry Ford's bank account.)

This opening night was not for the public. It was to be a private reception and only the top ladder of society folk were invited. They came by invitation and partook of a ten-dollar-per-plate feed.

I got an invitation, but the ten dollar feed meant nothing to me. I had filled up in a one-arm joint across the way.

All went well, the writer rejoicing that he had got past the big footman while the common folk without passes were kicked out. But I discovered that I was the only male person there without a full-dress suit. I felt pretty bad until





The jovial boys at the left form the Hudson Male Quartette, which is now a regular feature from the Book-Cadillac Studio of WCX, Detroit. Top row, left to right: Harry A. Leiter, and Harry E. Parker; bottom row: Joseph Kendrick and Harrison Burch. Below is Miss Carmen Morlock, of the Hudson Female Quartette, who is out to prove that men aren't going to monopolize the new WCX.

# for Station WCX at Book-Cadillac Studio

## LIEBERMAN

I discovered another culprit wearing a business suit. I thought it was another low person like myself until I discovered that it was none other than Edgar Guest, the second "James Whitcomb Riley." There's a real fellow. Miss Lucille O'Connell, program director of WCX, introduced me to him, and to his little boy, a lad of about ten years, who is being brought up to be the same inspiring, democratic man his father is.

### Eddie Thrills 'Em

**G**UEST read a number of his well-known poems over the microphone and when I looked out of the thirty-second story window I thought I saw the vast city underneath vibrating with applause.

His stuff is great and he reads it wonderfully, and some of the evening dress boys in the outer room smiled and moved their heads as though to say: "He's got the stuff, all right."

Preceding Guest, the mayor spoke and he said how proud he was to be at the head of a city which possessed such a great hostelry. Then the Hudson Double Quartet, a famous organization in Detroit, sang a group of musical selections. Each one of them is a soloist, and the organization is a combination of the Hudson Male Quartet and Female Quartet. They were accom-



panied by Harrison Burch, concert pianist.

Music from Jean Goldkett's orchestras, playing in the dining room of the hotel downstairs, interspersed the numbers. Goldkett's orchestras are probably destined to become about the best known in the air, now that WCX is going full

(Turn to page 59)



How One Song  
Brought Radio  
Fame!

And It Happened  
On a Sleepy  
Street-Car



## The Radio Life of Banks Kennedy "If I Can Arrange It"

By RUSSELL H. HOPKINS

*"I'm an arranger,  
A first class arranger  
The best in the land, can't you see?  
There's hardly a thing in this wide, wide  
world,  
That hasn't been arranged by me."*

ON A slow-moving Cottage Grove av. street-car, one day last fall, a young and promising lad named Banks Kennedy scribbled off the foregoing paragraph. Not that he didn't have anything else to do; in fact, he was organist at one of Chicago's biggest movie palaces, a leading instructor in the art of piano playing, and a leader in the University of Chicago's "social elect."

But he felt in a composing mood and he decided to write something to ease the agony of the aforementioned slow-moving street car.

That was about three months ago. Then one day a Sigma Alpha Epsilon fraternity brother of Kennedy's, Harry Aldyne by name—and incidentally the contest editor of RADIO AGE—asked him if he would like to entertain over Radio Station KYW the coming Wednesday. Banks, eager for a new thrill, consented.

### His Radio Debut

ONE Wednesday night at 8 o'clock, Banks Kennedy made his radio

debut. He was displeased that the program was strictly classical, but the RADIO AGE program directors saw under Kennedy's unwillingly serious exterior a gift for jazz and light entertainment that would lead him to untold heights in the radio world.

With that thought in mind, and heedful of Kennedy's success even at the more serious side of the radio endeavor, Harry Aldyne asked the young pianist to make his "jazz debut" at Station KYW's jazz carnival, beginning at midnight one Saturday in November.

Banks' eyes sparkled. Here's where he'd show 'em! Here's where he'd bring out his limitless repertoire of toe-ticklers and fancy-capturers!

"I'll be there—if I can arrange it," Banks told Aldyne. And therein was born the germ of an idea—an idea that first began to take shape in Kennedy's nimble brain on a slow-moving Cottage Grove av. street car.

Banks "arranged it." He introduced his "If I Can Arrange It" song—at least the first three hundred verses—and by the next morning hundreds of radio fans were writing to KYW and asking for more! That assured the song's success, so Banks assured his radio audience at least 50,000 more

verses would be forthcoming within a short time.

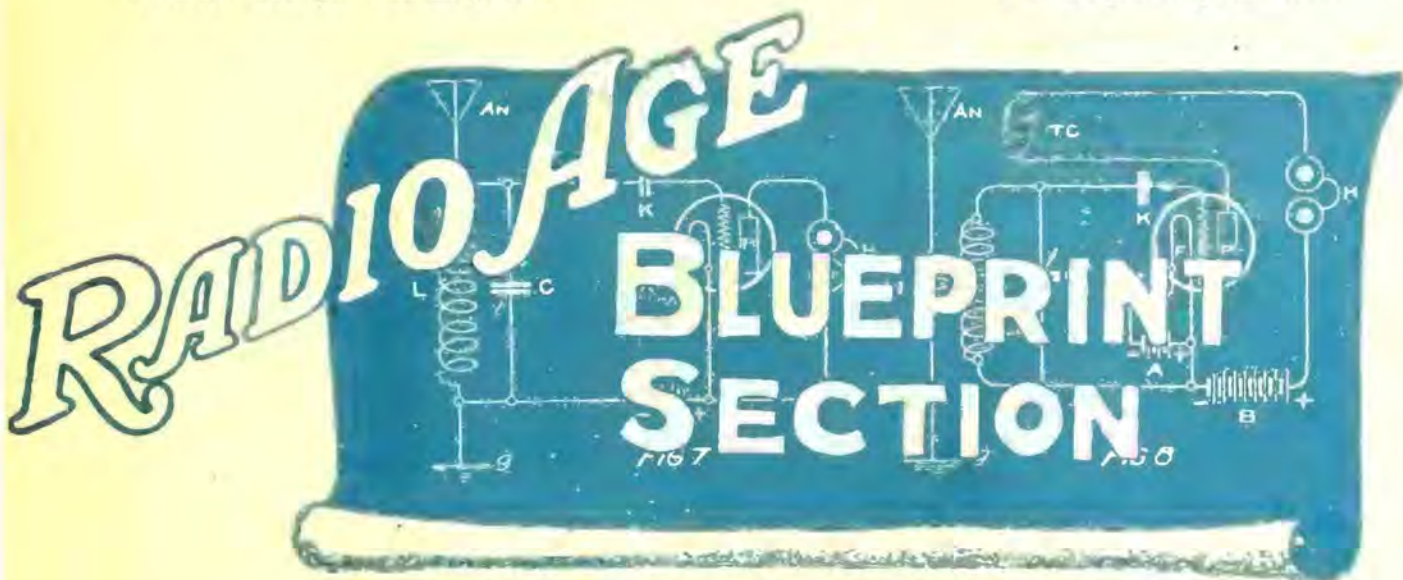
Later, at Station WEBH, under the auspices of RADIO AGE, Banks introduced several more verses, three times a week for several weeks. The song is now known as "Chicago's radio song," for its phenomenal success can be attributed directly to Banks' appearance before the microphone. Within a short time, he promises, it will be in sheet music form, with as many verses as can be squeezed in the smallest type made. That's a promise!

So you see, Banks owes a lot to radio. And RADIO AGE takes a lot of the credit for putting him on the air and showing him where his real *forte* lies.

To go into history, Banks is a Southerner by birth. Right now, in fact, he is spending the first weeks of the new year with his mother in Tuskalusa, Alabama. Of course, Banks can't resist the call of Radio, so while he's getting re-acquainted with the old homestead, he's singing from WSB, Atlanta; WBAP, Fort Worth, Tex.; and WFAA, Dallas, Tex. And it's a safe bet by this time that all the lads and lassies in the Sunny South know at least one thousand verses of "If I Can Arrange It".

We trust Banks arranged that in due time. (Turn to page 61)





## “Compact Efficiency” with A 3-Tube Reflex Circuit

By JOHN B. RATHBUN

Copyright: 1925

**R**EFLEX circuits have always had a peculiar fascination for me because of the opportunity that they offer for making one part serve the purpose of two or more parts, and last but not least, their compactness and portability. Further, the circuit enables us to use a non-oscillating detector of some description, such as a crystal or a two element tube, and this gives the reflex first rank as a receiver giving clear, distortionless reception with almost crystal-like tone. All the advantages of radio frequency and audio frequency amplification are had with one set of tubes, and hence with fewer tubes than with a straight radio frequency set.

For those of our readers who have not yet studied the reflex circuit, I will give a few words of explanation regarding its workings and general principles. To begin with, the radio frequency current received from the aerial is amplified at this high frequency by the tubes, and is then passed through some sort of detector which rectifies the waves and develops the audio frequency phase, just

### *A Circuit that Gives More Amplification Output than Usual 5-Tube R. F. Outfits*

as in the first stages of a radio frequency receiver. However, at this point a radical change is made in the circuit for the current rectified by the detector is now returned where it receives a second amplification at audio frequency in the same tubes, increasing the volume of sound. Thus, the same tubes act both as audio and radio frequency amplifiers and we make a corresponding saving in the number of tubes.

#### Equivalent to 5 Tubes

**I**N this way, two tubes with a crystal detector will give two stages of radio and two stages of audio amplification, approximately the equivalent of five tubes. I say “approximately” for the

reason that the tubes do not develop their full efficiency under these conditions when amplifying at two frequencies, but at any rate they develop far more than the same number of tubes under any other conditions. Working in this way the tubes probably develop 80 per cent of their full capacity as radio frequency amplifiers and 90 per cent of their capacity as audio amplifiers. The total actual delivery can be taken at about 75 per cent of the full tube capacity. A single tube reflex should give the equivalent of one stage of radio and one stage of audio, but as we know, this is not attained. Both the volume and range are somewhat better than a single tube regenerative, both in regard to range and volume, but are not equal to the full three tubes used in amplifying the regenerative.

Our present three tube reflex circuit has three amplifying tubes and a crystal detector. With the circuit arranged as shown, this is the theoretical equivalent of three stages of radio frequency amplification and two stages of audio amplification, or better than the output of the

Blueprints of the 3-Tube Reflex on Pages 40, 41, 44, 45

### *A Thirty-Two Page Blueprint Section in* **RADIO AGE ANNUAL FOR 1925**

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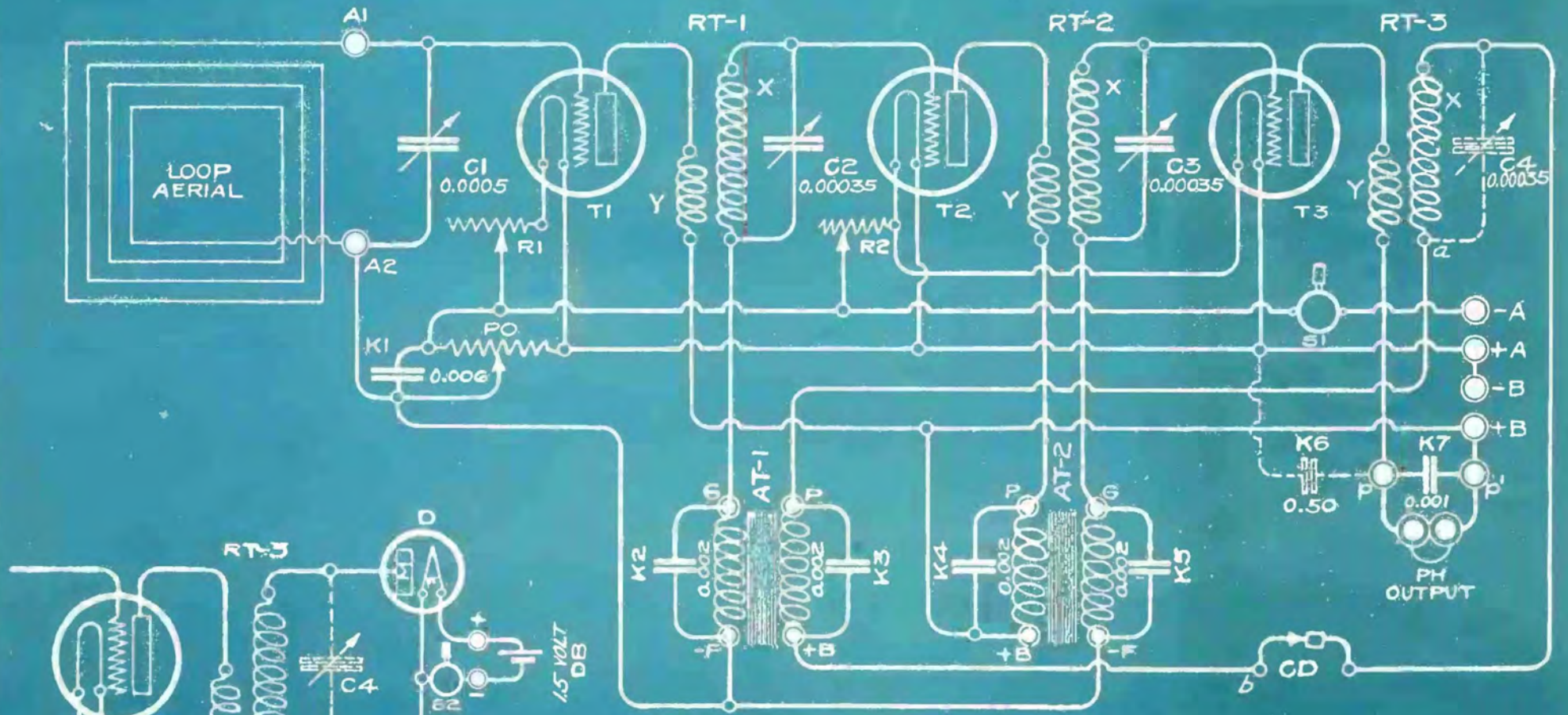
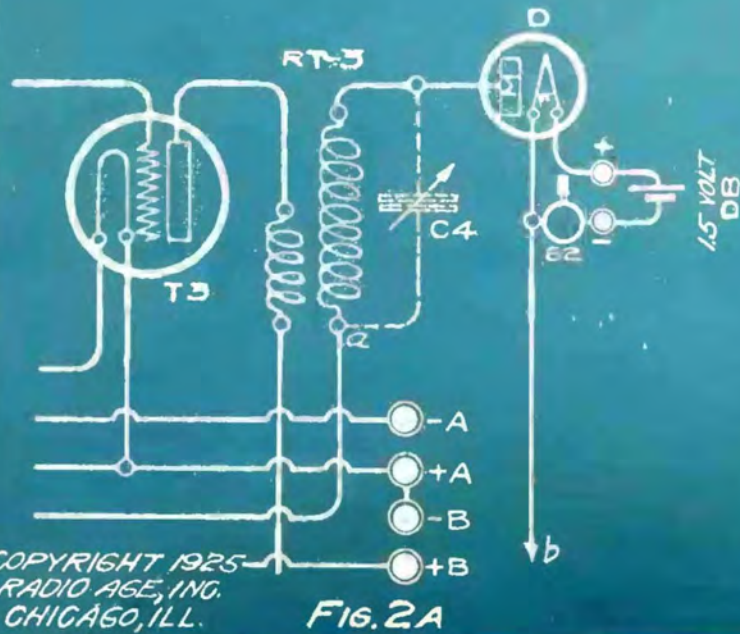


FIG. 1

### CLIMAX THREE TUBE REFLEX CIRCUIT

THE TUBES T1-T2-T3 SHOWN ABOVE ARE ALL AMPLIFYING TUBES SUCH AS UV-201A, C-301A, UV-199 AND C-299. THE "B" BATTERY OR PLATE VOLTAGE RANGES FROM 67.5 TO 90 VOLTS. THE "A" BATTERY VOLTAGE FOR ABOVE TUBES DEPENDS ON TYPE USED, BUT THE DIODE TUBE BATTERY IS 1.5 VOLTS (SINGLE DRY CELL).

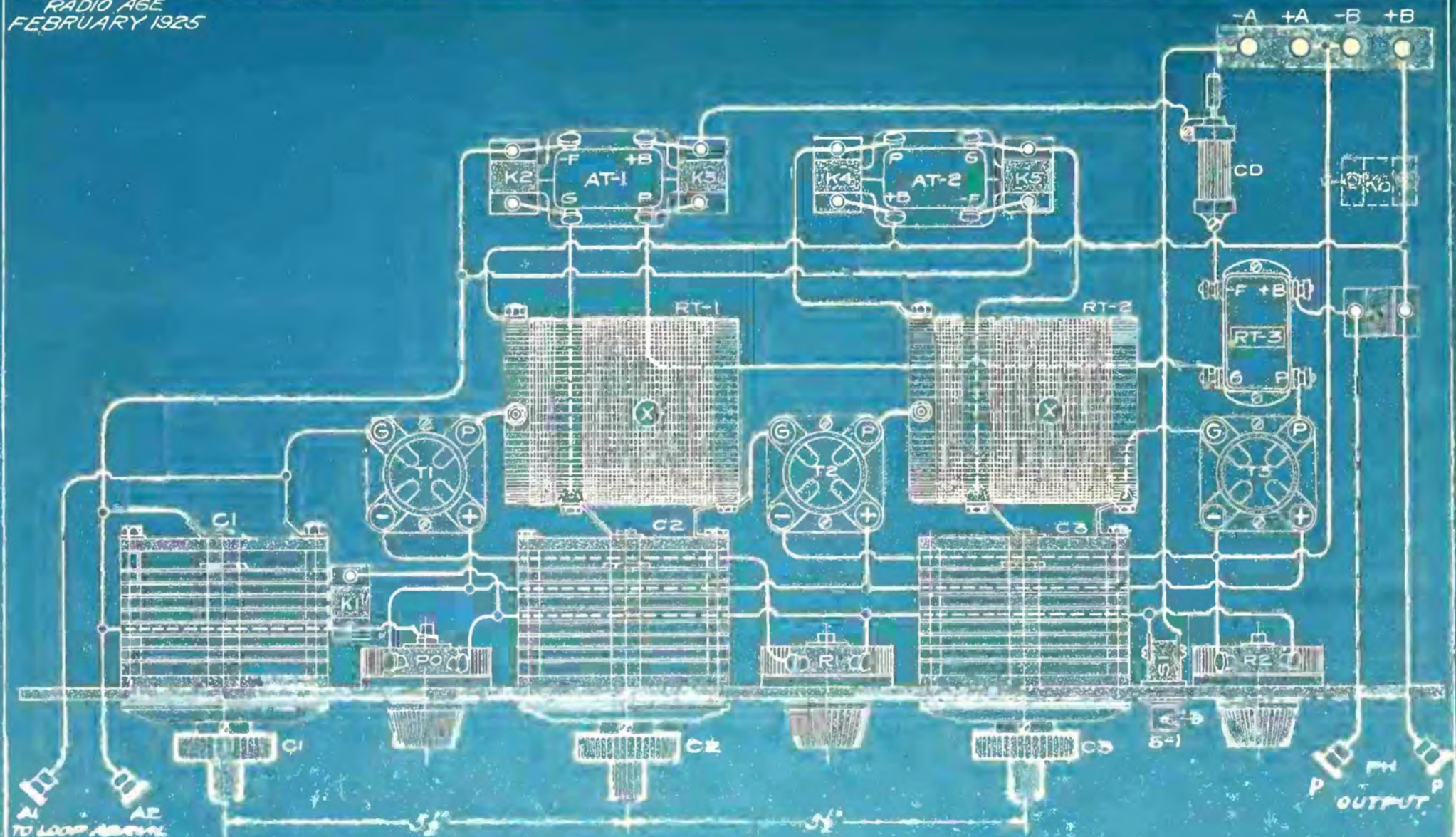
J. B. RATHBUN  
RFX-750



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CHICAGO, ILL.

FIG. 2A





F16.2

CLIMAX

THREE TUBE REFLEX CIRCUIT

IN-LINE TRANSFORMERS RT-1 AND RT-2 AT AN ANGLE OF 60° WITH HORIZONTAL, NOT FLAT DOWN AS SHOWN.

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J.B. RATHBUN  
RFX-750



(Continued from page 39)

usual five tube tuned radio frequency outfit. Actually, this gives just about the same performance as a five tube set with two radio stages, detector and two audio stages. The full output of the three theoretical radio stages is not quite realized. The use of a crystal detector in place of a three element tube detector eliminates one tube and greatly improves the tone, but at the same time the volume is somewhat diminished. However, the loss of volume is not so very great and would hardly justify the addition of another tube.

If the crystal is not desired, a two element tube such as the diode can be substituted, but a standard three element tube is not desirable for the reason that it introduces tube noises, regeneration and other factors which interfere with the clarity of reception. There are many good crystals on the market which give little trouble in a reflex circuit, but I must caution you against the use of a galena crystal or any other soft crystal of similar nature. Galena will not stand up under the high plate currents of a three tube reflex but will burn out continuously. It is all right on a crystal set, but not with from 5 to 15 milliamperes current driving through it.

As more than two stages of audio amplification are not advised on a reflex circuit, this set is reflexed in such a way that only two stages are employed, the two last tubes acting as both audio and radio amplifiers while the first tube is purely a radio frequency tube. This arrangement increases the radio frequency amplification efficiency somewhat and with but little loss in audio.

#### Description of Circuit

**B**OTH Fig. 1 and Fig. 2 show the same circuit but in different ways. Fig. 1 is the so-called conventional circuit with standard symbols for the more experienced builder, while Fig. 2 is a picture diagram for the novice. Fig. 3 is a panel layout showing arrangement of controls and approximate spacing of the panel mounted apparatus while Fig. 4 is an isometric view made for the purpose of showing how the apparatus actually looks back of the panel. For making the actual wiring connections, however, I strongly advise the wiring in either Fig. 1 or Fig. 2 be used, as many of the wires are concealed in the isometric view.

Now, looking at either Fig. 1 or Fig. 2, we see the three amplifying tubes T-1, T-2 and T-3. These may be either UV-201A or UV-199 tubes, but the WD-12 and WD-11 are not effective for this purpose. Two rheostats are used for the three tubes, one for the first radio stage (T-1) at (R-1) and rheostat (R-2) for the control of the two rear reflexed tubes (T-1—T-2). A plate voltage of 90 volts is supplied by the "B" battery to all of the tubes alike.

All of the radio frequency stages are coupled by the three radio frequency transformers (Air core type) marked RT-1, RT-2 and RT-3. For maximum results these should be of the tuned radio frequency type tuned by the 17 plate (0.00305 mf) variable condensers C2, C3 and C4 as in the neutrodyne, or other

radio frequency type receivers. These condensers, together with the 0.0005 mf loop tuning condenser (C1) give extreme selectivity and a maximum peak of amplification, but at the same time they make tuning correspondingly difficult because of the many controls to be handled. Thus, we have four tuning dials which make tuning rather difficult for the novice.

### Just An Idea of What You Will Find in THE RADIO AGE ANNUAL FOR 1925

How to Read Hookups. Something the beginner cannot do without.

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To avoid the use of so many condenser controls, the last transformer (RT-3) can be of the untuned type (Fig. 1) and by this method the variable condenser (C4) can be omitted as suggested by the dotted lines. This occasions a slight drop in the effectiveness of the circuit, but is usually advisable with sets operated by beginners. An untuned radio frequency transformer is shown at (RT-3) in Figs. 2, 3, 4. All the other stages are controlled or tuned across the secondary, which gives us three tuning controls including the loop tuner (C1). A standard loop aerial is connected across (A1) and (A2) in the usual manner.

Any standard air core radio tuned

frequency transformer or neutrodyne transformer can be used at RT-1, RT-2 or RT-3. The primary winding (Y) consists of about 12 turns of No. 26 D.S.C. wire while the secondary has about 64 turns of the same size wire. However, I recommend that these transformers be purchased ready-made, for home made transformers are seldom reliable. Fig. 4A shows the general dimensions of the transformers in case the home builder desires to "roll his own." Transformer RT-3, if of the untuned type, must be purchased, as this type is altogether out of the amateur builder's class.

#### 200 or 400 Ohm Potentiometer

**A**T (PO) we have a 200 or 400 ohm potentiometer used for varying the grid potential on the first radio frequency tube, and the radio frequency resistance is reduced by the bypass condenser (K1) which has a capacity of not less than 0.006 mf.

At the extreme right in Fig. 1 is the crystal detector (CD) in series with the secondary coil (X) of the radio frequency transformer (RF-3). There is little requiring further explanation at this point than to say that the crystal circuit connects to the primary coil (P-B) of the first audio frequency transformer (AT-1). The leads running from (a) and (b) to the terminals (P) and (B) of the audio transformer (AT-1) should be temporary wires at first so that the connections (a) and (b) can be reversed in case of the transformer coils bucking. First, try them in the position shown and then reverse (a) and (b) to determine the best working position.

At (AT-1) and (AT-2) are the two audio frequency transformers acting as the first and second stages respectively of the audio amplification phase. Transformer (AT-1) is reflexed into the second tube (T2) while the transformer (AT-2) is reflexed into the third tube (T3). Both transformers are of the usual iron core audio type with a ratio of from 5-1 to 6-1. Higher ratios are not generally advised while lower ratios reduce amplification, but give clearer reception. One of the most valuable features of the reflex circuit is its clear tone and therefore we should not impair this feature by using poor or high ratio transformers.

Both secondary and primary windings of both transformers are by-passed by the fixed condensers (K2-K3-K4-K5) which are of 0.002 mf capacity for the majority of audio transformers. However, some transformers have so much distributed capacity that these condensers will not be necessary for by-passing the radio frequency current, and in fact, some transformers work better without any bypass condensers at all. This is a point that you must work out experimentally by yourself for your particular conditions, but I advise you to try the effect of the condensers at any rate. Another fixed condenser (K6) of 0.5 mf capacity connected between the output post (p) and the (+A) is useful in reducing the "B" battery resistance and the speaker impedance offered to the radio frequency current.

(Turn to next page)



## A Compact Three-Tube Reflex Set

(Continued from preceding page)

Here it will be noted that the output terminals (p-p') are in series with the "B" battery and plate of the third tube (T3), where the point of full amplification is had. As this part of the circuit conveys radio frequency current as well as audio it will be well to use binding posts at (p) and (p') instead of jacks, for the capacity of the jack blades often seriously affects the performance. The blades of the jack are close together and act as a fixed condenser of no small capacity. When the plugs are changed, this often disturbs the balance of the circuit. The switch (S1) is in the negative "A" battery lead and should be used for cutting out the filament current, thus avoiding the necessity of turning down the rheostats and disturbing the adjustment every time that the set is put out of service.

### Diode as a Detector

IN Fig. 2A is a small corner of the circuit drawn out to show how a two element diode tube may be used instead of the crystal detector. The relation of this sketch to the main diagram can be easily traced out by the location of the tube amplifier (T3), the radio frequency transformer (RT-3), and the optional variable condenser (C4). The two element tube is at (D) with the plate (M) and the filament (F). The negative filament of the tube and the plate (M) are connected into the circuit just as with the crystal. A separate single 1.5 volt dry cell (DB) supplies current to the filament of the diode tube and is provided with a second cutout switch (S2). The terminals (a-b) are connected to the primary coil of the audio transformer (AT-1) as before.

This diode tube introduces no distortion into the circuit and avoids the necessity of adjusting a crystal. Its use is optional, but is shown as a means of obtaining tone value without a crystal. As the diode is not critical to filament voltage or current, it is not usual to use a rheostat, but one can be used if a higher voltage than 1.5 volts is employed.

Almost any standard loop aerial can be used with excellent results, which is within the wavelength range. It is tuned by the condenser (C1), which for safety's sake can be a 23 plate 0.0005 mf size instead of 0.00035 mf used across the transformer secondaries. The loop used in my experiments was a two foot loop of the solenoid type having 15 turns of lamp cord. This, however, is simply a suggestion as to size. Where there is much interference, the loop will be found quite useful in tuning out local stations because of its directional qualities. Three stages of radio frequency will insure good reception over long distances with the loop.

### Size of Panels, Etc.

My first set was mounted on a special 9"x13" panel without crowding or trouble feedbacks. Further constructions showed that everything worked out well on a 7"x14"x3-16" panel, and I believe that

this size is best, everything considered. If the panel is so short that the parts are crowded together, then there will be feedback between stages or between the radio transformers (RT-1) and (RT-2). If a very long cabinet is used, then the wiring will be so long that the losses will be materially increased. All wires should be as short as possible, particularly the wires running to the grid posts (G) on the sockets, and the wiring should be rather open so that the wires do not come together close at points where they are parallel. Don't crowd the wiring together for the sake of appearances. Performance is of more importance than appearance on back of panel.

In connecting up the set, be sure that the stator or stationary blades of the variable condensers marked (S) are connected to the grid side of the circuit as shown. Again, keep the audio frequency transformers as far out of the field of the radio frequency transformers as possible; that is, do not place the audios directly in line with the center of the radio frequency transformers.

The location of the crystal detector is a matter of personal taste and judgment. Mounted on the front of the panel, it is easy to adjust, but it is also more likely to be knocked out of adjustment by the hand when reaching for the tuning dials, and the wires to the detector are also much longer. On the other hand, if the detector is mounted on the bottom board in the rear, it is difficult to adjust and is inconvenient. There is no marked advantage either way except for those people who like to see a great variety of apparatus displayed on the front of the panel.

### Use Vernier Control

OWING to the sharp tuning of the condensers, it is advisable to use a vernier type for all three controls, and the true low loss type is of course preferable. Low loss type air core transformers are of great assistance in getting the distant stations and add volume on the locals. To decrease the losses further, use good sockets having a high insulating value and install them in the set so that the bottom of the sockets is at least 1-4 inch above the bottom board if a wood bottom board is used. A bakelite or hard rubber panel is to be preferred to a wood bottom board in every case, as there is as much opportunity for high frequency leakage at this point as on the vertical panel itself.

Spaghetti is not always the best thing to use for covering the wiring. It adds to the capacity effect of the conductors, and in a way offsets the care that has been taken against leakage and inductive losses at other points in the circuit. It has always been amusing to me to see how carefully the low loss coils are stripped of dielectric and insulation to avoid loss, and then how a spaghetti dielectric is deliberately placed on a much longer length of wire in the same circuit, thus completely eliminating the advantages of the low loss coils.

To make matters worse, the spaghetti is varnished which further increases its capacity over the dry wound wire of the coils. With two wires run parallel to

each other for any distance, the use of spaghetti has a marked effect on the capacity of the circuit.

### All Tubes Amplifiers

ALL tubes are amplifying tubes, hence a plate or "B" battery voltage of from 67.5 to 90 volts is used on the plates for maximum amplification. Lower voltages than these will give very poor results. In case the diode tube is used as a detector, please note that no "B" battery is applied to the plate of this tube for the reason that we wish to avoid oscillation in the detector branch of the circuit.

The "A" or filament current voltage depends upon the type of tube used. For the UV-199 tube the applied voltage is 4.5 volts or equal to the voltage of three dry cells connected in parallel. For the UV-201A tube we use a six volt storage battery. While the UV-199 tubes do not give quite the results that are obtained with the storage battery tubes, yet they are often very desirable where a storage battery is impracticable. A single set of three cells in series will give two months service or over, but for the most economical service I suggest that six batteries be employed—two groups of three cells in series.

In making these connections, have two rows of three batteries each and connect up each of these groups independently in series, that is, zinc to carbon, zinc to carbon, etc. Next, connect the two carbons of the two groups together, and then the two zincs, these connections being made at the end cells. The result is that we have decreased the demand on each cell by one half and in so doing have increased the life about three times. Doubling the number of cells in parallel does not only double the life. It does much more than that; it triples the life at a cost which is only double that of a single set of three cells.

Rheostat (R1) controls the current to tube (T1) only; therefore a high resistance rheostat should be used, say 15 to 20 ohms for the UV-201A tube and 30 ohms for the UV-199 tube. Rheostat (R2) carries the current for both (T2) and (T3); hence its resistance should be less than for the single tube. From seven to 15 ohms will be correct for this group.

The resistance controls are not critical as with detector tubes, and therefore automatic filament control devices can be employed which do away with rheostats altogether. This has certain advantages and disadvantages, but they can be used if desired for all tubes, using one automatic control for each tube placed in the negative lead. A battery switch must be used with this arrangement, as there is no other way of turning off the filament current except by disconnecting the "A" battery. With rheostats the switch may be omitted as the rheostat also acts as a switch, but in general it is advisable to use a battery switch under all conditions, particularly for the Diode tube.

Have You Seen the  
Radio  
Cross-Word Puzzle  
in this Issue?







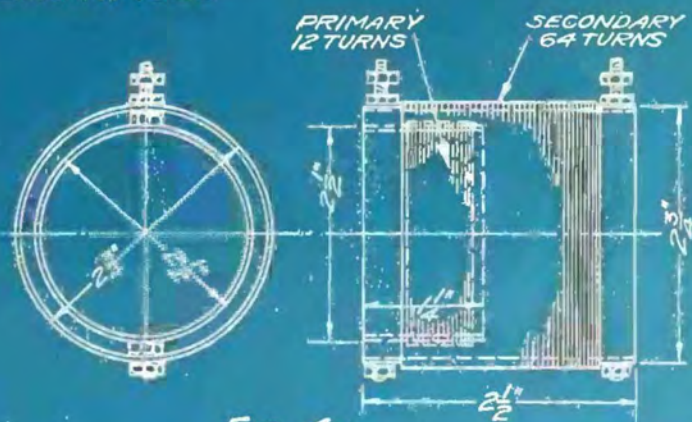


FIG. 4A

THE ABOVE COILS TO BE WOUND WITH  
NO. 26 DOUBLE COVERED SILK MAGNET  
WIRE (D.S.C.).

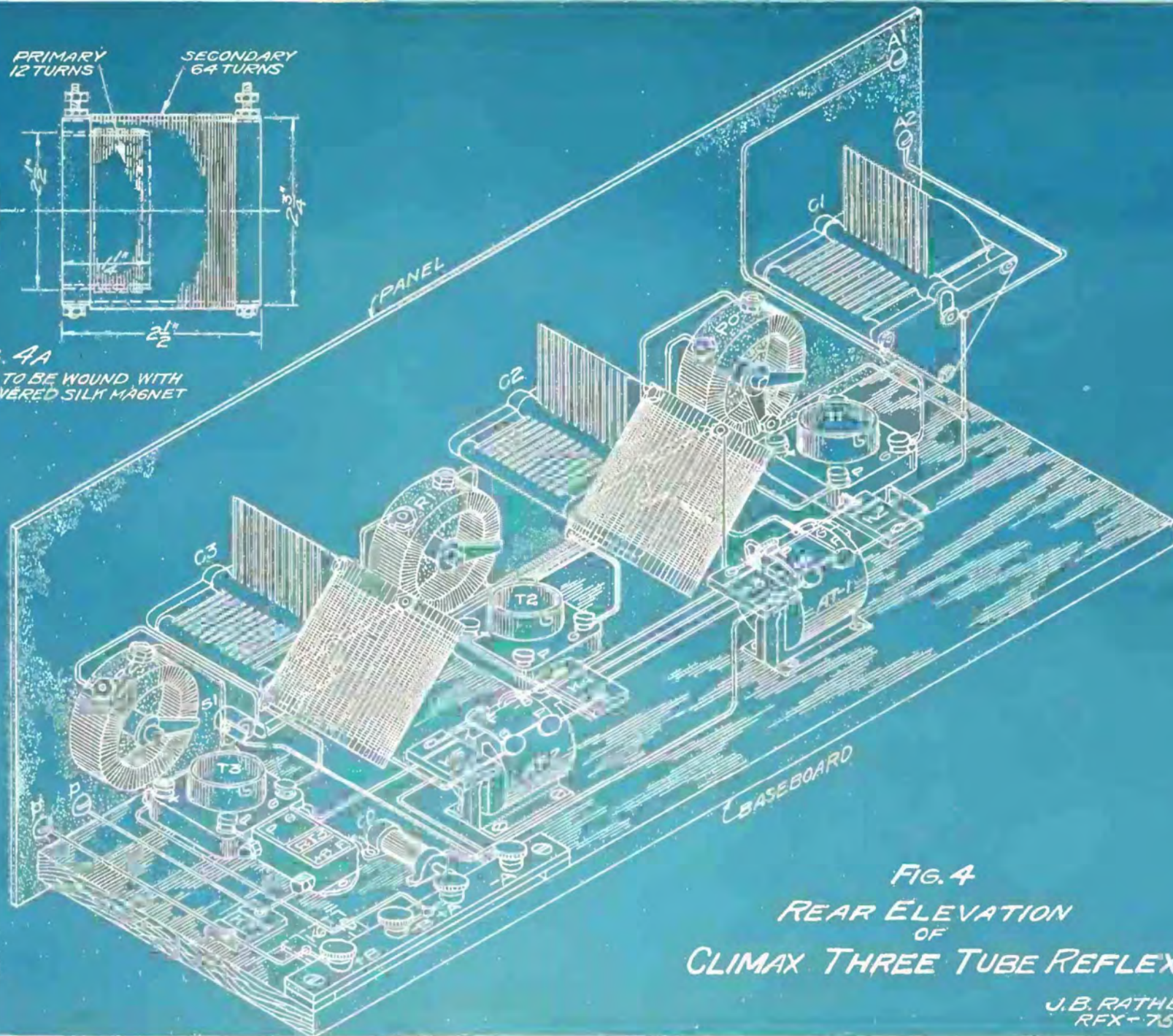


FIG. 4  
REAR ELEVATION  
OF  
CLIMAX THREE TUBE REFLEX



# The Wandering Minstrel of Radio

By  
L. S. WHITCOMB

*Nate Coldwell, the "Joy Digger," Was told by a Doctor to Get Out in the Air; Instead He Got "On the Air" and Today He Travels from Radio Station to Radio Station Making Others Happy; Covers 5000 Miles in Six Months!*



Here's the "Joy Digger" in a typical pose with his trusty "Uke," crooning an original melody to "Bob" Emery, announcer at Station WEEI, Boston, who is holding the microphone.

**N**ATE COLDWELL, who calls himself "The Joy Digger," and hails from Chicago, has made a big hit with New England radio fans. Coldwell is a real 20th century edition of the wandering minstrel and is one of the most interesting artists on the air at WEEI, Edison Light Co., of Boston, Mass. While Mr. Coldwell has been traveling in the East, he has been making his headquarters at WEEI and has made thousands of friends with his songs and stories.

During the past six months Coldwell has covered over 5,000 miles in his travels around the country. His story of these wanderings sounds like a Horatio Alger book. He came East from Chicago about three years ago to attend Dartmouth College at Hanover, N. H. Here his health failed and he was ordered by physicians to quit school and stay out in the air. Coldwell not only went out in the air; he went the doctors one better and got out on the air!

### He Croons 'Em

While his voice is not heavy, it is of fine quality and by getting close to the

"mike" and crooning his songs he is able to put them over wonderfully. All of Nate's numbers are original. New Englanders have fairly gone crazy over Coldwell. His song "You Can't Fool Fate" has been sung over and over again from Station WEEI, and every time he comes back, scores of telephone calls and telegrams flow into the studio requesting him to do his entire repertoire.

Just where Coldwell is at the present time is not known to officials of WEEI. He drops down to that station about as often as the rain visits this changeable New England climate. His last appearance at WEEI was the night of the Harvard-Dartmouth football game. Nate had seen the game on a pass. He had seen his college mates trounce Harvard and he was in rare form.

About a week ago, however, officials at the Edison Light station picked up Coldwell's program from WGY, General Electric Company, Schenectady. At that time the announcer told the listeners—in that Coldwell was on his way to the Pacific Coast. Wherever he is, his friends at WEEI know that he is headed for the nearest broadcast station and

also are sure that radio listeners within 500 miles will be royally entertained.

### Back Home Again

Just a few weeks ago some RADIO AGE experimenters heard Coldwell from WTAS, Elgin, Ill., which shows he's gradually drifting back to his old haunts near Chicago.

"The Wandering Minstrel" is known better away from Chicago than in it, so middle westerners may get a chance to hear him "do his stuff" after all.

In his extremely youthful days, Coldwell had very little inclination toward music or the composition thereof. In fact, his proud parents had long ago given up any hope that he might become a second Chopin or even an embryo Irving Berlin.


So what did Nate do but do a little composing after he started broadcasting! Of course, he lays claim to no fame for his compositions, but it has to be admitted that they are all exceedingly original and snappy.

What they lack in beauty of tone and arrangement, they make up for in pep and originality.





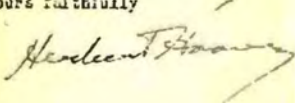
*At the right is a facsimile reproduction of a letter sent to RADIO AGE by Herbert Hoover, Secretary of Commerce, in acknowledgement of an editorial published in the October issue, praising the Secretary's stand in demanding stabilization of radio conditions. Above is a recent photograph of Mr. Hoover.*


  
 THE SECRETARY OF COMMERCE  
 December 5, 1924

Mr. Frederick A. Smith  
 Radio Age  
 500 N. Dearborn St.  
 Chicago, Ill.

Dear Mr. Smith:

This is just by way of expression of appreciation for your editorial in the October issue of "Radio Age" which has come to my attention on my return from the west. Our part in the radio industry is becoming more difficult every month and we certainly do need moral support.

Yours faithfully  


HH. 336.



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# Pick-ups and Hook-ups by our Readers



THE material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

NOW that we are over the holiday season, I suppose we can all settle down and start twisting the dials with a vengeance once more. However, I don't want our readers to think that we imagine any one has laid down on the job during the past month, but during this time of the year we are so occupied with other duties that sometimes the DX fans are too tired to bother with sending in their lists of calls received.

Last month we requested that our contributors exercise a little more care and neatness in submitting material for this department. It really is gratifying to notice the change that has already taken place. No more do we receive questions in the technical department written on the rough side of a shingle or the margin of a newspaper. Instead they are submitted in a nice, orderly manner, and it really is a pleasure for the editor to open his mail in the morning and know that he will not need to strain his eyes in an attempt to decipher a cryptic message.

Likewise several photographs have been received and the only thing that prevents our printing them is the lack of space. Good photographs of sets or stations are always welcome, and we want to receive more of them. It goes without saying that we are also desirous of obtaining stories, entertaining or otherwise, for this page, and I know that most of the amateurs and professional operators have a flock of them at their command, that I am sure will come pouring in once the word is passed around that the Pick-ups editor would like to have them.

We have by way of an innovation this month a contribution from a lady fan whom we think must be a regular experimenter, as her letter seems to point to the fact that she has built several sets.

We certainly welcome her contribution and hope that we shall have the pleasure of hearing from her from time to time.

Any number of good DX lists have been contributed by fans who are desirous of obtaining the well-known DT buttons. It really was quite hard this month to choose the best lists, and if any of you feel disappointed because you have been left out, do not be discouraged, but try again, as the above list contains only the cream of the largest number of letters ever handled through the Pick-ups and Hook-ups Department.

If you will look through our Strays column, you will notice the kind of reception that was necessary to get into the DT column this month.

Truly, the lads who have been honored

## CONTRIBUTORS

F. McDONALD Chicago, Ills.	GILBERT SLATER Pawtucket, R. I.	TED GERILL St. Louis, Mo.	EINAR HULTMAN Jamestown, N. Y.
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## DIAL TWISTERS

Name	Address	City
Chas. C. Drake	943 Gladstone Ave.	Detroit, Mich.
Roland Lure		Newport, N. J.
Marion S. Corly	184 Spring St.	
Wm. B. Simpson	445 Autumn Ave.	Brooklyn, N. Y.
Felix Frederiksen	Route 2	Delmar, Iowa.
Berney Philippon	631 55th St.	Milwaukee, Wis.
E. E. Richmonds		Waynesville, Ills.
Roy M. Canfield	45 North Park St.	East Orange, N. J.
Einar A. Hultman	97 Baker St.	Jamestown, N. Y.
James Grindle	1143 Garfield St.	Hammond, Ind.
Ted Gerell	5327 Pershing Ave.	St. Louis, Mo.
Charles H. Dawson	14 Cavell Ave.	Toronto, Ont., Can.
Henry W. Schwab	201 Buell St.	Muscatine, Iowa.
Wayne Mac Quidy	Drawer "S"	Pittsburg, Calif.
Otis C. Wyatt	57 Gladstone St.	Providence, R. I.
Ralph E. Riley	1711 Fifth St.	Oakland, Calif.
Miles Conrad	1224 Louisiana Ave.	New Orleans, La.
William L. Poser	Box 708-B Route A	Fresno, Calif.
Paul Hayes	918 Bell St.	Pasadena, Calif.
Eugene Borsaltue	1518 Wash. St.	Gary, Ind.
Sibley Law	Saxon Mills	Spartanburg, S. C.
Archie H. Klingbeil	258 Prospect St.	Ashtabula, Ohio.
S. J. Todd	1832 E. 82nd St.	Cleveland, Ohio.
Thomas Burke	3016 Warren Ave.	Chicago, Ill.
J. W. Vine		Swallows, Colo.
William Barker	571 Linwood Ave.	Columbus, Ohio.
Hugh Jones, Jr.	503 Horatio St.	Tampa, Fla.
Harry E. Lake	1529 Stone St.	Flint, Mich.
R. J. Dolan		Nelson, N. B., Can.
Maxwell Krasno	1219 26th St.	Milwaukee, Wis.
Arthur Rabe	21 Archer Ave.	Buffalo, N. Y.
M. Watson	1925 Bigelow St.	Cincinnati, Ohio.
Albert M. Turney, Jr.	3944 Massachusetts St.	Long Beach, Calif.
Wm. Wreeland, Jr.	67 Union St.	Montclair, N. J.
Hudson Marhoff	919 Lakeside Place	Chicago, Ill.
Jas. Geyses	1005 Swissvale Ave.	Wilkinsburg, Pa.
G. Titmarsh	120 Benson Ave.	Toronto, Ont., Can.
C. H. Wendt	601 So. 50th Ave.	Omaha, Neb.
Jack Dobson, Jr.	Pineflat	Sonoma, Calif.
H. E. Potter	1 Hayden St.	Binghamton, N. Y.
William Corcoran	26 Arlington Ave.	Auburn, N. Y.

with DT buttons this month can well be proud.

It seems that more and more of the radio fans are turning to the loop aerial as the only means of satisfactory reception. We guess that we are right in that presumption, as the "Strays" column seems to bear us out.

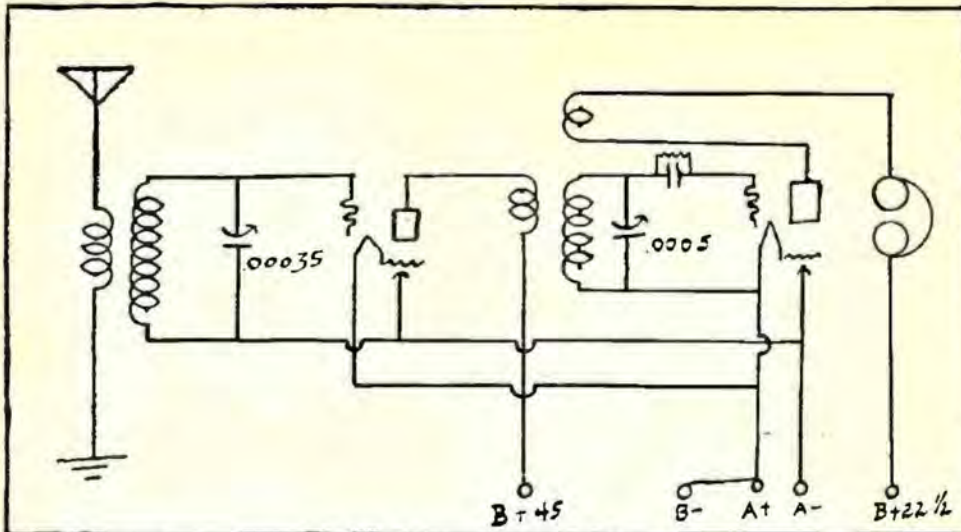
Keep up the good work boys; keep it up.

THE PICK-UPS EDITOR.

## RADIO AGE:

Enclosed please find a sketch of the radio frequency and regenerative outfit that I am using at present, and from which I am getting very good results. With a small thirty-foot aerial I am able to pick up anything east of the Rocky Mountains. I use about twenty-five feet for real DX work, as I find that this reduces interference to a minimum. Using the small aerial, I am able to tune from 200 to 560 meters, and while the





Above is the circuit contributed by Mr. McDonald, showing the method of adding radio frequency to a regenerative set.

volume is not quite as good as it would be with the larger aerial, the selectivity more than makes up for that loss.

For the radio frequency transformer I use a low loss coil of the type that is commonly used in neutrodyne sets, with a .00035 Variable condenser across the secondary. A three circuit tuner is used before the detector tube, and the secondary is tuned with a .0005 variable condenser. As there are any number of three circuit tuners on the market, I will not go into detail here as to their construction.

Using this circuit, I have logged on week nights (not Monday) coast to coast and border to border stations in less than two hours, time.

Very truly yours,  
Chicago, Ill. F. McDONALD.

Mr. McDonald has done considerable experimenting with radio sets and if he says this circuit is good, he really should know. If any of the fans want information as to the winding of the three circuit tuner, it can be obtained from an article in another section of RADIO AGE. Any of you fellows who have three-circuit tuners and desire to add a stage of radio frequency can easily do so by employing this hook-up.

#### RADIO AGE:

Gentlemen:

I am sending you this letter to let you know that I received my DT button all right and that I am mighty proud of it. I feel real chesty as I walk down the street with that little thing stuck in my lapel.

When I got home the other night, there was a letter waiting for me from a fan in Chicago, who had seen my name in the Strays column of RADIO AGE and wanted information regarding the circuit I described. I will answer it immediately and give him all the necessary information so that he will be able to build a set that will work just as well as mine.

I am enclosing a wiring diagram and a description of the set, and if you have room in your valuable columns, you can print it if you see fit.

The circuit is a variation of Mr. Rathbun's (the blueprint Editor) with an aerial adapter. It sure is a DX-er and does not radiate to any great extent. I am not a bit backward in giving Mr. Rathbun credit for the circuit, as all I did was add the coupler, which consists of fifty-five

turns of number 26 wire wound on a tube three inches in diameter. The rotor is wound on a tube slightly smaller in diameter and has six turns on both sides of the shaft. Use the same size wire when winding the rotor.

At present I am experimenting in the hopes to improve the tuner, but I am afraid that I can not do much in this regard, as the circuit seems to be about as near perfect as is possible. Last week I listened to PWX, Havana, Cuba, for half an hour, using only the GROUND CONNECTION. To me that seems like pretty good DX work.

Trusting that you will see fit to publish this letter, and wishing you a Happy and Prosperous New Year, I will close.

Yours very truly,  
GILBERT SLATER,  
88 Linwood Ave., Pawtucket, R. I.

We are very glad to hear from you again, Gilbert, and it gives us real pleasure to publish your circuit in our columns. We like to hear from fans who use the old head once in a while. Most of the radio fans today take too much for granted and don't experiment like the "old timers" (?) did.

Your set must be very good as the results you get with it are just fine; in fact

they seem so good that maybe ye editor will make himself one of 'em.

As Gilbert is good enough to offer his services to any fan who writes him, you fans should see that he gets a few letters.

We have a very interesting account of a receiver built by Ted Gerill, of 5327 Pershing Ave., St. Louis, Mo., on which he gets excellent results. We are going to pass it along to the fans who feel that they would like to experiment with a receiver of this type. Below is Ted's letter:

#### RADIO AGE:

Gentlemen:

As per your request in the January issue of RADIO AGE, I am enclosing hook-up of the set with which I am getting excellent results. I use two 199-type tubes (detector and one step of audio). The circuit as you no doubt can see is the well known single circuit. The condenser and coupler are shielded with tin foil to eliminate body capacity.

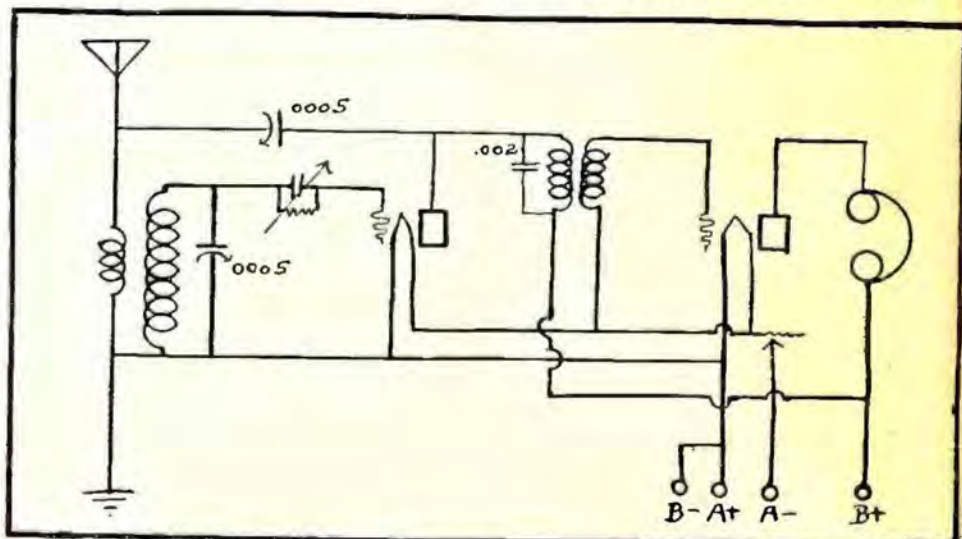
The aerial is about sixty feet long, strung between two poles or masts about thirty feet high. And on clear, cold nights I get very good results. My set with the exception of the head-phones, tube and the audio transformer, was made entirely by myself.

Any of the fans who would care to correspond with me regarding this type of set are cordially invited to do so.

Yours radio respectfully,  
TED GERILL,  
5327 Pershing Ave., St. Louis, Mo.

With the above description and wiring diagram, Ted has given us a list of the stations that can be logged by himself at almost any time. For the sake of permitting some of our readers to make comparisons we will jot down a few: KDKA, KFKB, KFKX, KOA, CNRW, KFI, KNX, KHJ, KPO, WBZ, WCAL, WEA, WGY, WCD, and last but by no means least, 2LO of London, England. Ted evidently is the type of fan that we spoke of in a preceding paragraph; a real experimenter who makes most of his own equipment. For his efforts we are going to take the liberty of admitting him to the great order of the Dial Twisters.

Einar A. Hultman of Jamestown, N. Y., gives something in the radio frequency line, at which he is quite proficient. We are reproducing his letter and



This hookup was contributed by Gilbert Slater. It shows how to add an antenna adapter to Mr. Rathbun's single tube loop set, recently published in blueprint form in RADIO AGE.



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- 2 Precision Jacks
- 1 Bakelite Rheostat, 30-ohm
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- 1 Bakelite Binding Post Strip
- 7 Marked Binding Posts
- 1 Grid Leak and Condenser
- 5 Bakelite Sockets
- 1 .001 Condenser
- 1 .006 Mica Condenser

35 feet Hook-up Wire  
1 Kit consisting of 3 Hazelting Licensed Neutroformers & 2 Neutrodons  
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**\$33.75**

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- 3 Bakelite Sockets
- 2 Thordarson or Columbia A.F. Transformers
- 1 Connecticut Filament Switch
- 2 Bakelite 6-ohm Rheostats
- 2 Bakelite 30-ohm
- 1 Bakelite Potentiometer, 400 ohms
- 1 Carter Double Circuit Jack
- 1 Dubilier 1 mfd. Condenser
- 1 .006 Mica Condenser
- 1 .0005 Mica Condenser and 2 megohm Grid Leak
- 3 .0025 Mica Condensers
- 10 Binding Posts
- 1 .00025 Mica Condenser
- 1 Bakelite Terminal Strip for Binding Posts
- 1 Multicord cable for connecting batteries
- 1 7x30 1/4 Drilled Bakelite Panel
- 1 Baseboard
- 35 ft. Hook-up Wire
- 24 in. Bakelite Dials
- 2 4 1/2 volt C Batteries

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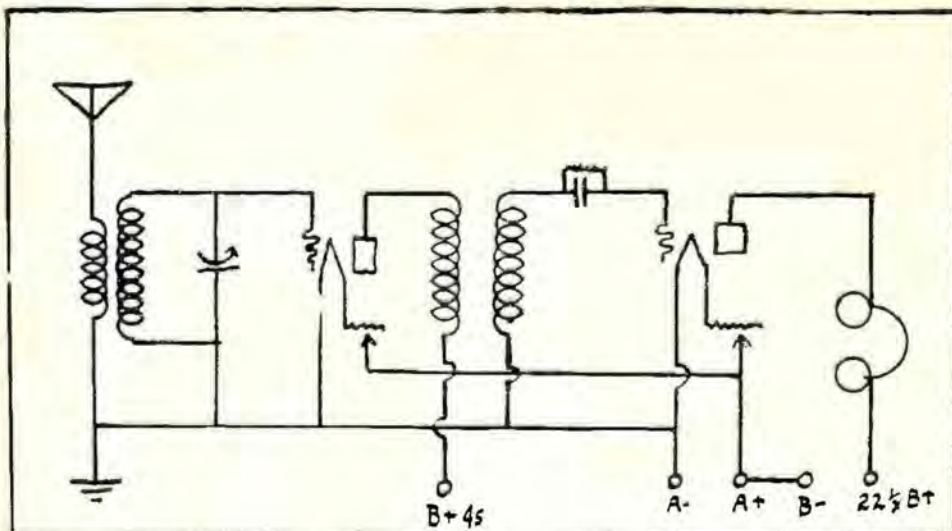
- 1 Cockaday Coil
- 2 23-Plate Hy-Grads Cond.
- 1 Bakelite Rheostat, 6 ohm.
- 2 Bakelite Rheostat, 30 ohm.
- 3 Bakelite Sockets
- 1 High ratio Columbia or Thordarson Transformer
- 1 Single Circuit Jack
- 1 low ratio Columbia or Thordarson Transformer
- 2 Double Circuit Jacks
- 2 3 in. Bakelite Dials,
- 1 Grid Leak and Mica Cond.
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- 7 Binding Posts
- 1 7x21 1/4 in. Drilled Bakelite Panel
- 3 Bezels
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- 1 switch lever
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Complete blue-prints and wiring diagrams.

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1-Tube Set..... **\$10.45**





One stage of radio frequency and detector is shown in this wiring diagram, the work of Ted Gerill, who gets wonderful results. Write him about it and he'll furnish further details.

wiring diagram and trust that any of the fans who are having trouble with a circuit of this type will find his contribution a help.

RADIO AGE:  
Gentlemen:

Enclosed is a list of the stations I have received on my set, which I constructed myself. It employs one stage of radio frequency amplification and I am getting wonderful results with it.

The R. F. Transformers are of the air core type, such as are used in the neutrodyne circuit, and the secondary is tuned with a small condenser. The circuit is not critical and the condenser settings will always be the same. Any one desiring further information on the subject can address me at my home if he so desires.

Very truly yours,

EINAR A. HULTMAN,  
97 Baker St., Jamestown, N. Y.

Some of the stations received by Mr. Hultman speak well for the sensitiveness of the set: WCAL, WTAS, WOS,

WEBN, WSB, WLS, KYW, KFKX, CKAC and plenty of others. Any of you fellows who want information on circuits of this type are requested to get in touch with him. With a list like that, is he entitled to a DT button, fellows? I'll say so. So here goes.

#### STRAYS

Jack Deason, Jr., of Pineflat, Calif., reports that he is able to receive over 500 miles on his crystal set, with more or less regularity. He has, besides the crystal set, a two circuit tuner with one stage of amplification, on which he has received quite a few of the east coast stations and Havana, Cuba, PWX. Most of his success he attributes to location, but then we know that quite a little of it goes to good construction.

It must be an ideal place for reception, up around Toronto, Canada, judging by the way the DX lists read from that part of the country. We just have another darb from G. Titmarsh, who has logged two stations in California (KGO and

KHJ) in one evening, and held them for over two hours each. That is quite a nice record for some other DT to shoot at.

We have a communication from Paul Hayes, 918 Bell St., Pasadena, Calif., who is very anxious to become a DT. The list he submits surely will allow us to admit him to the order. He is one of those fans who are commonly known as "hams" or "brass pounders," and the number of 6's that he has worked, in Hawaii, is a caution. And this reminds us—what has become of the relay boys who sit up till the milk man comes around and the commercial operators both ashore and ashore who have plenty of interesting things to report in these columns? Let's hear from some of you once in a while.

William Vreeland, Jr., reports that he received 2EH Edinburgh, Scotland, during the International Test Week, and that he has an official confirmation from that station. He uses a neutrodyne hook-up.

A letter from Hugh Jones of Tampa, Fla., tells us about the interference the fans in his part of the country have with the ships on the Gulf of Mexico. Despite this fact, he has a very good list of DX stations and we certainly are going to award him a DT button for his perseverance in "standing by" and getting through.

Here is a record for some of the one tube fans to shoot at. William Barker of 571 Linwood Ave., Columbia, Ohio, has received KHJ, WDAF, WHB, WOS, KGO, CFCA, WOAK, KYW and a "flock" of others. Yes sir, he gets his DT Button.

If Marion S. Corly will send us her address we will send her a DT button, as the list of stations she submitted entitles her to one, but since she failed to give her address we are unable to mail it out. Many of these "lady bugs" could give us

## End your Radio Troubles for 30c in Stamps

We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups to be found in these issues. Select the ones you want and enclose 30c in stamps for each desired. The supply is getting low, so enrich your store of radio knowledge by laying in an ample stock of copies NOW!

#### May, 1922

—How to make a simple Crystal Set for \$6.

#### September, 1922

—How to make a Regenerative Set at a low cost.

#### October, 1922

—How to make a Tube Unit for \$23 to \$37.

—How to make an Audio Frequency Amplifying Transformer.

#### November, 1922

—Design of a portable short-wave radio wavemeter.

#### May, 1923

—How to make a portable Reinarts set for summer use.

#### June, 1923

—How to build the new Kaufman receiver.

—What about your antenna?

#### December, 1923

—Building the Haynes Receiver.

—Combined Amplifier and Loud Speaker.

—A selective Crystal Receiver.

#### January, 1924

—Tuning Out Interference—Wave Traps—Eliminators

—Filters.

—A Junior Super-Heterodyne.

—Push-Pull Amplifier.

—Rosenbloom Circuit.

#### March, 1924

—An Eight-Tube Super-Heterodyne.

—A simple, low loss tuner.

—A Tuned Radio Frequency Amplifier.

—Simple Reflex Set.

#### April, 1924

—An Efficient Super-Heterodyne (fully illustrated).

—A Ten-Dollar Receiver.

—Anti-Body Capacity Hookups.

—Reflexing the Three-Circuit Tuner.

—Index and Best two installments of Radio Age Data Sheets.

#### May, 1924

—Construction of a Simple Portable Set.

—Radio Panels.

—Third Installment of Radio Age Data Sheets.

#### June, 1924

—Important Factors in Constructing a Super-Heterodyne.

—A Universal Amplifier.

—A Sure Fire Reflex Set.

—Adding Radio and Audio to Baby Heterodyne.

—Radio Age Data Sheets.

#### July, 1924

—A Portable Tuned Impedance Reflex.

—Operating Detector Tube by Grid Bias.

—A Three-Tube Wizard Circuit.

—Data Sheets.

#### August, 1924

—Breaking Into Radio Without a Diagram.

—The English 4-Element Tube.

—Filtered Heterodyne Audio Stages.

—An Audio Amplifier Without an "A" Battery.

—Data Sheets.

#### September, 1924

—How Careful Mounting Will Improve Reception.

—One Tuning Control for Hair's Breadth Selectivity.

—Four Pages of Real Blueprints of a New Baby Heterodyne and an Aperiodic Variometer Set.

—Data Sheets.

#### October, 1924

—An Easily Made Super-Het.

—Two Radio and Two Audio for Clear Tone.

—A Simple Regenerative Set.

—The Ultradyne for Real DX.

—Real Blueprints of a 3-Tube Neutrodyne and a Mid-Get Reflex Set.

#### November, 1924

—Blueprints of a Single Tube Loop Set and a capacity

Feedback Receiver.

—A 3-Tube Low Loss Regenerator.

—Mastering the 3-Circuit Tuner.

#### December, 1924

—Blueprints of a New 8-Tube Super-Heterodyne.

—How to Make a Receiver that Minimizes Static.

—A Trans-Atlantic DX Receiver.

—How to Make a Home Made Battery Charger and a Loud Speaker at a Small Cost.

#### January, 1925

—A Reflexed Neutrodyne

—A Six Tube Super-Het

—An Efficient Portable Set

—A Tuned Plate Regenerator

—Making a Station-Finder

RADIO AGE, Inc.

500 N. Dearborn St., Chicago



some dandy DX lists if they would but take a few minutes and drop us a line. This month we are lucky; we have two with us.

Gentlemen:

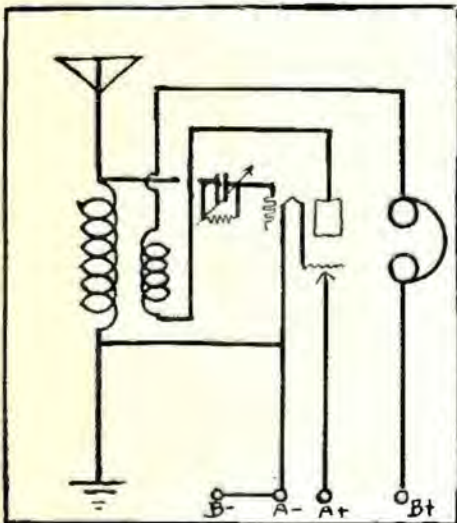
I have built many sets and tried many hookups, having success with them all. The only hook-up I had not tried was the reflex. Being a constant reader of your magazine, I ran across your single control Midget receiver. I built this set and of course it had to be like this; it would not work.

After experimenting night after night I began to get discouraged, leaving it rest for a few days. I tried again, but to no avail. Finally I began to get discouraged with RADIO AGE. Knowing I must have made a mistake, I looked for that issue, only to find that I had lost it. Finally, deciding to give it up as a bad job, I dismantled the set, only to find



## David Grimes' Choice

The new Grimes 3XP Inverse Duplex circuit has established a new standard for reflex circuits and incidentally for radio reception. In developing this unusual receiver David Grimes tested each piece of apparatus as to its ability to function properly. It is significant that he chose



Here we have a single circuit type of receiver as used by Mr. Hultman in his wonderful DX work.

that the cause of the failure was due to my own carelessness.

In soldering the condenser terminals a small amount of the rosin (I used rosin core solder) had flowed between the binding post on the condenser, and although the joint was soldered perfectly, the rosin acted as an insulator and as a result there was no electrical connection.

I want to beg your pardon for feeling as I did toward RADIO AGE, and at the same time ask you to please forward to me the hook-up of the Midget reflex, which I am sure will this time prove a complete success.

Very truly yours,  
MRS. STEPHEN HERZOG,  
3831 Wilton Ave., Chicago, Ill.

That's an interesting letter from a lady fan, who builds her own. Isn't that the way it usually turns out? Some little thing that just cannot be located, puts the whole set on the hummer. Yes, Mrs. Herzog, we'll forgive you, we know just how you feel. You are to be complimented on your willingness to admit your mistake. The desired hook-up will be forwarded immediately. Hope you have better luck this time.

We have received another letter from H. F. Lovett, who was made a DT last month. He writes a very humorous letter, very much so, and lives in Halifax, N. S. Amongst other things he reports that he has listened to complete programs from KFKX three nights in succession. That's pretty good DX. Same to you, Mr. Lovett. (Turn the page)



# Jefferson Transformers

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| Automobile Ignition Coils       | Furnace and Oil Burner Transformers |
| Jump Spark—Make and Break Coils | Oil Burner Ignition Coils           |



### Send for these hookups

Included among the circuits for which we will send you complete working drawings are the Grimes 3XP Inverse Duplex, The Jefferson Baby Grand six tube Superheterodyne and the Jefferson eight tube Superheterodyne. Any of these will be sent upon receipt of five cents in stamps to cover postage.





## Tonal Beauty Lies Deeper than the Varnish

**D**EEPER even than the circuit diagram—chiefly, indeed, in the audio transformer.

All-American engineers, builders for years of the largest selling transformers in the world, have achieved another triumph, in the world's finest transformer at any price. Rauland-Lyric amplification, with an ordinary tuner and loudspeaker, has received the plaudits of musical authorities hitherto skeptical of all radio reproduction.

Perfect amplification makes of radio a joy unending. Who shall say that such a benefit is not worth the slight additional cost?

There is romance in the story of Rauland-Lyric. A request will bring it to you complete—from the laboratory studies to the auditions with world-famous music critics. Rauland Manufacturing Company, 2680 Coyne Street, Chicago.

The price is nine dollars

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**Rauland-Lyric**  
AN  
**ALL-AMERICAN**  
TRADE MARK  
**TRANSFORMER**

The Choice of Noted Music Critics

H. R. Pruitt of Fillmore, Ind., has submitted a very interesting account of a circuit that is proving quite popular in his part of the country. It seems to be a variation of the well known Autoplex. Sorry that we haven't room to print it, but he says he will answer all communications that are addressed to him.

R. J. Dolan, of Nelson, N. B., Canada, submits a list of stations that he received on his single tube loop set, as described by our Mr. Rathbun a few months back, that would make most fans turn green with envy. Amongst others is a verified report from KGO, over 3,000 miles from his city. That IS real DX work. Stick to it Mr. Dolan; stick to it.

It seems that this past month was quite a good one for the single tube fan. Harry E. Lake of 1529 Stone St., Flint, Mich., reports receiving Aberdeen, Scotland, Madrid, Spain, Havana, Cuba and a flock of distant stations on a single circuit outfit, during the International Test Week.

Archie H. Klingbeil, 258 Prospect Street, Ashtabula, Ohio, hands in a report of stations received on his five tube neutrodyne. His log is very complete. Very few professional operators keep a better one. You have the right idea, Archie; that's the way they should be kept.

M. Watson, who listens in from 1925 Bigelow St., Cincinnati, Ohio, has a world of interesting dope for the crystal fans if they will but write him. As there has been more or less interference in that city until recently, when the transmitting bands were adjusted, he knows of what he speaks. Sorry, but our space is not large enough this month to permit us to print your contribution.

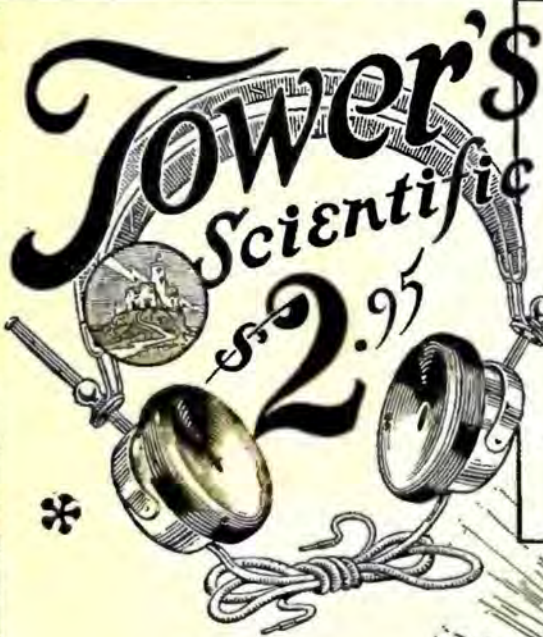
Ralph Riley of Oakland, Calif., writes to let us know what good results he is getting from his first set, which he constructed from one of our isometric drawings. As he is a new fan, and this was his first set, he seems to be considerably surprised that it operates correctly. That just proves that our slogan, "Let our Hook-ups be your guide," is correct.

James Grindle of Hammond, Ind., certainly gets a DT button for the list of stations he submits. He has an "ultradyn" built from RADIO AGE instructions and he certainly is getting wonderful results with it. All his stations are received on a 36 inch loop, and he has logged practically every station in North America together with plenty of European ones. His set must be very selective, as he has heard amateurs in practically every district. He picked up six foreign stations during the International Test Week, and has certificates of verification from all of them to prove reception.

Any of our readers who want some real information regarding the Haynes DX circuit can get worth-while information from Roy M. Canfield of 45 No. Park Ave., East Orange, N. J. He submitted a very interesting article regarding this set's construction and operation. Perhaps we can publish it in a future issue of RADIO AGE.

E. E. Richmonds of Waynesville, Ill., wants to hear from some of the "Reinartz" fans, whom he thinks are going back on the old circuit. If he only could see our mail, I know he would think different. He is a real follower of John L., and his letter proves that he has done considerable experimenting with this circuit.





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Tower's Scientifics bring joy and happiness into more than a million homes every day. All the quality of phones selling at much higher prices.

Only Government Licensed Radio Operators are allowed to test and approve TOWER'S Scientific Headsets, thus guaranteeing uniform tone quality.

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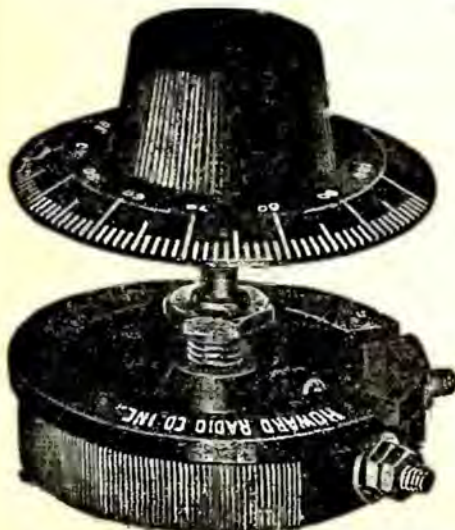


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“COMET”  
“B” BATTERIES

At all good radio stores or write

ELECTRICAL MFG. AGENCY  
25 N. Dearborn St., Chicago, Ill.

## Meet Our First Radio Mother

(Continued from page 33)

Stars from the KYW studio gave the program and met their many friends in the radio audience.

So popular was the first tea and so crowded for the children that Mrs. Peterson promised her “radio kiddies” that she would have a special Christmas party for them, with a Christmas tree and gifts for all. Again every available place was filled with radio families. Children were perched on top of the ice box, on the stove and on the platform. When Mrs. Peterson turned Santa Claus and gave them a gingerbread woman cookie which she had made especially for them, in addition to a box of candy, their joy was unbounded.

### The Children All Know Her

RECENTLY the phone rang just before Mrs. Peterson was to broadcast. “This is Dr. Blank talking. I have a little patient who has been very ill. She told me this morning when I called that if you would only speak to her over the radio it would make her well faster than any of my medicine. Could you just say, ‘Good morning, Peggy?’”

And that morning over the air Mrs. Peterson's cheering voice said, “Good morning, Peggy. You are better. Call me on the phone when you are able to sit up.”

### A Real Cooking Class Over the Air

A course in general cooking in a series of twelve lessons, covering everything from soup to desserts, has been given twice. Registrations were made by mail, with the understanding that to each woman reporting that she had tried the recipes from nine out of the twelve lessons, a certificate would be issued. If any difficulties arose in making the recipe, if any part was not clear, a question by mail brought a prompt answer, which pointed out the mistake and made success assured.

Several thousand women registered for these courses and came into the Home Service Department for the graduating exercises at the end of the course.

Now hundreds of women are asking for an advanced cooking class by radio, and it has been arranged to give a series of twelve lessons in January. These lessons are based on Mrs. Peterson's new radio cook book, “Simplified Cooking.”

To make it easy to jot down the recipes and keep them in a permanent book, Mr. Paul D. Warren, Superintendent of Home Service, has prepared a radio recipe note book, complete with space for index, in addition to forty-eight blank pages, sent free to all radio listeners in Chicago, and available to all others for three two cent stamps to cover cost and postage.

“No wonder the men like this service,” says Mrs. Peterson; “it is headed by a man. I want every radio pal of mine to know that the real inspiration of this service is Mr. Warren, who makes possible the carrying out of all our most delightful plans.” (Turn to page 57)

\* Tested and Approved by RADIO AGE \*

## —proving the need of FIL-KO-LEAK SCIENTIFICALLY CORRECT

Here's a typical “grid log” which shows the need of a variable grid leak. A Fil-Ko-Leak was substituted for a 1 meg. fixed leak. It was adjusted for each station until volume was greatest and distortion eliminated.

Note: Only four of thirty-one stations came in with the Fil-Ko-Leak set at 1 megohm, the value of the leak it replaced.

	Megohms
WFAA Dallas, Texas.....	5
WMH Cincinnati, Ohio.....	2 1/2
WSB Atlanta, Ga.....	5
WSH Chicago, Ill.....	2
WGN Chicago, Ill.....	2
*WSAI Cincinnati, Ohio.....	1
WHB Kansas City, Mo.....	1 1/2
WLW Cincinnati, Ohio.....	4
KSD St. Louis, Mo.....	4 1/2
WCBD Zion City, Ill.....	4 1/2
WTAS Elgin, Ill.....	3 1/2
WOC Davenport, Iowa.....	5
KGO Oakland, Cal.....	5
KFI Los Angeles, Cal.....	2 1/2
WDAR Philadelphia, Pa.....	1 1/2
WMAT Springfield, Mass.....	4 1/2
*WBZ Springfield, Mass.....	1
WEAF New York.....	3
WOO Philadelphia, Pa.....	4
WOR Newark, N. J.....	3 1/2
WWJ Detroit, Mich.....	4
*WTAM Cleveland, Ohio.....	1
WOS Jefferson City, Mo.....	2
WTAY Oak Park, Ill.....	3 1/2
KDKA Pittsburgh, Pa.....	1 1/2
KYW Chicago, Ill.....	3 1/2
WDBH Worcester, Mass.....	4 1/2
KFNF Shenandoah, Iowa.....	5
WOJ Chicago, Ill.....	3 1/2
WDAF Kansas City, Mo.....	1
WHK Cleveland, Ohio.....	1 1/2

\$2.00

In Canada \$2.90



Fits Standard Condensers

Each FIL-KO-LEAK is Hand Calibrated in Megohms

## —for improved reception

YOU can “log” your Fil-Ko-Leak just as you do your other tuning units. You will get stations you never heard before. You will clear up distortion on nearby broadcasters and increase volume of weak, distant stations and get them with crystal clarity. You read Fil-Ko-Leak resistance in exact terms of the megohm through a peep-hole in the panel. (It's also equipped for baseboard mounting). Resistance element is constant and accurate, and is not affected by atmospheric conditions, wear or jarring. Every Fil-Ko-Leak is guaranteed to be perfect electrically and mechanically, and to be accurately calibrated over the operating range for all tubes (1/4 to 5 megohms). This calibration is doubly checked. Literature on improved reception sent on receipt of 2c postage to Dept. RA 225.

MADE AND GUARANTEED BY



DX INSTRUMENT CO  
HARRISBURG, PA.



To offer all of this wonderful service, Mrs. Peterson has to have about her a staff of women trained in Home Economics. Each member of her staff is a specialist and she has been anxious to have her radio family know her Home Service family. For over a year Miss Vivette Gorman, the party specialist, has been giving Sunday night suppers, lunch box suggestions and novelties for entertaining over the radio. Her talks at 9:00 o'clock, Wednesday evening from Station K.Y.W. have solved the problem for many a hostess in distinctive entertaining.

In accordance with the interest shown by the radio pals in knowing the other members of the staff, Mrs. Peterson has introduced Miss Grace Wright and Miss Ruth Yoe for a series of weekly food talks.

"What is our recompense for this wonderful service?" says Mrs. Peterson. "It lies in knowing that all over this country women are finding cooking a joy, not a job, and that they tune in at 11:35 each morning to find a friend who goes into the kitchen with them. The kitchen is the heart of the home. Through it we truly serve."

Mandolinist Deluxe



Above is an "action" photo of Zygmont Nowicki, mandolinist who has appeared recently on RADIO AGE programs from the Congress Hotel studio of KYW, Chicago. Mr. Nowicki is connected with the Polish consulate at Chicago and is widely known for his prowess with the mandolin. He appeared for RADIO AGE'S last program on January 3, beginning at midnight, and is scheduled to be on the air for this magazine again on Saturday, February 7, from the same station at the same hour.

# BAKELITE

TRADE MARK REG. U. S. PAT. OFF.



## Endorsed by Remler, Too—

Manufacturers know from experience that radio parts must be constructed with the best materials, if satisfactory service is to be obtained. That is why the Remler Radio Mfg. Co., of San Francisco uses Bakelite for tube sockets, variometers and many other parts.

As an insulation, Bakelite is in a class by itself. It possesses high dielectric strength, is unaffected by atmospheric changes, and its properties are not impaired with age.

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### Complete Radio Outfits

on Easy Monthly Payments.

Marshall 4 and 5 tube radio frequency sets—the latest development in radio design—the sensation of the present season—wonderfully selective—perfect in musical quality—in solid mahogany cabinets with built-in loud speaker, sold direct to you at surprisingly low prices, a small payment down, balance in easy monthly payments after trial.

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Send today for full information regarding these marvelous sets and our unprecedented offer of 2 weeks' FREE Trial.  
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RADIO AGE ANNUAL for 1925, Now Ready!



# When Winter Winds Blow Cold



## FRESHMAN MASTERPIECE

*\* The Greatest Value Ever Offered.  
In A Radio Receiving Set!*

**A 5-tube tuned Radio Frequency Set** 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.

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,

*It is Mighty Easy to Operate*

**Have Your Dealer Install One in Your Home!**

All genuine Freshman Masterpiece Sets have a serial number and trade-mark riveted on the sub-panel. The Receiver is not guaranteed if number has been removed or tampered with.

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*Radio & Condenser Products*

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**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. KLABAG RADIO LABORATORIES, KENT, OHIO

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One of the first and still in the lead.  
Write for discounts.

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**Tuned Radio Frequency Kit**

**\$17<sup>50</sup>**



**It's Easy to Build**

a five tube radio frequency receiver when you use the Freshman Masterpiece Kit. The result will be a receiver that will bring in even the most distant stations with the volume and clarity of locals. The equal of any 5 tube set in selectivity, simplicity of operation and all around efficiency.

**No Neutralizing or Balancing Condensers Required**

**60**

Ask your dealer to install one in your home. Beware of imitations and Counterfeits.

**The Standard of the World**



The base-type  
**Freshman Variable Grid Leak**  
is the standard for those who build their own sets. It is the most compact and being entirely sealed it always remains unaffected by any climatic conditions.

Complete with either .00025 or .0005 Freshman Condenser—**\$1.00**  
without condenser..... .75

*At your dealer's, otherwise send purchase price and you will be supplied postpaid*

Chas. Freshman Company, Inc.  
Freshman Bldg.,  
240-248 W. 40th St., N. Y.

**The Annual's Ready!**

\* Tested and Approved by RADIO AGE \*

## Who's the Red-Headed Girl from WFAA?

(Continued from page 35)

"I have played the piano since I was large enough," she continued. "All of my playing is by ear and I have always picked up any unusual little songs that struck me as unique from people and phonograph records. I don't care much for the usual popular music. I do sing and play some of it, but I like the others best.

"My pianologues have always made a hit at parties, and I have always enjoyed doing them. Adam Calhoun, announcer for WFAA, heard me once and thereafter continually begged me to give a radio program, which I positively refused to do.

"Not that I didn't want to, but I had no idea that people would like anything that I could do. One day Mr. Calhoun came up and asked me to come to the studio and play some for him while he made a few tests in the operating room. Of course, I didn't mind doing that, and I don't remember anything that I played and sang, but without my knowledge or consent, that was my debut into radioland."

Dear reader, have you ever written the "Red-Headed Girl" a card or letter of appreciation? Yes? Then it might have been you who first informed her that her voice had been heard outside of the studio.

Don't fail to give Mr. Calhoun his share of the credit for these popular concerts, for it was a clever ruse that he worked to get her before Mr. Mike.

"Was I angry? No, I was flattered indeed to receive mail in such quantities," she confided. "I enjoy giving my programs as much as my audience does hearing them.

**She's Modest, Too**

"I DON'T sing; I don't even attempt to sing, and about the hardest blow I have ever received was in a recent letter asking who my accompanist was. My playing is my one redeeming feature and my singing is accidental. Three numbers that never fail to bring applause are "Baby Vampire," "Please Keep Out of My Dreams" and "Broadway Taxicab."

These unique programs have brought her invitations from many towns to appear in person but only one has been accepted, that being in her old home town, Greenville.

"I read and play golf but I have more fun reading my radio mail than anything else. I get letters from everywhere and some of the cleverest poems imaginable."

Unlike some popular artists, the "Red-Headed Girl" does not carelessly file her mail in the waste basket without reading it. She reads it all and thoroughly enjoys it.

**Radio Age's Schedule on the Air**

From WEBH (370) Tuesday evening, January 27, 9 to 10 p. m.

From KYW, Saturday, February 7, midnight to 2 a. m., 536 meters. Jazz carnival.

From WTAY (283) Oak Park, Ill., technical talks every Wednesday evening at 9:45.



### Detroit Attends Opening of WCX

(Continued from page 37)

force, so a word about them will not be inappropriate. There are two orchestras, and a symphony trio. The orchestras are dance and concert, and are the only Victor Recording orchestras in Detroit. C. W. Kirby, director of WWJ, the Detroit News station, was up in the studio and he told me about Jean's music makers. He is quite proud of them, for he started them on the road to fame by having them broadcast through his station. Kirby was on hand to congratulate his competitors on their fine station. Most readers will remember that Kirby is one of the country's hardest fighters against women announcers, but I am sure that everybody would be as thrilled as I was by his little wife's graceful Highland twists of speech.

The job of getting the station in broadcasting order is a tribute to the hard-working Mr. Tony, who is director. I had come up there in the morning to get the invitation and I saw a bare room.

"You're not going to broadcast from here, are you?" I asked in amazement, for completion seemed a month off, instead of a bare ten hours.

"Sure," replied Tony; and sure enough, it was all ready and in good shape that night.

THE station broadcasts on 500 watts, and carries much farther now from its high position than it did from the old Detroit Free Press building. Since the opening night, reports of reception at distances unapproachable in the old days have been reported. Which seems to be an argument for tall towers and great heights for all stations which hope to reach out.

WCX was opened on May 4, 1922, and acquired a great reputation for its "Red Apple Club" and church services sent from the Central Methodist Episcopal church in Detroit. These were so impressive that a man once sent in a check for \$500 in appreciation of the services.

### Chas. Freshman Co. Moves

Demand for the Freshman Masterpiece 5 tube tuned radio frequency receiver, which within a period of less than six months has assumed world wide proportions, has compelled the Chas. Freshman Co., Inc., to move into the brand new twelve story fire-proof building at 240-8 W. 40th St., New York, known as the Freshman Building.

The vastly increased space and every known manufacturing convenience will enable the Freshman Company to more than double the productions of the Masterpiece and their line of small radio parts.

It may interest those persons who are interested in the growth of radio to know that this company started in business with a single item—the "Antenella"—a light socket plug that eliminates the use of an aerial and other outside wiring, only two and one-half years ago. Growing to a point where the monthly business is over the million dollar mark within this period speaks highly for the public interest in radio.

# \* A new Tungar!



The new Tungar does all the old Tungar did—and more. It will charge both radio A and B batteries, with no change except slipping the wire from one terminal to another. It charges 2, 4 or 6 volt A batteries—24 to 96 volt B batteries—and auto batteries, too.

It is simpler than ever to use. Just two clips and a plug. No need to disconnect your battery from your set, or make any change in the wiring. The Tungar charges overnight while you sleep. And it makes no disturbing noise.

It is more compact than ever. It has a new bulb, unchanged in principle, but more convenient in size and use. G-E research has made a good product better!

Keep your batteries charged with a Tungar—and get the most out of radio.



300,000  
Tungars  
already  
in use!

The new Tungar charges both radio A and B batteries, and auto batteries, too. Two ampere size (East of the Rockies) . . . \$18

The Tungar is also available in five ampere size (East of the Rockies) \$28

60 cycles—110 volts

## Tungar

REG. U.S. PAT. OFF.

### BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the nameplate.

Merchandise Department  
General Electric Company  
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# GENERAL ELECTRIC

## RADIO AGE SUBSCRIPTION BLANK

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500 North Dearborn Street,  
Chicago

Gentlemen: Please enter my subscription for RADIO AGE, the Magazine of the Hour, for one year, beginning with your next issue, for which I enclose \$2.50.

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## First for Reception

Tremendously increased range and power are yours from the moment you install a Jiffy Ribbon Antenna. Far distant stations—programs—hitherto beyond your range, are quickly, surely reached with this exceptionally efficient aerial.

Jiffy Ribbon Antenna is winning enthusiastic public favor everywhere. It is not a copper aerial—thus, it is immune to oxidization and is guaranteed absolutely non-corrosive. It has great tensile strength—will not kink or curl and remains bright and clean month after month.

Enjoy full reception and absolute efficiency from your set by equipping it with a Jiffy Ribbon Antenna.

Comes in 100 foot lengths complete with insulators ready for installation—



**\$1.50**

*Most good dealers carry  
Jiffy Ribbon Antenna.  
If yours cannot supply  
you—order direct.*

MAIL TODAY

Apex Stamping Company,  
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Send me.....Jiffy Ribbon Antenna. I agree to  
pay postman \$1.50 each, plus few pennies postage.

Name.....

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## Low Loss Tuners That Give Results



Made in amateur, and broadcast types. Price \$7.00. A post card will bring it to you. We pay postage and insurance. Descriptive literature and hookup sent free on request.

**DAVENPORT RADIO  
LABORATORIES**

Davenport, - - - Iowa

## The Radio Age Annual

For 1925

## Is Now Ready!

With its 32 page blueprint section and countless other technical features, the ANNUAL for 1925 comprises the biggest dollar's worth ever offered to the radio public.

ORDER YOURS NOW OR YOU  
MAY BE TOO LATE

One Dollar a copy

COUPON ON PAGE 80

## Pity the Poor Radio "Outside Man"

(Continued from page 30)

thing to say a certain job will be broadcast, and it is entirely a different proposition to do it. For that reason Westinghouse has to depend upon the initiative, ingenuity and resourcefulness of its outside man. The seeming impossibilities and the heartbreaks sometimes released to lessen the pressure on an overworked and overwrought outside man, are all unknown to the radio public. What has transpired leading up to the event is never known except in the inner circle of operations where the boys can unburden themselves of all the details.

At the present time KYW happens to have as its outside man, John J. Michaels, an ex-seagoing operator, about as tall as a minute but imbued with plenty of grit and radio acumen. How he came to give up the sea life is a mystery even to Michaels himself, for he is of the type that will always have the tang of sea air no matter in what walk of life he may be strolling.

KYW will have booked a job at the stockyards in which it is planned to pick up the speech of some notable at a meeting. The first thing Mike hears of it is a little written slip on which is given the location, the time, the date and where the microphone is to be located. So far, so good. Mike goes ahead, assembling a coil or two and three wires, the first for telephonic communication, and the second for a microphone line. Then he resurrects a line amplifier from the stock room, adds to this an eight volt storage battery for the filaments, and four blocks of 45 volt B batteries for the plates of the amplifier tubes. Next, he corrals a couple of microphones and a stand or two. Some of the plunder he loads into an army case and the rest of it is strapped on the outside. Oh, yes, he has almost forgotten the test set and his own tool kit.

When all of these items have been run to earth, Mike lugs them to the elevator and down to the street where he chartered a taxi. Arrived at his destination, he finds the job is two flights up and no elevator.

On arrival he leaves his first load and goes down for the second, mopping his brow and wondering how the weather is off Hatteras. Finally, after a struggle, he gets all of his stuff on the top floor. Then he sets out to search for the master of ceremonies to find where the microphone can be placed to best advantage, also where the announcer is to sit so a microphone with a switching arrangement can be installed for this worthy. He finds the thirty-second under-secretary of the chairman who tells him all the places where he may NOT put the microphone. Appeals to reason are of no avail, so Mike goes looking for the main steer who can say yes or no. Sometimes he finds him; sometimes not. Always the man higher up is easier to approach and do business with than the many small caliber minions to be encountered. So Mike strings his lines, finds a place in which to operate the amplifier, rings into the station on the Edison building for a test, and all is well until the moment of broadcasting.

Just about two minutes before the program is to go on, it is found that some enterprising waiter has kicked down the microphone line, or someone has cut it because it does not harmonize with the color scheme for the evening. Mike, cussing inwardly, but outwardly calm,



restores it to its original form, and the stunt begins.

After the event is over Mike loads all his "junk" and rushes back into a taxi and returns to the station to dispose of them and seek solace in sleep, having nightmares of the job booked on the morrow.

KYW has always been especially active in broadcasting outside jobs that would appeal to its radio public, and the outside man has more than his share of the work. One job in a theater nearly caused Mike to lose his mind, for the management absolutely refused to allow the microphones to be seen by the audience. Hence they were hidden down by the footlights under a tin enclosure where the stamp of feet, the tinny reverberation of the footlights and baking from powerful lights almost ruined the microphones and the broadcasting.

You can never tell where you are likely to find the outside man. One day he will be at a football game; the next finds him crouched in the organ loft of a church picking up music and dust. The next day he might be under the river in the tunnel picking up whatever might be going on. If tomorrow Mike is told that KYW is to broadcast the blubber of the Eskimos, he will merely smile, pack up his plunder and consult a time table for the next dog train from Spitsbergen or Sitka.

### How Young Banks Kennedy "Arranged It"

(Continued from page 38)

BANKS' musical endeavor is by no means confined to "arranging" one song. He is the proud author of such songs as "Dream Ships that Pass In the Night," "Crying for the Moon," "Harold Teen," and several other beautiful as well as eccentric pieces that have won favor both with the radio listeners and theater patrons in the Middle West.

Banks has a personality in the radio studio that makes him well-liked at once. And, strange to say, this personality emanates from the radio studio and reaches the hearths where the loud speaker sends his joyful ditties into thousands of homes. As Eddie Borroff of KYW would say, "Banks arranges it somehow."

There can be no better way to close this article than to recite one of the thousands of "Arrange it" verses. We repeat the following because it pertains to radio. You'll have to listen in to get the others. We hope, anyway, that no matter how famous Banks gets, that he'll never be too proud to write a few hundred more "If I Can Arrange It" verses. Here we go:

"I'm going to buy me a radio set,  
If I can Arrange it;  
It's going to be the best made, you bet,  
If I can Arrange it.  
It must get London and Paris, of course—  
I want to hear the Prince fall off of his horse—  
If I can Arrange it—  
Arrange it, somehow.

#### CHORUS:

"For I'm an arranger,  
A first class arranger,  
The best in the land, can't you see?  
There's hardly a thing in this wide,  
wide world,  
That hasn't been arranged by me!"

# You will be satisfied with a "Pacentized" set

THE man who uses Pacent Radio Essentials in building his set has the assurance that he is using the finest parts that engineering skill and trained hands can build.

That this confidence is not misplaced is shown by the fact that over 40 of the leading radio set manufacturers use one or more Pacent Radio Essentials for standard equipment. This shows the leadership that Pacent has attained in the radio parts industry.

Select the parts for the new set you contemplate building from the list given opposite. Get them from your favorite dealer—he carries them or can get them for you.

**PACENT ELECTRIC COMPANY**  
Incorporated  
91 Seventh Ave., New York City  
Washington Minneapolis Boston San Francisco  
Chicago Birmingham Philadelphia St. Louis  
Buffalo Jacksonville Detroit

**PACENT**  
Radio Essentials

- Adapters
- Improved Audioformer
- Autoplug
- Coil Plug
- Coil Plug Receptacle
- Condensers, Low Loss
- Detector Stand
- Duojack
- Duoplug
- Duo-Lateral Coils
- Headsets, Everytone
- Jacks
- Jack Set
- Radioloop
- Loop Plug
- Loop Jack
- Multijack
- Plugs
- Potentiometers
- Rheostats
- Resistors, Laboratory
- Sockets
- Twinadapter, etc., etc.

TRADE MARK

## \* Pacent RADIO ESSENTIALS

DON'T IMPROVISE - PACENTIZE



Noiseless Grid Leak

40c

each in any value from 1/4 to 10

FRESHMAN SUPERIOR

*You can depend upon them to remain accurate at all times*

Made of high resistance material impregnated throughout (not coated paper). Unaffected by climatic conditions. Will not deteriorate. Clamped between solid knurled ferrules assuring rigid construction and firm contact at all times.

At your dealer's, otherwise send purchase price and you will be supplied postpaid.

Chas. Freshman Co., Inc., 240-248 W. 40th St., Freshman Bldg., N. Y.

**RADIO AGE ANNUAL FOR 1924—AT SPECIAL PRICE!**

Clip the coupon and send it with 50 cents, and the RADIO AGE ANNUAL FOR 1924 will be sent you by return mail.

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RADIO AGE,  
500 N. Dearborn St., Chicago.

Enclosed is 50 cents, for which send me the RADIO AGE ANNUAL for 1924.

Name .....

Address .....

City .....

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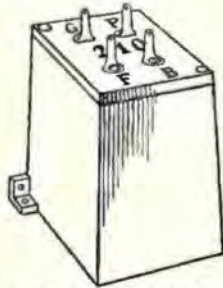
# Silver-Marshall, inc.

RADIO

## \* TWO-TEN and TWO-ELEVEN

Long Wave Transformers

### MATCHED TESTED CHARTED



For Those Who Build The Best

Type TWO-TEN and TWO-ELEVEN Long Wave Transformers are the same as those used in the SILVER-MARSHALL 401 Unit, except that each instrument is now housed in a separate aluminum case with bakelite top.

All curves are charted under the personal supervision of McMurdo Silver, Asso. I. R. E., and all measurements made with a vacuum-tube volt-meter and laboratory amplification measurement equipment of the most advanced type.

These transformers are suitable for use with any tube in from one to four stages, and are supplied in sets of two or three TWO-TENS, and one TWO-ELEVEN, each with identical peaks.

**TWO-TEN**—iron-core intermediate transformer. Passes 11 kilocycle band without distortion. Peaked at 5,000 meters approximately. Provides 1 1/2 to 2 1/2 times the amplification obtainable with any other transformer.

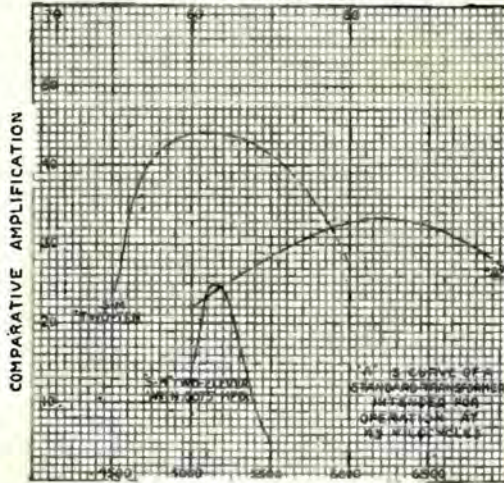
**TWO-ELEVEN**—sharply tuned input or output transformer. Peaked at approximately 5,000 meters. Price, for either transformer, \$8.00.

### An Individual Curve Sheet Goes With Each Instrument

Ask any radio engineer what HE thinks of a long wave transformer and he will say, "Show me its curve." If no measurements are available he will chart its curve and judge accordingly—because the CURVE TELLS THE STORY. That is why the curve of each Type TWO-TEN and TWO-ELEVEN Long Wave Transformer is plotted in the SILVER-MARSHALL laboratory. The characteristic curve is recorded directly upon the tag that accompanies each instrument. It shows the peak, the side-band passed, the amplification to be expected in any circuit. With this definite data you can build your intermediate amplifier with complete assurance of success. Without it, you build by guesswork. Insist upon getting the curve-sheet.

### The Curve Tells the Story

FREQUENCY IN KILOCYCLES



WAVE LENGTH IN METERS

### Parts for the Silver Super

Circulars and prices on parts for the Silver Super will be sent upon request. Mr. Silver's own book, "The Portable Super-Heterodyne," should be owned by every one who means to build this "Seven-tube Wonder Set." Price.....50c

## SILVER-MARSHALL, Inc.

105 So. Wabash Ave., Dept. A  
CHICAGO, ILL.

Eastern Distributors  
TWENTIETH CENTURY  
RADIO CORP.  
102 Flatbush Ave.,  
Brooklyn, New York

## Is There a Radio Trust?

(Continued from page 4.)

The proceedings against Radio Corporation and the seven other respondents are still pending. On April 9, 1924, Radio Corporation filed its answer. Radio Corporation denied the jurisdiction of the Federal Trade Commission to issue the order quoted or to conduct the proceedings.

A rare bit of radio information is presented in the closing paragraph of Radio Corporation's answer. It appears that Radio Corporation was created for "Patriotic Service" and furthermore, that if it had not been for Radio Corporation, the modern art of radio communication would not exist.

The full paragraph is printed as follows:

XXXIII. Respondent alleges that it was created in order to carry out the expressed desires and wishes and at the instigation of officials, officers and servants of the United States; that the respondent was created primarily with a motive of carrying on and it has since carried on a patriotic service of making a world-wide communication system of radio in which the most important influence rests in the United States of America and with American citizens; that certain of the arts and arrangements (and those the most important) in the complaint, complained of were taken under the supervision of officials, officers and servants of the United States; that the acts and arrangements which are in the complaint complained of have been in the public interest and to the public benefit and have been entirely reasonable and have greatly contributed to the rapid growth of the art of radio. Through them and because of this respondent, the modern art of radio communication now exists."

How this "Patriotic Service" of Radio Corporation has worked out in actual practice and in contact with other American individuals and groups of individuals, not so fortunately aided by "officials, officers and servants of the United States" will be shown in later articles. Court decisions on recent attempts of Radio Corporation to enforce patent restrictions have apparently not taken into account the patriotic importance of Radio Corporation.

### "Precision" Features D. X. L. Condensers

One of the newer condensers brought forth this season is the D. X. L. line of Straight Line Low Loss Variable Condensers, manufactured by the D. X. L. Radio Corporation, 5769 Stanton Avenue, Detroit, Michigan. While there are several unusual features of design, the most outstanding point is the precision of construction.

D. X. L. engineers have designed this type of condenser so that power losses are actually too low to measure. Realizing that absolute precision in construction is essential to the maintenance of this standard, the highest quality of materials has been specified and a rigidly inspected production maintained. In the construction solid brass and aluminum of the best quality are used together with a minimum amount of hard rubber for insulation.

## Radio Dealers HEADQUARTERS

Dealers—if you want the best products, the fastest shipments and the most liberal discounts, write on your letterhead for our catalog L1003.

**WAKEM & McLAUGHLIN**  
225 E. ILLINOIS ST. — CHICAGO

## HUDSON-ROSS

Sells only Guaranteed Radio Apparatus.  
Send for discounts.  
123 W. Madison St. Chicago



### CABINETS

If you are interested in a radio cabinet in which is combined both beauty and practicability, just write  
**LAKESIDE SUPPLY CO.**  
Dept. R  
73 West Van Buren St.  
CHICAGO, ILL.  
Telephone, Harrison 3840

Paul Green, the super-het expert, will have another enlightening and instructive article in March RADIO AGE.

\* Tested and Approved by RADIO AGE \*





Reach Out with



**LOW LOSS (Practically No Loss) Straight Line Condenser**  
New Stations - Increased Volume  
Sharper Tuning

Your set—no matter how sensitive—will improve with D. X. L. Condensers. There is practically no power loss. Madrid—London—reach out for them. D. X. L. Condensers, precision built, get the utmost from all sets. D. X. L. is one of this season's achievements—one step forward toward perfection. D. X. L. Condensers range from \$4.00 to \$5.00 list. Ask for literature—you'll be interested in the D. X. L. design.

**Set Manufacturers**

Add to the quality of your set. D. X. L. Condensers will increase your sales enormously. And you can depend on the satisfaction of the owners. Wire for prices and deliveries.

Purchase from your dealer or send money order to factory.

**D. X. L. RADIO CORPORATION**  
5765 Stanton Ave. Detroit, Michigan

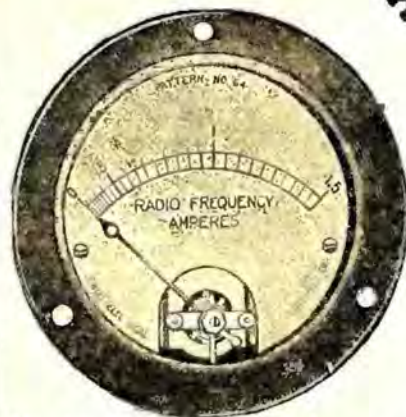


Ask Any Amateur

And he will tell you that the "Jewell Trio" of instruments for transmitting sets are accurate and dependable—yes, the best made. (Our Nos. 54, 64 and 74.)

¶ Send for our Radio Instrument Catalog No. 15-A.

¶ Buy from your dealer.



No. 64 Radio Frequency Ammeter.

Offices in Principal Cities

**Jewell Electrical Instrument Co.**

1650 Walnut St. - Chicago

"25 Years Making Good Instruments"

How the "Girl with the Summer Resort Name" Bowled Over the Sophisticated New York Radio World—Read about Her in the Feature Section of the March RADIO AGE.

**KHJ**  
Los Angeles, Cal.

We are glad to confirm your report of reception of our program.

John S. Daggett,  
"Uncle John,"  
Mgr., Times Radio Staff.

**General Electric Company**

Pacific Coast Broadcasting Station  
KGO  
5555 E. 14th St. Oakland, Cal.  
Sept. 11, 1924.

Mr. T. J. Kennedy,  
1360 University Ave., New York, N. Y.

We are glad to confirm your reception of KGO on the evening of Sept. 6 as we were broadcasting the opera "Carmen."

We always appreciate hearing from our radio listeners and hope that you will be able to pick up KGO regularly.

Yours very truly,  
Jennings Pierce,  
Radio Broadcasting Pub. Dept.

**DX Fans! Confirmations Stop All "Doubting Thomases"**

Confirmations of Stations Received from New York, N. Y., with

**KENNEDY TUNER**

DX Fans! If you want real results, get a **KENNEDY TUNER AND HAVE THE WHOLE U. S. A. AT YOUR FINGER TIPS.**

Only one dial to get stations and the other to increase or decrease volume. **Kennedy Tuner** is used in place of variocoupler, variometer and honeycomb coils, saving the cost of over \$9.00 worth of unnecessary junk that is in most receiving sets, and no dead end losses.

**Kennedy 5.00 Tuner**  
Including Globe Trotter Diagram

**GUARANTEE:**  
If not satisfied after 30 days, we will cheerfully return your money.

**KFI**  
Los Angeles, Cal.

Thanks for your letter received. Yes, "The Minuet," by Louis Parker, was broadcast from the Anthony station during the late program.

Yours, Radio KFI.

**General Electric Company**

Pacific Coast Broadcasting Station  
KGO  
5555 E. 14th St. Oakland, Cal.  
Sept. 4, 1924.

Mr. Vincent T. Kenney,  
124 W. 96th St., New York, N. Y.

We are glad to confirm your reception of our late program from the Hotel St. Francis on the morning of August 27th.

We are always glad to answer any questions of our radio friends and hope you write in often with your comments.

Yours very truly,  
Jennings Pierce,  
Radio Broadcasting Pub. Dept.

**KLZ Denver, Colo.**

We are pleased to acknowledge receipt of your report of reception of our phone station. We have placed a tack in our map for you.

Reynolds Radio, Inc.

Send for Free Diagram

**T. J. KENNEDY**

RADIO GLOBE TROTTER

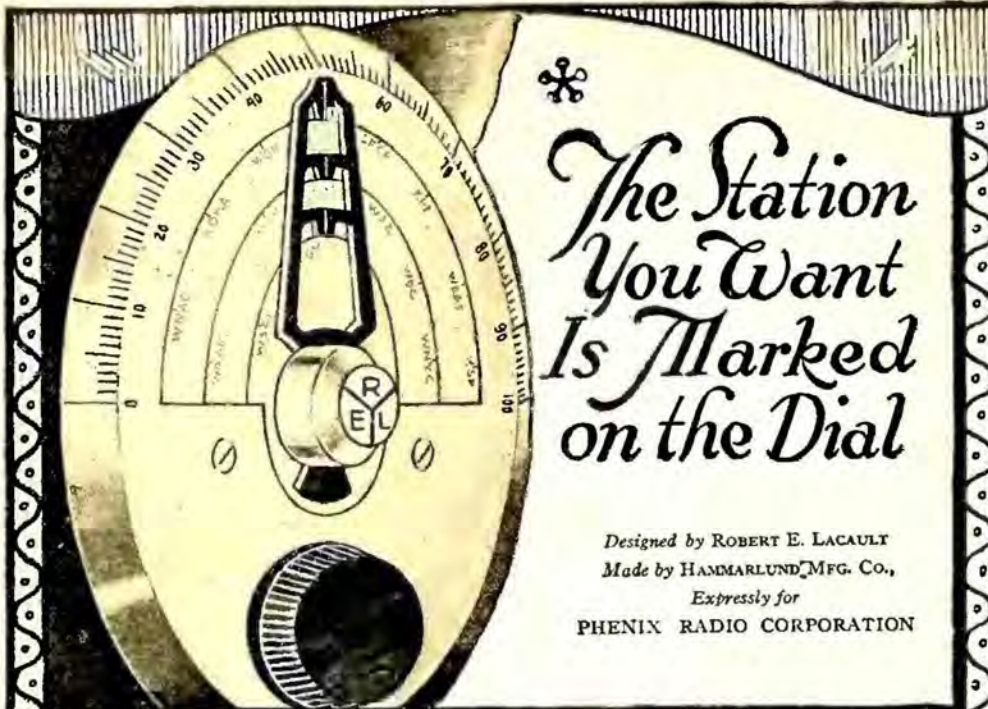
1360 University Ave., New York, N. Y.

**2-LO, London, Eng.**

We beg to acknowledge your reception of our program.

Yours faithfully for the  
British Broadcasting Co., Ltd.,  
Jr. Director, London Station, C. C. H. King





## The Station You Want Is Marked on the Dial

Designed by ROBERT E. LACAULT  
Made by HAMMARLUND MFG. CO.,  
Expressly for  
PHENIX RADIO CORPORATION

## Direct Tuning

Stop fishing for your favorite station. Select the program you want—get it lightning-quick. Replace your old dials with ULTRA-VERNIER Tuning Controls. Then, when you have tuned in a delightful station, pencil-record it on the dial. Never again need you guess or fumble for that station, or bother with wave-lengths. Simply turn the finder to your pencilmark, and you hear it!

Should you move—or a station discontinue or wave-lengths change—erase the marks, leaving the dial beautifully clean and new. Thus, you may now have all the joy of radio, with none of the discouragements. Moreover, the ULTRA-VERNIER is a single vernier tuning control.

At your dealer; otherwise send purchase price and you will be supplied postpaid.

## ULTRA-VERNIER TUNING CONTROL

PHENIX RADIO CORPORATION

3-9 BEEKMAN STREET

NEW YORK CITY



Designed by R. E. Lacault, E. E. A. M. I. R. E., inventor of the famous Ultradyne circuit. This monogram seal (R. E. L.), is your assurance of Lacault design.

\$2.50

At your dealers

Made by the Hammarlund Mfg. Co., your assurance of quality and dependability—produced solely for the Phenix Radio Corporation.

## Converting the Single Circuit

(Continued from page 28)

is left entirely to the desire of the reader. If the present cabinet is large enough to accommodate the additional apparatus, so much the better. By all means use it, as this will preserve the symmetry of the design. If, however, this is impossible, it can be installed on a small auxiliary panel and mounted close to the receiving set. The writer found it is quite satisfactory to mount the unit on a small panel and fasten it by means of a long wood screw directly to the top of the cabinet, which houses the receiver proper.

If an auxiliary panel is used, it will be well for the builder to remember to keep the four connecting wires (indicated by the dotted lines in Figure 4) from the unit to the receiver as far apart as possible.

When mounting on top of the receiver cabinet, I used flexible wire in making the connections from the unit to the receiver, to permit the lifting of the cover. If your set is of the kind described and has two stages of audio amplification, it can be reflexed with the same ease and at less expense. It is not advisable to attempt to add more than one stage of amplification to the one tube reflex. A second stage is seldom used, nor is it desirable.

The single tube will operate a loud speaker on local stations satisfactorily, while one stage of audio amplification will give tremendous volume. Audio amplification is added in the usual way, the phone leads being connected to the primary of the transformer, either direct or through a jack.

### Construction Details

TO build the unit, proceed as follows:  
1. Secure a piece of cardboard tubing 3" in diameter and wind the secondary of the transformer which consists of 51 turns of the No. 22 DCC wire. The primary is wound on top of this and consists of 31 turns of the same size wire, separated from the secondary by a layer of paper or "empire" cloth. The transformer can be mounted either on the back of the condenser or on the baseboard of the auxiliary panel. Any of our readers who do not care to wind the transformer themselves can substitute one of the dependable manufactured coils which are designed for the neotrodyne circuit but will work equally well in this unit.

Any good audio frequency transformer can be used, but the builder is cautioned in selecting this piece of apparatus, as by actual tests the audio transformer has been found to be at fault in 75 per cent of the reflex sets that fail to function.

The crystal detector should be of the fixed type, although one with an adjustable cat-whisker can be used, but the first mentioned is by far the most satisfactory. It is a more sensitive detector and the close, fixed adjustment does not permit of high resistance between its terminals and excludes the possibility of oscillations and squeals. Crystal detectors composed of two minerals are also

## Best for Reflex

and Crystal Sets  
**FRESHMAN**

Double Adjustable  
Crystal Detector

No more searching for the sensitive spot. —Merely turn the knob as you would a dial.

For base or panel mounting, complete with Freshman Super-Crystal **\$1.50**

At your dealer's, otherwise send purchase price and you will be supplied postpaid.

CHAS. FRESHMAN CO., Inc.  
Freshman Bldg., 240-248 W. 40th St.  
New York



## HERCULES

\* Aerial Mast  
All Steel Construction

Painted black complete with galvanized steel guy wires and masthead pulley. 20 ft. mast \$10, 40 ft. mast \$25, 60 ft. mast \$45. We pay freight. Ideal for receiving or transmitting. Greater range. More satisfactory results. Write for literature and large

**FREE BLUEPRINT**

S. W. HULL & CO., Dept. R3  
2048 E. 79th St. Cleveland, Ohio



Now Ready—The RADIO AGE ANNUAL for 1925—One dollar a copy. Get yours Now.

\* Tested and Approved by RADIO AGE \*



very efficient, those using "zincite" and "bornite" giving the best results. The rather heavy pressure on the minerals prevents the adjustment from being disturbed easily. The crystal detector is a very necessary part of the reflex, and as such too much can not be said regarding the selection and operation of this piece of equipment.

As a reflex circuit is largely a radio frequency one, a few words regarding the kind of tube to be used might not be amiss. Soft tubes such as the UV 200, or C-300 cannot be used; neither can one get results with the WD 11 or WD 12 tubes. A hard tube such as the UV201-A, C 301-A, UV 199 or C 299 will give excellent results.

**Eight Million Hear John McCormack**



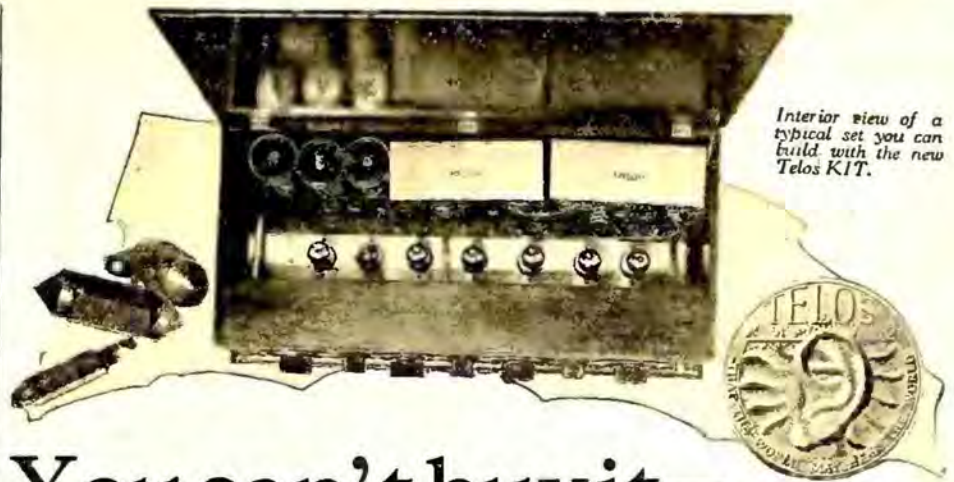
New York.—The golden tenor of John McCormack and the lyric soprano of Lucrezia Bori, borne through the air to an audience of at least 8,000,000 persons, on New Year's Night ushered in a new era of radio broadcasting and raised the question whether there will have to be a realignment of the economic forces which compete in entertaining the public.

Radio has never before been able to draw upon the talent of the world's greatest singers and musicians. McCormack was one of many who repeatedly declined to sing for it.

However, he and Bori stepped over the barrier and from a little room at WEA F, began the experiment which may result in amusement and entertainment changes measured by millions of dollars.

**Linked with Many Stations**  
WEAF was linked up for this program

**SUPER-HETERODYNE**  
Ultradyne—Haynes Griffin—Remler  
Dealers: Send for Discounts  
**HUDSON-ROSS**  
123 W. Madison St. Chicago



**You can't buy it—**

*but if you are the least bit handy with tools, you can build this amazing Telos set yourself in a single afternoon:*

The basic goodness of Telos design is the same as it has been for three years. But now, Telos excellence has been extended to include *three* stages of tuned R. F. and superimposed (reflex) resistance coupled A. F. as well.

The new Telos KIT opens up a world of fascinating possibilities in radio. As in the photo above, you can build a 5, 6 or 7 tube set, and run it all on dry cells. It will cost you less to run than any other set of like power!

You can introduce a crystal detector if desired! you can use transformer

A. F. if you prefer. But no matter what combination you select, you will find clear, unmistakable instructions in the book that comes with every Telos KIT, and you will accomplish results you never thought possible before!

Fill out the coupon now. Get your copy of the new, generously illustrated booklet, "The KIT of a Thousand Possibilities." It's free, but the edition is limited to those who are genuinely interested in superlative radio reception!

**DANZIGER-JONES, Inc.**  
Dept. C. 25 Waverly Place  
NEW YORK, N. Y.



**Telos Radio**

Danziger-Jones, Inc.,  
Dept. C, 25 Waverly Place,  
New York, N. Y.  
Send me at once your booklet "The KIT of a Thousand Possibilities."

Name.....

Address.....



# Amazing Results WITH THE MUSSELMAN INSIDE ANTENNA

**RADIO FANS!** Do you want results you never dreamed were possible—do you want selectivity to the Nth degree—do you want ideal, distortionless reception, clear as a bell, no matter what atmospheric conditions prevail? Then you should have a MUSSELMAN INSIDE ANTENNA—the newest sensation in radio.



**NON-DIRECTIONAL**  
This semi-loop antenna insures wonderful selectivity, positively corrects distortion, yet is absolutely non-directional. It is the only scientifically correct antenna on the market. Hundreds of tests by leading experts pronounce it unbeatable.

**HOW DOES IT WORK?**

Study the small cut within the loop. Note that the MUSSELMAN INSIDE ANTENNA is wound with a special double conductor. First, a copper core; then 1-32 inch rubber insulation; over this an outer braiding of tinned copper wire. The latter acts as an ideal wave collector, the inner core as a metallic ground. Millions of feet of this MUSSELMAN SELECTIVE ANTENNA WIRE have been sold. Coiled loop is mounted in handsome hardwood frame, fitted with binding posts.

**WIRE FOR EVERY RADIO USE**

We manufacture all kinds of insulated radio wire, including colored rubber-covered hook-up wire, lead-in wire, etc. Let us know your requirements, and we will send samples, prices. Tell us your antenna troubles—we can help you.

**MAIL THE COUPON—SEND NO MONEY**

Use the coupon to order the new \$20.00 MUSSELMAN INDOOR ANTENNA at our special introduction price—only one to a customer. Send no money—just pay the postman \$10.00, plus postage. Try this Antenna at our risk—return for refund if not more than pleased with it. If you wish 75 ft. MUSSELMAN SELECTIVE ANTENNA WIRE, pay postman only \$5.00, plus postage. Act today. End your antenna troubles NOW.

**CYCLE MFG. & SUPPLY CO.**  
549 W. Washington Blvd., CHICAGO

Cycle Mfg. & Supply Co., Dept. A  
549 W. Washington Blvd., Chicago.

- Gentlemen:
- ( ) Send me MUSSELMAN INSIDE ANTENNA at your special price of \$10.00.
  - ( ) Send me MUSSELMAN SELECTIVE ANTENNA (75 ft.) \$5.00.

I will pay postman correct amount, plus mailing charges

Name.....

Street.....

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

**\* 100 to 1**

**AMERICAN BRAND**

**CONDENSER**

with the **Worm Drive**

**VERNIER**

**23 PLATE \$5.00**

only \$5.00

**3or Sale**

**Everywhere**

**AMERICAN BRAND CORPORATION**

**8 WEST PARK ST. NEWARK, N. J.**

with WCAP Washington, WJAR Providence, WNAC Boston, WDBY Worcester, WGR Buffalo, WFI Philadelphia, and WCAE Pittsburgh. Thus McCormack and Bori reached an audience a thousand times larger than either had ever entertained at one time before.

What will happen next is already worrying many of those who are in the business of selling entertainment of one kind or another.

When the public, sitting comfortably at home, can have entertainment of the highest caliber without direct expense, will it go miles away and attend the theatre at a cost of \$2.75 and upward for each seat?

Will it buy more phonograph records or fewer records?

Will the thousands of persons who have hitherto managed to resist the lure of the radio capitulate now and overwhelm manufacturers and dealers with orders for receiving sets?

These questions are going to be answered very quickly for the Victor Talking Machine company in co-operation with the American Telephone and Telegraph company, will broadcast two programs of similar high class character each week. The company declares the continuance of the programs "will depend upon the response we receive from radio audiences."

**See Menace to Theatre**

Theatrical men declared tonight that the patronage of nearly every theater in New York City was affected by the appearance of McCormack and Miss Bori as radio broadcasters. Although the theaters invariably suffer a falling off on the evenings following holidays, the extent of tonight's decrease was that it could not possibly be explained by that rule and theatrical men were unanimous in their conviction that radio was largely responsible.

"Radio constitutes the greatest menace that the theater has ever faced," William A. Brady said. "Why in the world should people go to the theater and pay money? Why should any one be foolish enough to go to the theater in these circumstances?"

**New Fada Chicago Office**

Announcement is made of the opening of a Fada office at 326 West Madison Street, Chicago, Illinois. This Chicago Fada office will be in direct charge of L. J. Chatten, who has for the past year and a half been a district sales executive of the Fada organization.

Mr. Chatten's sales work in the past has made him well acquainted with radio sales conditions throughout the country and in particular with those trade conditions existing in the Mississippi Valley and it is felt that his qualifications are admirably adapted for the position of manager of our Chicago office.

Mr. Chatten will, of course, make his headquarters at the Chicago office and will in addition keep in direct contact with Fada jobbers and dealers throughout all the Central Western states.

**ANNUALS FOR 1924**

Only a few left. You may have one by sending 50 cents to Radio Age, Inc., 500 N. Dearborn St. Chicago.

# Pfanstiehl Radio Frequency Coils



Set of Three  
\$6.00

Users report them superior to any coils they have ever used in a tuned radio frequency circuit for—

Selectivity  
Distance  
Tone Quality

# Pfanstiehl Velvet Action



Three Circuit Tuner \$5.00

1. Low Loss.
2. Stagger Wound.
3. Sealed against Moisture.
4. Extremely Smooth Tickler Action.
5. Single Panel Mounting.

The simplest, most rugged unit yet designed. Improve your set and your results with it.

# The PFANSTIEHL RADIO CO.

Highland Park - Illinois  
Chicago Office  
1001 W. Washington Boulevard  
Tel. Monroe 2703



## The How and Why of Vacuum Tubes

(Continued from page 22)

caused the plate to attract the negative electrons, thereby establishing a path of conductivity between the plate and the filament, but when the negative terminal of the battery was connected to the plate, the electrons were repelled from it and no conductive path was established between the two. For this reason, current will flow only in one direction through the tube, and when an alternating current is applied to the circuit, those impulses which flow toward the plate only will pass through, while those in the opposite direction cannot pass. Thus only one-half of any cycle will flow and the resultant action is a pulsating current in one direction, although the applied current was alternating.

This rectifying quality of the tube made it possible to use it as a detector, in much the same way as a crystal was used, only in the case of the tube it was necessary to use a battery to give the plate a positive charge to attract the electrons.

### How Current Varies

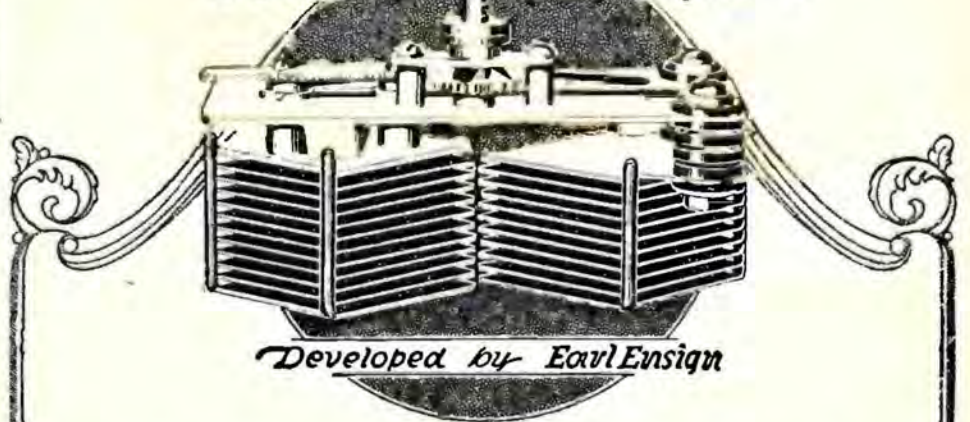
**I**F A pair of phones is introduced into the plate circuit, a continuous current will flow through them all the time that the filament is heated, but the changes caused by an incoming wave will vary this battery current, adding to it when it is in the right direction and weakening it when it is in the opposite direction, and it is these changes and not the continual steady flow of the battery current through the phones which cause the diaphragm to vibrate and give off a sound.

In the crystal detector, however, no current flows, except that of the signal itself. Thus it is seen that the rectifying action of the plate and filament combination will make a fair detector of radio signals. The introduction of the third element into the tube (the grid) made it possible to obtain a relay or amplifying property which was not apparent in the two element tube. This grid, which consisted of a wire mesh placed between the filament and the plate, really made the vacuum tube popular. With this three element tube, the circuit is so arranged that the incoming signal is impressed upon the grid. The battery, plate and phones are connected in series and as long as the grid is not electrically charged, a continuous current flows through the plate circuit when the filament is heated. The electrons from the filament thread their way through the wire mesh of the grid and reach the plate as before, but if a weak charge is given to the grid, the flow of current in the plate circuit will be greatly affected by it.

In the up-to-date circuit of today, the return of the grid circuit of the detector tube is connected to the positive side of the filament battery, and a grid leak and condenser are inserted in the grid circuit. This keeps a slight positive charge on the grid, which tends to help the plate draw the electrons out of the filament. Because of this positive charge,

# The Ensign CONDENSER

## A New Principle \*



Developed by Earl Ensign

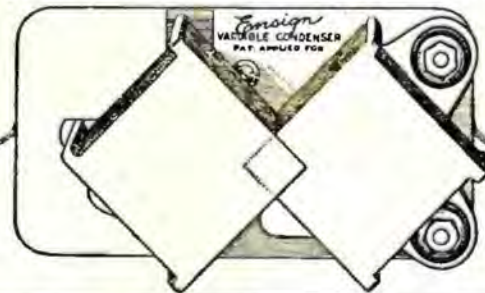
The Ensign is a real *sliding, square* plate condenser with a *straight* line wavelength graph, using the *entire* dial. Sturdy construction. One hole mounting.

ARMOUR INSTITUTE TESTS SHOW	PRICES
Maximum capacity..... .000521	Including 360 deg. dial
Minimum capacity..... .0000087	.00025..... \$4.50
The loss was so low the laboratory standard could not measure it.	.00035..... 4.75
	.0005..... 5.00

Below is a cut of bottom of condenser. Note the intersecting area between plates is always a square. The size of this square changes in exact geometrical ratio as the movable set of plates slides in and out thus spacing the wavelength graduations evenly over the entire dial.

Send for descriptive literature. Orders filled by mail until dealers are established.

Manufactured by **CARLETON SANDERS** Mishawaka, Ind.



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They all have surprises for you in the March RADIO AGE, on the stands February 15:

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Frank D. Pearne  
Edmund H. Eitel  
Zeh Bouck  
John B. Rathbun  
H. Frank Hopkins

And an up-to-the-minute section about your radio favorites. Get the

**MARCH RADIO AGE**

### NOTICE TO READERS

**W**E receive many remittances from fans who want us to furnish them with blueprints or panel layouts. As it would be practically impossible for us to stock complete blueprints, panel layouts, etc., of all circuits, we cannot comply with these requests.

However, we do sell **BACK COPIES** of RADIO AGE, and if you want complete, concise information regarding construction or wiring of any particular circuit, we should suggest that you consult the list of back issues, which you will find published in RADIO AGE every month.





## TUNE RIGHT THRU INTERFERENCE WITH THESE NEW WONDER COILS

A tuned radio frequency receiver built around a set of Henninger Aero-Coils—the new Low-Loss Inductance System—will out-tune anything that has ever come within your experience.

These coils give you "needle-sharp" selectivity as nothing else will. You'll like this feature. It enables you to actually choose your own program.

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### AT YOUR DEALER'S

Go to your favorite dealer today and get a set. Remember—a set of Aero-Coils make a much appreciated gift for a radio fan friend. \$3.50 each or \$10.50 the complete set, with all fittings.

HENNINGER RADIO MFG. CO., 1772 Wilson Ave., Dept. 22, Chicago

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# AERO-COIL

*The Complete Low Loss Inductance System*

## Federal Tubes—They Satisfy



*Just the Tube to give the  
Radio Set Owner the  
Joy of Perfect Reception*

**Every Federal Tube a Talker  
Every User a Booster**

*Clear Tone and Better Reception Assured  
Excellent for bringing in Distant Stations*

Federal Tubes are made by men who are expert in tube construction. Try them and end your tube troubles.

Made in the following Types

Type F201A . . . 5 Volt .25 ampere Amplifier  
Type F199 . . . . 3 Volt . . . . Dry Cell

Price \$4.00 each

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This coupon when presented to your dealer, will entitle you to a 50 cent Reduction on every FEDERAL TUBE purchase within the next 30 days.  
If your dealer cannot supply FEDERAL TUBES, send your order direct to us. The Service Lamp Co.

**The Service Lamp Co.**

112-14 Trinity Place  
New York City, N. Y.

(Continued from preceding page)

some of the electrons will attach themselves to the grid as they swarm through it, but the actual result is a greater flow of electrons to the plate.

Now, if a signal is received on the grid, the potential of the grid rapidly alternates, because the current is alternating in nature. As it gets a positive charge, some of the electrons are attracted to it from the great mass which is passing through to the plate.

At the next half of the cycle, the grid becomes negative, but the electrons are not so easily thrown off from a cold metal and most of them remain attached to it. The next half cycle is positive again and more electrons are captured by the grid. The grid becomes more and more negative the longer the signal lasts until it reaches the point of saturation. At least, this is what would happen were it not for the high resistance grid leak which allows them to leak off back to the positive side of the filament battery. They cannot be thrown off from the cold grid as they are from the filament; consequently they must be supplied with some other means of escape when they accumulate to such a degree that they would clog the action of the tube.

By carefully adjusting the resistance of this leak, the grid can hold only a certain number of electrons, and it is this adjustment of resistance which is so vital to the efficient operation of the tube.

The more negative the grid becomes, the greater will be the reduction in the current flowing in the plate circuit, and therefore the greater the changes in the current flowing through the phones, which will cause a louder signal, for it is the change in this current which affects the phones and not the continuous current which flows through them.

This shows, then, how the tube may be used as a detector and an amplifier at the same time, the detecting component being caused by the rectifying qualities and the amplifying being caused by the weak impulses on the grid, causing enormous changes in the plate current.

This action of the grid is sometimes called the trigger action, as a variation of one volt on the grid will sometimes produce a hundred times as much change in the plate current, as would a change of the same value in the plate voltage. When these tubes are used as amplifiers, the grid is kept at a negative potential at all times.

### Silver Contacts in New Socket

One of the unusual features of the No Loss Isolantite Socket is the extra large 5-16 in. in diameter sterling silver contacts arranged so as to be self wiping. The contacts are fixed to heavy phosphor bronze springs insuring a firm, low-resistance connection at all times. The spring members are each made of two leaves and they are placed in the base in a way to minimize internal capacity. Permanent soldered connections are made to main phosphor bronze spring, at the same time serving as a lug; or temporary connections may be made to nuts provided for this purpose.

The base of the socket is produced from Isolantite, which has been found to have very desirable properties for radio use.



## Don't Worry About that Antenna, Fans

(Continued from page 20.)

you get louder results, more distant stations, more atmospheric disturbance and more interference from stations. Interference, he says, is the real limit on receiving distance. Except for interference, there is no limit. So those fellows who listen for Mars are not so crazy after all! If you want to astonish your friends, says the doctor, use a whale of a long antenna, or use a very sensitive, many-tube receiving set, or both, and pile up your records. But that is all you will accomplish, he adds. You will get only truly satisfactory reception during the exceptional occasions when interference is small. Antenna length is a compromise between loudness of signals and freedom from interference, a compromise between quantity and that perfection of quality that would be ideal. The hysteria over distance records is diminishing.

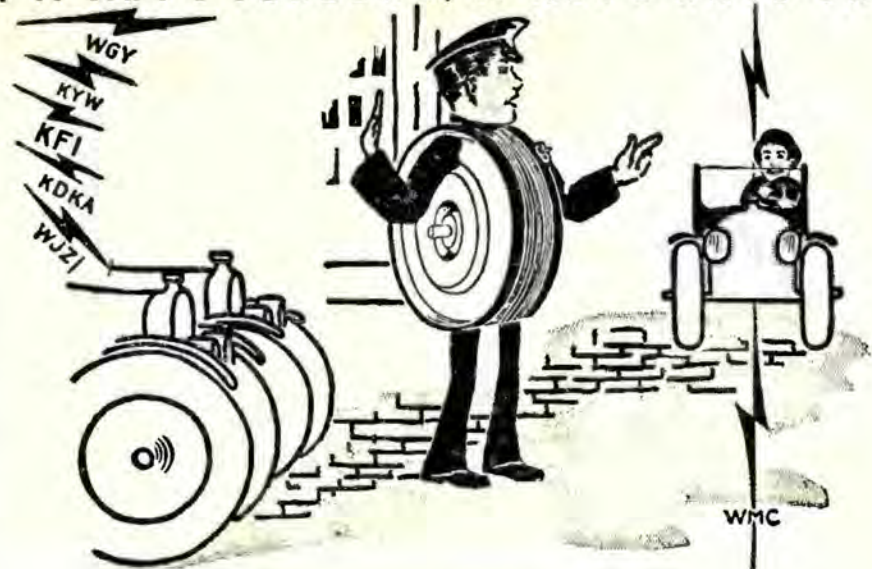
Indoor antennas, said Dr. Dellinger, violate all the things he said about outdoor antennas. They are not high or long and they are close to parts of buildings. The best form is 50 or more feet of copper wire suspended on insulators just under the roof and extending through an insulating tube down into the room where the receiving set is used. It will work almost as well without the insulators. You can just hang the wire around the moulding of your room. In fact, you can connect your receiving set to the bed spring or to the wires in your piano, but the results will be less satisfactory. With a special plug you can connect with the electric wiring of the house and use it for an antenna, if the wiring is of the open type. Electron tube sets work very well with indoor antennas because they are readily adjusted to make up for the lack of strength of the smaller antennas. A crystal set does not give satisfactory results on a short or indoor antenna except for relatively near or exceptionally powerful broadcasting stations.

The users of crystal sets no doubt will welcome the increased power to be used by several broadcasting stations. Indoor antennas work better in the upper than in the lower floors of a building. The smaller and lower they are, the more sensitive must be the receiving set to make up for their weakness, but the more free they will be from interference.

The coil antenna, or loop, will operate only on sets particularly designed for it, says Dr. Dellinger. Its big advantage is that with it you can cut out a station you don't want to hear by turning the coil around a vertical axis. In this case, the directional effect is very marked. With such an antenna built into the cabinet of your receiving set, your antenna troubles have disappeared, but with such a small antenna you must use many tubes.

After reading the rules and regulations (Turn to page 70)

If it isn't a FERBEND, it isn't a WAVE TRAP



## The Traffic Cop of the Air

He arranges in orderly fashion the mass and jumble of broadcasting stations that are seeking entrance to your set, and brings 'em in, one at a time, so you can enjoy them! Never reduces, but nearly always increases volume. Add a Ferbend Wave Trap to your set and "police" your reception. Regulate the traffic!

Make every night silent night! Trap out the interference. Why pay \$50.00 to \$200.00 extra for increased selectivity, when for \$8.50 you can get a genuine Ferbend Wave Trap which will absolutely cut out any interfering station, no matter how loud, how close by or how troublesome.

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will work 400 to 1000 miles if made by my plans. No tubes or batteries. Copyrighted plans \$1.00; or furnished FREE with complete parts for building set, including special coil and panel correctly drilled for only \$5.00. Satisfaction guaranteed or money refunded. Satisfied customers everywhere. Particulars free.  
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fans



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CONNWEY ELECTRIC LABORATORIES  
309 Fifth Avenue NEW YORK CITY

## Speaking of Your Antenna!

(Continued from preceding page)

of the National Board of Fire Underwriters, and those of the city building and electrical departments concerning antennas, the average radio user would be too old to enjoy his hobby. It is necessary, in order to collect the insurance after your house burns, to find out what the Company wants in the way of protection and install it, but the radio doctor's words on this subject are encouraging.

"Are antennas dangerous?" he asked. Then he answered: "The lightning hazard is practically *nil*. Only for outside antennas need lightning protection be considered at all, and it is very simple."

The article needed is, like men who listen to the neighbor's loud speaker instead of buying a radio outfit, small and cheap. It is called a "lightning arrester." It should be connected between the antenna and the ground wire. A transmitting antenna needs more

protection, but Dr. Dellinger was discussing only those used by average folks exclusively for receiving. Whatever slight chance there may be of an antenna's coaxing lightning into the house will operate just as surely in the case of the telephone or light wires. An antenna will, of course, draw current from an electric light wire if it touches it, and will deliver the juice into the body of the radio fan if said body is in contact with said antenna.

All this, from an expert who is an expert, is very satisfying to those who hesitate on the threshold of radio recreation, held back by the antenna problem as a western horse is restrained by a rope corral that he could step over easily. All that needs to be added is that even the best antenna will not prevent interference from the law of gravitation if, in climbing a tree to attach the antenna the radio bug fails to watch his step.

\* Tested and Approved by RADIO AGE \*

## "The Hidden Voice," A Radio Story

(Continued from page 29)

Mrs. Stansbury started back in amazement, almost dropping the infant.

"I don't know what it means, Mrs. Stansbury," volunteered the minister, who knew the family very well. "It seems to come from his stomach."

"Oh, call a doctor, quick," pleaded the mother.

"Help, help! Murder!" came from the abandoned carriage.

"Ha, we'll get at the mystery now," said the policeman, as he began to fumble about among the pillows and around the body of the carriage. Presently he pulled out the drawer below and produced Jimmie's miniature receiving set.

"Help! I'm being kidnapped," came through the scrolled front of the cabinet.

"Radio!" cried the minister.

"Yes, that's the baby's stomach," remarked the policeman, with a grin. "Let's investigate further." They went into the house.

"Why, that's Jimmie's radio," said Mrs. Kinnie, much to the wonder and relief of her daughter, who sat hugging her rescued infant.

"Is that so? Where is he?" inquired the policeman.

### The Mystery Solved

The crowd dashed into the house and ran up to Jimmie's room. Without ceremony they opened the door and ran in, only to find that young man convulsed in mirth—as much mirth as could be permitted when a pair of headphones are strapped around one's head.

For, with an improvised crystal set, Jimmie had been listening with increasing enthusiasm and satisfaction to his friend's relentless call for help from the broadcasting station. It was more than Jimmie had expected along the line of co-operation. But now that it was forthcoming, he was gleeful over the phenomenal success of his "idea."

On seeing the gathering, his smile quickly disappeared, but he soon came "back to earth" and rendered a satisfactory explanation of the hidden voice in the baby carriage. Needless to say, praise for his radio ingenuity was wholehearted.

For an hour or more an eager discussion of the affair took place, in the house and on the lawn, for the crowd that gathered could not possibly be accommodated indoors. Meanwhile the policeman called up his station and received this message from the desk sergeant:

"We picked up a woman who acted as if she was going crazy. She admitted she stole the child and abandoned him because he talked like a grown-up and kept calling for help."

Meanwhile also, Mrs. Stansbury made an important discovery and communicated it to Jimmie.

"Edward must have chewed his zwieback all the time," she said; "for he has cut two front teeth that were awful hard coming through."

"Zwieback can't have all the credit," Jimmie retorted. "This really is a case of radio teething!"



## And Now We Have Radio Cross-Words!

(Continued from page 16)

"eclecticism" are positively not exhibited under this tent.

### Let's Go!

NOW for the start. You will see that the squares form horizontal and vertical lines and that a number of black squares appear. The white squares each contain a letter and the black squares are used as periods with a full word between adjacent squares. This is the case either in a horizontal or vertical direction. The words run from left to right, or from top to bottom, starting at the left hand edge of the figure or from the top. The space between the black squares must contain a full word and each of the white squares must be filled. All squares are numbered horizontally and vertically.

Just as an example, I have worked out eight of the words in the upper right hand corner, and by the way, this contains the only unusual two words in the lot submitted to you. On examination, you will see that complete words are formed in both horizontal and vertical rows. Thus, the word "Loop" is horizontal word (10), the word "Earth" is horizontal (17), etc. Vertically, we have "Lab" as vertical (10), "Oral" as vertical (11), and so on. The horizontal and vertical words have letters in common so that the letter (R) forms a part of both "Earth" and "Oral." The letter (O) is a part of "Loop" and also of "Other." I have worked out the German trade name "Baha" and the slang word "Phan," thus clearing the puzzle of any strange words.

Herewith you will discover the definitions of the words that you are to use in working out the puzzle, and these definitions are arranged in two groups for the horizontal and vertical lines. When you have thought of a word that means the same as the definition, and contains just the number of letters as the numbered square, then mark the letters on the chart as shown in the example. Horizontal word (1) contains four letters and the same is true of vertical word (1). Horizontal word (5) contains five letters and vertical word (6) has only two letters.

In the list of horizontal words, horizontal (10) reads, "A form of aerial." This works out as "Loop." Vertical (10) is defined in the list as "Experimenter's workroom Abr." The full word is laboratory, and the abbreviation is "Lab," the latter occupying the three vertical white squares under (10). Remember. The words extend from black square to black square, or from the outer edge to the following black square. Hop to it.

Send in your solutions, and if they reach RADIO AGE by January 25, they will be published with the solution in the March issue. Other correct solutions will be published with new radio puzzles in future issues of RADIO AGE.

(Turn to next page)





Graph showing how the regenerative effect in the Model L-2 Ultradyne increases as the strength of the received signal decreases.

## Why the ULTRADYNE Gets Distance on the Loud Speaker!

### Ultradyne Kit

Consists of one low loss Tuning Coil, one low loss Oscillator Coil, one special low loss Couplet, one type "A" Ultraformer, three type "B" Ultraformers, four matched Grid Condensers. The Ultraformers are new improved long wave 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

Unlike other Super-radio receivers, the Ultradyne, with its exclusive use of the "Modulation System" and special application of regeneration, is capable of detecting and regenerating the faintest signal, making it audible on the loud speaker.

The regenerative effect in the Ultradyne increases as the strength of the signal decreases, until the signal becomes so weak that no amount of amplification will make it audible. A radical advance in radio engineering and the latest development of R. E. Lacault, E. E., A. M. I. R. E., Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

You will marvel at the unusual selectivity, sensitivity and range of this new Model L-2 Ultradyne.

Write for descriptive circular.

### How To Build and Operate The Ultradyne Model L-2

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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## MODEL L-2

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RADIO DEALERS  
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123 W. Madison St. Chicago  
Send for dealers discount.

### THE LONG DISTANCE TEST

Results of RADIO AGE'S long distance test from KYW on January 3 are now being compiled and will be announced with the winners' names in the March issue of RADIO AGE.

## AMBASSADOR Low Loss Products



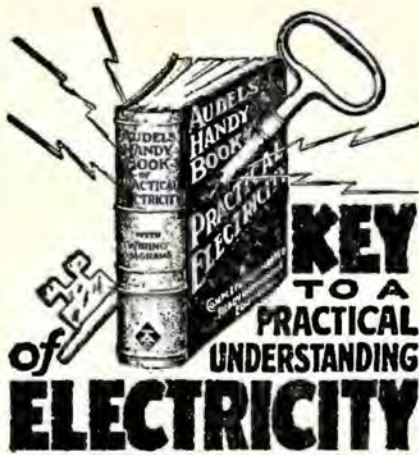
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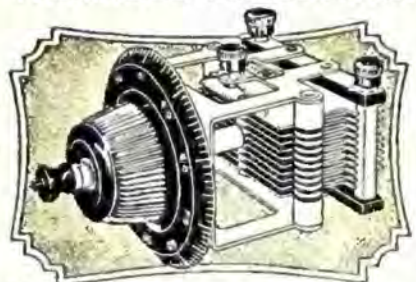
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Stations which are jammed so close to each other on the dial of the usual condenser that it is impossible to separate them, are pulled apart twenty times the distance on your dial when you use a BARRETT & PADEN Micrometer Condenser. Use them. You'll see the difference!

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Dealers! Write for our proposition.

HEAR BANKS KENNEDY  
on RADIO AGE'S program  
From KYW, Feb. 7,  
Beginning at midnight

(Continued from preceding page)

#### HORIZONTAL LINES

1. Magnitude of surface.
5. A conductor made by twisting a number of small wires together.
10. A form of aerial.
14. Carried by a ship.
16. An intermediate connection to a coil.
17. To ground.
18. Doing nothing.
22. German trade mark for a make of radio apparatus.
23. Abbreviation of diameter.
24. Age or period.
26. Girl's name.
28. First name (abbreviated) of the Governor of Illinois.
30. Small negative particles.
34. Debt.
35. Technical man (Abr.).
36. Pitch.
39. Not out.
41. Potential (Abr.).
43. Speaking apparatus (Abr.).
44. Indefinite article.
45. To consume.
47. Organ of hearing.
48. Women's husbands.
49. Sell.
50. Oscillation constant (Abr.).
51. One of the connections on a receiver (Abr.).
53. Conjunction.
55. Editor (Abr.).
56. Patent (Abr.).
57. Cover.
59. Atmosphere.
61. Above (Prefix).
64. Alternator (Abr.).
66. Chart.
67. Move fast.
68. Pressing collection.
70. Temper of mind (Manner).
73. DA-DIT-DIT-DAA.
74. Energy.
75. British Thermal unit (Abr.).
77. The subject of this magazine.
78. Abbreviation for single pole, single throw switch.
79. A metal alloy.
80. Earth's satellite.

#### VERTICAL LINES

1. Contained in a storage battery.
2. Communication by Hertzian waves.
3. A well known reflex circuit.
4. Oil.
6. By.
7. Battery (Abr.).
8. Low potential (Abr.).
10. Experimenter's work room (Abr.).
11. Pertaining to the mouth.
12. Different.
13. A name often used for a radio "Nut."
19. Part of the verb "to be."
21. Amperes, Volts, Ohms (Abr.).
24. A substance which cannot be decomposed by any known method.
25. Victorious Army Aviator.
26. Unit of work.
27. A wire for collecting radio waves.
30. Female sheep.
31. A high explosive.
32. Prefix meaning salt. Used in dry battery electrolytes.
33. Space occupied by magnetic forces.
38. Positive electrode.
40. Naval Radio Station Call number.
42. A hobby.
43. Beverage.
44. To grow old.
51. Space between two parts.
52. Moisture found in plants (Juice).
54. Immense.
57. Drinking vessel.
58. By.
60. Annoying noise made by tube set which affects neighboring aeriels (slang phrase).
61. To droop.
62. To polish or shine.
63. The name of the stage which amplifies at voice frequency.
69. Amperes (Abr.).
65. Pull along.
68. An extinct bird.
69. A gaseous element used in testing spark plugs.
71. Deflector (Abr.).
72. Greek letter corresponding to "E".
73. A mechanical part used for giving a reciprocating motion to another part.
75. Brass (Abr.).
78. Objective pronoun.

#### "Polyplugs" on Market

The well-designed and popular priced "Polyplug," the product of the Polymet Manufacturing Corporation, 70-74 Lafayette Street, New York City, has introduced many manufacturers of Loud Speakers to furnish Phone Plugs with their units. As the Phone Plug is such an essential part of the Loud Speaker, it is only a matter of a short period when every Loud Speaker manufacturer will include a Plug with his product.

The Polymet Manufacturing Corporation has also brought out two additional Radio Units, which have been enthusiastically welcomed by manufacturers of Radio Sets. This is a Rheostat called the "E-Z" Stat, and a Potentiometer called the "E-Z" Omer.

The popularity of these two units is due to the construction which helps the manufacturer of sets speed up his assembly production. These items remove all the fuss of adjustments because the adjustment is permanently fixed.

\* Tested and Approved by RADIO AGE \*

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WORLD BATTERY COMPANY

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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 case—and insurance against acid end leakage. Take advantage of this remarkable introductory offer NOW. To those who prefer it, we will send FREE a handsome nickel finish Auto Spillite. Instead of the "B" Battery. Be sure to specify which is wanted.

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## A Unit for Measuring Capacity

(Continued from page 19)

X, as was shown in the foregoing example of impedance, or as follows:

- Coil X = 100 Ohms.
- Dial reading 42 -
- Coil Y = .58x100 or 58 Ohms, or
- Coil X = 50 Ohms.
- Dial Reading 42 +
- Coil Y = 1.42x.50 or 71 Ohms.

### To Measure Capacity

Connect a known capacity to terminals X1 and X2. Say .001 microfarad, then connect the unknown capacity to terminals Y1 and Y2, moving the pointer until the silent period is found. If this should fall on 50—, then the capacity of Y will be

- Condenser X = .001 M F
- Dial reading 50 -
- Capacity Y = .50x.001 M F or .0005 M F or
- Condenser X = .001 M F
- Dial reading 80 +
- Capacity Y = 1.8x.001 M F or .0018 M F.

Many other forms of measurement can be made on this instrument when a known quantity is connected across terminals X1 and X2 using the formulae, "Y" = Dial reading X "X"

Remembering that readings from the "-" side of the scale will always be in the form of a decimal or hundredth part of "X" and that "Y" is always less than "X," thus "Y" = Dial reading X "X" while the readings from the "+" side of the scale will always be 1 + Dial reading or one and a decimal or hundredth times "X." Thus "Y" = "X" + dial reading X "X" and "Y" will always be greater than X.

## Jack Nelson Will Get a Laugh Here

(Continued from page 32)

sary that you confine your votes to contestants whose names appear in this list. Possibly your favorite is awaiting your votes to boost him to a position in the first division. Such apparently was the case with Art Linick, whose name did not appear on this page of our preceding issues.

RADIO AGE has definitely decided on a unique shield as an award for the final victor of this contest. Who are you going to help win this token of popular favor?

While some of the contestants seem to hold their positions through a steady stream of votes each month, still a careful count of the ballots shows that each month indicates a wave of popular favor for some individual who gathers more votes than any other through that period.

By way of creating greater interest in this contest, a year's free subscription to RADIO AGE will be given to the first three readers whose ballots name the candidate receiving the greatest number of votes during the period from January 16 to February 15. So get busy and send in your ballots.

\* Tested and Approved by RADIO AGE \*

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# Corrected List of Broadcasting Stations

KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh	276	KFOA	The Principia	St. Louis, Mo.	244
KDFM	Westinghouse Electric & Mfg. Co.	Cleveland, Ohio	276	KFOB	The Searchlight Publishing Co.	Fort Worth, Tex.	221
KDPT	Southern Electrical Co.	San Diego, Calif.	244	KFOC	Kidd Brothers Radio Shop	Taft, Calif.	258
KDYL	Newark Hotel	Salt Lake City, Utah	360	KFOD	Chovin Supply Co.	Anchorage, Alaska	207
KDYQ	Orgon Theatre	San Diego, Calif.	280	KFOE	Dickenson-Henry Radio Laboratories	Colorado Springs, Colo.	224
KDYM	Oregon Institute of Technology	Portland, Oreg.	360	KFOG	Southern Calif. Radio Ass'n.	Los Angeles, Calif.	226
KDZB	Frank E. Siefert	Bakersfield, Calif.	240	KFOH	Radio Service Co.	Burlingame, Calif.	231
KDZE	Rhodes Department Store	Seattle, Wash.	270	KFOK	Democrat Leader	Fayette, Mo.	238
KDZI	Electric Supply Co.	Wenatchee, Wash.	360	KFOL	Oklahoma Free State Fair Assn.	Muskegon, Mich.	252
KDZR	Bellingham Publishing Co.	Bellingham, Wash.	360	KFOM	Third Baptist Church	Austin, Tex.	268
KFAD	Banker Bros. Mercantile Co.	Phoenix, Ariz.	360	KFON	Meier Radio Shop	Portland, Oreg.	283
KFAE	State College of Washington	Pullman, Wash.	330	KFOO	G. S. Carson, Jr.	Russell, Kans.	261
KFAF	Western Radio Corporation	Denver, Colo.	278	KFOP	Walter LaFayette Ellis	Iowa City, Ia.	224
KFAJ	University of Colorado	Boulder, Colo.	360	KFOR	Texas National Guard	Oklahoma City, Okla.	250
KFAK	Studio Lighting Service Co. (O. K. Olsen)	Hollywood, Calif.	280	KFOT	W. Riker	Denison, Texas	252
KFAU	Boise High School	Boise, Idaho	270	KFOV	Omaha Grain Exchange (Portable)	Holy City, Calif.	234
KFAW	The Radio Den (W. B. Ashford)	Santa Ana, Calif.	280	KFQW	C. F. Knieer	Omaha, Nebr.	231
KFAY	Virgin's Radio Service	Medford, Ore.	283	KFQB	Alfred J. Hubbard	North Bend, Wash.	248
KFBB	F. A. Buttrely & Co.	Irving, Mont.	283	KFQC	Farmer's State Bank	Seattle, Wash.	273
KFBC	W. K. Arbill	San Diego, Calif.	278	KFOY	Yosemite State Bank	Belden, Neb.	233
KFBE	Reuben H. Horst Co.	San Luis Obispo, Calif.	242	KFQZ	Taft Radio Co.	Hollywood, Calif.	240
KFBG	First Presbyterian Church	Tacoma, Wash.	360	KFRI	The Reynolds Radio Co. Inc. Portable Station	Denver, Col.	224
KFBK	Kimball-Upson Co.	Sacramento, Calif.	283	KFRJ	Guy Simmons, Jr.	Conway, Ark.	250
KFBL	Leese Bros.	Everett, Wash.	224	KFRM	James F. Boland	Fort Hill, Okla.	263
KFBS	Trinidad Gas & Electric Supply Co. and Chronicle News	Trinidad, Colo.	280	KFRN	M. Laurence Short	Hanford, Calif.	224
KFBU	The Cathedral	Laramie, Wyo.	283	KFRQ	Curtis Printing Co.	Fort Worth, Tex.	246
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	248	KFRS	J. Gordon Kienzard	Fulman, Wash.	217
KFCF	The First Congregational Church	Helena, Mont.	248	KFRZ	The Mexico College of Agriculture	State College, N. M.	266
KFCG	Frank A. Moore	Walla Walla, Wash.	256	KFRZ	The Electric Shop	Hartington, Neb.	222
KFCL	Leslie E. Rice	Los Angeles, Cal.	236	KFUL	Thomas Gorkzao & Bros.	Galveston, Tex.	258
KFCP	Ralph W. Flyzare	Ogden, Utah	360	KFUM	W. D. Corley	Colorado Springs, Colo.	242
KFCV	Fred Mahaffey, Jr.	Houston, Texas	360	KFUO	Cocordia Seminary	St. Louis, Mo.	545
KFCZ	Omaha Central High School	Omaha, Nebr.	258	KFRW	United Church of Olympia	Olympia, Wash.	220
KFDD	St. Michaels Cathedral	Boise, Idaho	252	KFSG	Angelus Temple	Los Angeles, Calif.	276
KFDH	University of Arizona	Tucson, Ariz.	360	KFTH	The Van Buren Co.	Helena, Mont.	261
KFDJ	Oregon Agricultural College	Corvallis, Oreg.	360	KFTR	Tacoma Daily Ledger	Tacoma, Wash.	252
KFDM	Nielson Petroleum Co.	Beaumont, Tex.	306	KGCG	Knock & Watson Radio Service	Portland, Oreg.	360
KFDX	First Baptist Church	Shreveport, La.	360	KGO	General Electric Co.	Oakland, Calif.	312
KFDY	South Dakota State College	Brookings, S. Dak.	360	KGU	Marion A. Mulroyn	Honolulu, Hawaii	360
KFDZ	Harty O. Iverson	Minneapolis, Minn.	231	KGW	Portland Morning Oregonian	Portland, Oreg.	492
KFEC	Meier & Frank Co.	Portland, Oreg.	248	KGY	St. Martin's College (Rab. Sebastian Ruth)	Lacy, Wash.	258
KFEK	Augsbury Seminary	Minneapolis, Minn.	261	KHJ	Times-Mirror Co.	Los Angeles, Calif.	395
KFEL	Winner Radio Corp.	Denver, Colo.	254	KHQ	Louis Wasmer	Seattle, Wash.	360
KFEQ	J. L. Scroggin	Ogden, Utah	268	KJQ	C. O. Gould	Stockton, Calif.	273
KFER	Auto Electric Service Co.	Fort Dodge, Iowa	231	KKB	Northwest Radio Service Co.	Seattle, Wash.	252
KFEY	Bunker Hill & Sullivan Mians and Concentrating Co.	Kellogg, Idaho	360	KLS	Warner Brothers Radio Supplies Co.	Oakland, Calif.	360
KFFB	First Baptist Church	Moberly, Mo.	266	KLX	Tribune Publishing Co.	Oakland, Calif.	509
KFFR	Nevada State Journal (Jim Kirk)	Sparks, Nev.	226	KLZ	Reynolds Radio Co.	Denver, Colo.	283
KFFV	Graceland College	Lamoni, Iowa	280	KMJ	San Joaquin Light & Power Corp.	Fresno, Calif.	248
KFFY	Pineau & Murphey Music House	Alexandria, La.	275	KMO	Love Electric Co.	Tacoma, Wash.	360
KFGB	Heidbreder Radio Supply Co.	Utica, Neb.	224	KNT	Walter Henrich	Kukah Bay, Alaska	263
KFGC	Louisiana State University	Baton Rouge, La.	254	KNX	Los Angeles Evening Express	Los Angeles, Calif.	337
KFGD	Chickasha Radio & Electric Co.	Chickasha, Okla.	248	KOB	New Mexico College of Agriculture & Mechanic Arts. State College	N. Mex.	560
KFGH	Leland Stanford University	Stanford University, Calif.	273	KOP	Detroit Police Department	Detroit, Mich.	288
KFGI	Clary Hardware Co.	Boone, Iowa	226	KPO	Hale Bros.	Sao Francisco, Calif.	423
KFGJ	First Presbyterian Church	Orange, Tex.	250	KQP	Apple City Radio Club	Hood River, Oreg.	360
KFGK	Emmanuel Missionary College	Berrien Springs, Mich.	286	KQV	Douglas-Hill Electric Co.	Pittsburgh, Pa.	270
KFHA	Western State College of Colorado	Gunnison, Colo.	252	KQW	Charles D. Herrold	San Jose, Calif.	240
KFHH	Ambrose A. McCus	Neah Bay, Wash.	261	KRE	V C Battery & Electric Co.	Berkeley, Calif.	275
KFHJ	Fallon & Co.	Santa Barbara, Calif.	360	KSCA	Kansas State Agricultural College	Manhattan, Kans.	341
KFHL	Penn. College	Oskaloosa, Iowa	240	KSD	Post Dispatch (Pulitzer Pub. Co.)	St. Louis, Mo.	546
KFHR	Star Electric & Radio Co.	Seattle, Wash.	283	KSP	First Presbyterian Church	St. Louis, Mo.	560
KFHS	E. C. Adams, Inc.	Los Angeles, Calif.	469	KUO	Examiner Printing Co.	San Francisco, Calif.	360
KFIF	Beason Polytechnic Institute	Portland, Oreg.	248	KWG	Portable Wireless Telephone Co.	Stockton, Calif.	360
KFIO	North Central High School	Spokane, Wash.	252	KWH	Los Angeles Examiner	Los Angeles, Calif.	360
KFII	First Methodist Church	Yakima, Wash.	242	KYQ	Electric Shop	Honolulu, Hawaii	270
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	226	KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	536
KFIZ	Reorganized Church of Jesus Christ of Latter Day Saints	Independence, Mo.	240	KZM	Preston D. Allen	Oakland, Calif.	360
KFJB	Daily Commonwealth and Oscar A. Huelsman	Fon Du Lac, Wis.	273	WAAB	Valdemar Jensen	New Orleans, La.	268
KFJC	Marshall Electrical Co.	Marshalltown, Iowa	248	WAAC	Tulane University	New Orleans, La.	360
KFJD	National Radio Manufacturing Co.	Oklahoma City, Okla.	248	WAAD	Ohio Mechanical Institute	Cincinnati, Ohio	260
KFJE	Liberty Theatre (E. E. Marsh)	Astoria, Oreg.	252	WAFF	Chicago Daily Drivers Journal	Chicago, Ill.	286
KFJF	Delano Radio and Electric Co.	Bristow, Okla.	233	WAAM	I. R. Nelson Co.	Newark, N. J.	263
KFJG	Hardsack Manufacturing Co.	Ottumwa, Iowa	242	WAAN	University of Missouri	Columbia, Mo.	254
KFJM	University of North Dakota	Grand Forks, N. Dak.	280	WAAP	Omaha Grain Exchange	Omaha, Nebr.	286
KFJN	Ashley C. Dixon & Son	Stevensville, Mont. (near)	258	WABB	Harrisburg Sporting Goods Co.	Harrisburg, Pa.	286
KFJY	Iowa State Teacher's College	Cedar Falls, Iowa	280	WABD	Parker High School	Danbury, Ohio	243
KFJJ	Tunwall Radio Co.	Fort Dodge, Iowa	246	WABH	Lake Shore Tire Co.	Sandusky, Ohio	280
KFJZ	Texas National Guard, One hundred and twelfth Cavalry	Fort Worth, Texas	254	WABI	Banzon Railway & Electric Co.	Bangor, Me.	240
KFKA	Colorado State Teachers College	Greeley, Colo.	273	WABW	Connecticut Agricultural College	Storrs, Conn.	284
KFKB	Hinkley-Jones Hospital Association	Millford, Kans.	286	WABM	F. A. Doherty Automotive and Radio Equipment Co.	Saginaw, Mich.	250
KFKC	Conway Radio Laboratories (Ben H. Woodruff)	Conway, Ark.	250	WABN	Ott Radio, Inc.	LaCrosse, Wis.	244
KFKD	The University of Kansas	Lawrence, Kans.	275	WABO	Lake Avenue Baptist Church	Rochester, N. Y.	283
KFKF	F. F. Gray	Butte, Mont.	283	WABP	Robert F. Weising	Dover, Ohio	266
KFKV	Westinghouse Electric & Manufacturing Co.	Hastings, Nebr.	341	WABQ	Haverford College, Radio Club	Haverford, Pa.	261
KFKZ	Nassour Bros. Radio Co.	Colorado Springs, Colo.	248	WABR	Scott High School, N. W. B. Foley	Toledo, Ohio	276
KFLA	Abner R. Wilson	Butte, Mont.	283	WABU	Victor Talking Machine Co.	Sandusky, N. J.	220
KFLB	Stearns Electric Manufacturing Co.	Menominee, Mich.	234	WABV	College of Wooster	Wooster, Ohio	276
KFLC	Paul E. Greenlaw	Franklinton, La.	234	WABX	Henry B. Joy	Mt. Clemens, Mich.	270
KFLD	National Educational Service	Denver, Colo.	268	WABY	John Masaldi, Jr.	Philadelphia, Pa.	242
KFLE	Bizzell Radio Shop	Little Rock, Ark.	261	WABZ	Coliseum Place Baptist Church	New Orleans, La.	263
KFLR	University of New Mexico	Albuquerque, New Mexico	254	WAHG	A. H. Grebe & Co.	Richmond Hill, N. Y.	316
KFLU	Rio Grande Radio Supply House	San Benito, Texas	236	WBAH	Purdue University	W. Lafayette, Ind.	283
KFLV	Rev. A. T. Frykman	Rockford, Ill.	229	WBAN	The Dayton Co.	Minneapolis, Minn.	417
KFLX	George Roy Clough	Galveston, Tex.	240	WBAP	Wireless Phone Corp.	Pateron, N. J.	244
KFLZ	Atlantic Telephone Co.	Waukegan, Ill.	254	WBAX	James M. Quinn University	Decorah, Ill.	360
KFMB	Charley Chubb	Little Rock, Ark.	254	WBAY	Rorham-Charte Publishing Co. (Star Telegram)	Fort Worth, Tex.	476
KFMC	University of Arkansas	Fayetteville, Ark.	263	WBBD	Erner & Hopkins Co.	Columbus, Ohio	423
KFMD	Morningside College	Sioux City, Iowa	261	WBBS	John H. Stenger, Jr.	Wilkes-Barre, Pa.	254
KFME	Dr. George W. Young	Minneapolis, Minn.	231	WBBS	Western Electric Co.	New York, N. Y.	492
KFMF	M. G. Sateren	Houghton, Mich.	266	WBBD	Barbey Battery Service	Reading, Pa.	234
KFMG	Carleton College	Northfield, Minn.	283	WBBS	Irving Vermilya	Mattapoisett, Mass.	246
KFMH	Henry Field Seed Co.	Shenandoah, Iowa	266	WBBS	Grace Covenant Presbyterian Church	Port Huron, Mich.	248
KFMJ	Wooten's Radio Shop	Coldwater, Miss.	254	WBBS	H. Leslie Atlas	Richmond, Va.	283
KFMK	Central Mo. State Teachers College	Warrensburg, Mo.	234	WBBS	Blake, A. B.	Chicago, Ill.	226
KFMN	Radio Broadcast Ass'n.	Paso Robles, Calif.	240	WBBS	Potoskey High School	Wilmington, N. C.	275
KFMV	L. A. Drake Battery and Radio Supply Shop	Santa Rosa, Calif.	234	WBBS	Peoples Pulpit Assn.	Potoskey, Mich.	246
KFMW	Montana Phonograph Co.	Helena, Montana	261	WBBS	First Baptist Church	Rossville, N. Y.	273
KFNA	Royal Radio Company	Burlingame, Calif.	231	WBBS	Jeans Motor Sales Co.	New Orleans, La.	252
KFNB	Rhodes Department Store	Seattle, Wash.	455	WBBS	Johnstown Radio Co.	Monmouth, Ill.	224
KFNC	First Christian Church	Whittier, Calif.	236	WBBS	Ruffner Junior High School	Johnstown, Pa.	242
KFND	Radio High School Radio Club	Alhambra, Calif.	224	WBBS	Washington Light Infantry Co. "B" 11th Inf.	Norfolk, Va.	225
KFNE	Leslie M. Schafbusch	Moberly, Missouri	246	WBBS	Noble B. Watson	Christon, S. C.	268
KFNF	Echophone Radio Shop	Marengo, Iowa	234	WBBS	Johns Elec. & Radio Mfg. Co.	Indianapolis, Ind.	227
KFNG	Latter Day Saints University	Long Beach, Calif.	234	WBBS	Johns Elec. & Radio Mfg. Co.	Baltimore, Md.	254
KFNP	Rohrer Elec. Co.	Salt Lake City, Utah	261	WBBS	Foster & McDonald	Chicago, Ill.	264
KFNR	David City Tire & Electric Co.	Marshfield, Ore.	240	WBBS	T & H Radio Co.	Anthony, Kans.	256
KFNS	College Hill Radio Club	David City, Nebraska	226	WBBS	Pennsylvania State Police	Butler, Pa.	286
KFNT	Hommel Mfg. Co.	Wichita, Kansas	231	WBBS	D. W. May, Inc.	Newark, N. J.	260
KFOA	Boyd Co.	Richmond, Calif.	224	WBBS	Southern Radio Corp.	Charlotte, N. C.	360
KFOB	Beacon Education Technical High School	Omaha, Nebraska	248	WBBS	Westinghouse E. & M. Co.	Springfield, Mass.	280
KFOC	Beacon Radio Service	St. Paul, Minn.	226	WBBS	St. Lawrence University	Condon, N. Y.	287
KFOD	Leon Hudson Real Estate Co.	Fort Smith, Ark.	233	WBBS	Kaufmann & Baer Co.	Pittsburgh, Pa.	462
KFOE	Edwin J. Brown	Seattle, Wash.	224	WBBS	Clyde R. Randall	New Orleans, La.	268
KFOF	Garretton and Dennis	Los Angeles, Calif.	238	WBBS	Entrekin Electric Co.	Columbus, Ohio	286
KFOG	Harold Chas. Mailander	Salt Lake City, Utah	242	WBBS	Nebraska Wesleyan University	University Place, Nebr.	283
KFOH	C. C. Baxter	Dublin, Texas	242	WBBS	Alfred P. Daniel	Houston, Texas	263
KFOI	The New Furniture Co.	Greenville, Texas	242	WBBS	St. Olaf College	Northfield, Minn.	317
KFOJ	Missouri National Guard	Jefferson, City, Mo.	442	WBBS	Sanders & Szymanski Co.	Baltimore, Md.	275
KFOK	Colorado National Guard	Denver, Colo.	231	WBBS	Chesapeake & Potomac Telephone Co.	Washington, D. C.	459
KFOL	G. & G. Radio & Electric Shop	Olympia, Washington	236	WBBS	Alamo Radio Electric Co.	San Antonio, Tex.	263
KFOM	Los Angeles Co. Forestry Dept.	Los Angeles, Calif.	231	WBBS	W. H. Dunwoody Industrial Institute	Minneapolis, Minn.	280
KFON	Cape & Johnson	Salt Lake City, Utah	268	WBBS	State College of Mines	Rapid City, S. Dak.	240
KFOO	Heints & Kohlmoos, Inc.	San Francisco, Calif.	236	WBBS	Durham & Co.	Philadelphia, Pa.	286
KFOQ	St. Johns M. E. Church	Cartersville, Mo.	268	WBBS	J. C. Dice Electric Co.	Little Rock, Ark.	263
KFOP	First Presbyterian Church	Pine Bluff, Ark.	242	WBBS	University of Vermont	Burlington, Vt.	246
KFOS	Symons Investment Co.	Spokane, Wash.	283	WBBS	Carthage College	Carthage, Ill.	260



# CLASSIFIED ADVERTISEMENTS

Don't overlook the value of RADIO AGE'S classified advertisements. Many such messages have paved the way to independent incomes.

The classified advertising rates are but ten cents per word for a single insertion. Liberal discounts are allowed on three, six and

twelve -time insertions, of five, fifteen and thirty per cent, respectively. Unless placed through an accredited advertising agency, cash should accompany all orders. Name and address must be included at foregoing rates and no advertisement of less than ten words will be accepted.

### RADIO OFFERS

15 to 25 per cent discount on nationally advertised sets and parts. Every item guaranteed. Tell us your needs. IMPERIAL RADIO COMPANY, Delaware, Ohio.

**RADIO SETS.** Our prices save you money. Lists free. The Radio Shoppe, Box 645, East Liverpool, Ohio.

**JOIN THE RADIO Parts Exchange Club.** Your parts inspected (Fee 25c), and exchanged for the parts you need. What have you; what parts do you require? Write us for details. The Radio Parts Exchange Club, 112 So. Homan Ave., Chicago.

### RADIO CIRCUITS

#### SPECIAL FOR FEBRUARY

The Rainartz Radio Booklet, by Frank D. Pearns, fully illustrated, and RADIO AGE, for \$2.50. Price of booklet alone is 50c. Send check, currency or money order to RADIO AGE, 500 N. Dearborn Street, Chicago.

### MISCELLANEOUS

158 Genuine Foreign Stamps. Mexico War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only 5c. Finest approval sheets, 50 to 60 percent. Agents Wanted. Big 72-p. Lists Free. Wa Buy Stamps. Established 20 Years. Hussman Stamp Co., Dept. 152, St. Louis, Mo.

**RADIO SALESMEN and SET BUILDERS**—We need you and you need us. If you are reliable and well known in your community, we will appoint you our representative and furnish you with standard well advertised sets and parts at prices that will enable you to sell at a handsome profit. Write at once for catalog and sales plan. Waveland Radio Co., Div. 49, 1027 N. State St., Chicago, Ill.

Classified ad copy for March Radio Age must reach us by January 27.

### AGENTS

90c an hour to advertise and distribute samples to consumer. Write quick for territory and particulars. American Products Co., 2130 American Buildings, Cincinnati, Ohio.

Man wanted for this territory to sell wonderful value men's, women's, Children's shoes direct, saving consumer over 40%. Experience unnecessary. Samples supplied. Big weekly permanent income. Write today Tanners Mfg. Co., 1334 C. St., Boston, Mass.

### BUSINESS OPPORTUNITIES

**DEALERS**—Write for our illustrated catalog of reliable Radio Merchandise. Rossiter-Manning Corporation, Dept. D, 1830 Wilson Ave., Chicago, Ill.

**RADIO**—Join our sales organization and make big money. We want a man in every county to sell well advertised sets and parts made by the leading manufacturers. Widener of Kansas City makes \$150.00 weekly. You can do as well or better. Write today for catalog and discounts. Name your county. Waveland Radio Company, Div. 50, 1027 No. State St., Chicago, Ill.

**NEW WRITERS WANTED**—Articles, stories, poems, scenarios, etc. \$13.500 just paid to unknown writer. Entirely new field. (No bunk). NOT A CORRESPONDENCE COURSE. Moving picture industry and publishers crying for new original material. YOU CAN DO IT. We buy manuscripts for books and magazines. Send self addressed envelope for list of 100 subjects. CALIFORNIA STUDIOS, P. O. Box 697, Los Angeles, Calif.

100 VOLT EDISON TYPE "B" BATTERY, knocked down. Parts and plans—complete, \$12.50. Lane Mfg. 2937 W. Lake, Chicago.

A PRACTICAL TUBE RECEIVING SET FOR \$10. Postpaid. Less phones and tube. Complete with phone, tube and battery, \$18.00. J. B. RATHBUN, 1067 Winona St., Chicago, Ill.

## Canadian Broadcasting Stations

CFAC	Calgary Herald, Calgary, Alberta.....	430	CFQC	The Electric Shop (Ltd.), Saskatoon, Saskatchewan.....	400
CFCA	Star Pub. & Print. Co., Toronto, Ontario.....	400	CFRC	Queens University, Kingston, Ontario.....	400
CFCF	Marconi Wireless Tel. Co. of Canada, Montreal, Quebec.....	440	CFUC	University of Montreal, Montreal, Quebec.....	400
CFCH	Abitibi Power & Paper Co., Iroquois Falls, Ont.....	400	CFXC	Westminster Trust Co., New Westminster, B. C.....	440
CFCI	La Cie de L'Evenement, Quebec, Quebec.....	410	CFYC	Victor Westworth Gillum, Vancouver, B. C.....	400
CFCK	Radio Supply Co., Edmonton, Alberta.....	410	CHAC	Radio-Engineers, Halifax, Nova Scotia.....	400
CFCL	W. W. Grant Radio (Ltd.), Calgary, Alberta.....	440	CHCB	Albertan Publishing Co., Calgary, Alberta.....	410
CFCM	Radio Specialties (Ltd.), Vancouver, B. C.....	450	CHCC	Marconi Company, Toronto, Ont.....	410
CFCN	Laurentide Air Service, Sudbury, Ont.....	410	CHCD	Canadian Wireless & Elec. Co., Quebec, Quebec.....	410
CFCO	Victoria City Temple, Victoria, British Col.....	410	CHCE	Western Canada Radio Sup. (Ltd.), Victoria, B. C.....	400
CFCP	The Jack Elliott Radio Limited, Hamilton, Ont.....	410	CHCL	Vancouver Merchants Exchange, Vancouver, B. C.....	440
CFCQ	The Radio Shop, London, Ont.....	420	CHCM	Riley & McCormack, Calgary, Alberta.....	415
CFCR	Sparks Co., Nanaimo, B. C.....	420	CHCS	The Hamilton Spectator, Hamilton, Ont.....	420
CFCS	Henry Birks & Sons, Calgary, Alta.....	440	CHNC	Toronto Radio Research, Toronto, Ont.....	350
CFCT	Chas. Guy Hunter, 551 Adelaide St., London, Ont.....	410	CHXC	J. R. Booth, Ottawa, Ont.....	435
CFCH			CHYC	Northern Electric Co., Montreal, Quebec.....	410
CFCL			CJBC	Jarvis Baptist Church, Toronto, Ont.....	312
			CJCA	Edmonton Journal, Edmonton, Alberta.....	455
			CJCB	London Free Press Print. Co., London, Ont.....	430
			CJCC	T. Eaton Co., Toronto, Ont.....	410
			CJCE	Spratt-Slack Radio Co., Vancouver, B. C.....	420
			CJCF	The News Record, Kitchener, Ont.....	295
			CJCI	Maritime Radio Corp., St. John, New Brunswick.....	400
			CJCK	Radio Corp. of Calgary, Calgary, Alta.....	316
			CJCM	J. L. Phillippe, Mont Joli, Quebec.....	430
			CJSC	Simons Agnew & Co., Toronto, Ont.....	410
			CKAC	Evening Telegram, Toronto, Ont.....	430
			CKCD	La Presse, Pub. Co., Montreal, Quebec.....	420
			CKCE	Vancouver Daily Province, Vancouver, B. C.....	410
			CKCF	Canadian Independ. Telephone Co., Toronto, Ont.....	450
			CKCK	Leader Pub. Co., Regina, Saskatchewan.....	420
			CKCO	Ottawa Radio Association, Ottawa, Ont.....	440
			CKCX	P. Burns & Co., Calgary, Alberta.....	440
			CKLC	Wilkinson Electric Company, Calgary, Alberta.....	400
			CKOY	Wentworth Radio Supply Co., Hamilton, Ont.....	410
			CNRC	Manitoba Telephone System, Winnipeg, Man.....	450
			CNRE	Canadian National Railways, Calgary, Canada.....	440
			CNRF	Canadian National Railways, Edmonton, Alta.....	450
			CNRG	Canadian National Railways, Montreal, P. Q.....	341
			CNRH	Canadian National Railways, Ottawa, Ont.....	435
			CNRI	Canadian National Railways, Regina, Sask.....	420
			CNRJ	Canadian National Railways, Saskatoon, Sask.....	400
			CNRK	Canadian National Railways, Toronto, Ont.....	400
			CNRL	Canadian National Railways, Winnipeg, Man.....	450



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Easy to tune—  
New principle prevents all back lash, gives infinite tuning precision. Fits all standard condenser shafts.  
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9K Campbell St.

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The Ensign variable straight-line wavelength condenser is one of the most advanced straight line condensers that has as yet been placed on the market. By means of the peculiar type construction of both the stationary and movable plates, it is possible to secure a straight-line wavelength curve over the entire range from minimum to maximum.

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No. 205B-Black Pyralin Bell.....\$22.50  
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WCBA	Charles W. Heimbach	Allentown, Pa.	280	WJAN	Peoria Star	Peoria, Ill.	280
WCBC	University of Michigan	Ann Arbor, Mich.	280	WJAR	The Outing Co. (J. Samuels & Bro.)	Providence, R. I.	360
WCBD	Wilbur G. Voliva	Zion, Ill.	345	WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	286
WCBE	Uhalt Radio Co.	New Orleans, La.	263	WJAX	Union Trust Co.	Cleveland, Ohio	390
WCBF	Paul J. Miller	Pittsburgh, Pa.	236	WJAZ	Chicago Radio Laboratory	Chicago, Ill.	268
WCBG	Howard Williams (Portable)	Pascagoula, Miss.	268	WJBD	Denon University	Granville, Ohio	225
WCBH	University of Miss.	Oxford, Miss.	242	WJBY	Bureau Lodge, Loyal Order of Moose	Moonshew, Ill.	278
WCCI	Nicoll, Duncan & Rush	Bama, Tennessee	240	WJCD	Radio Corp. of Am.	New York, N. Y.	405
WCCJ	J. C. Maus	Jennings, Louisiana	244	WJCE	Radio Corp. of Am.	New York, N. Y.	455
WCCB	E. Richard Hall	St. Petersburg, Fla.	266	WKAA	H. F. Paar	Cedar Rapids, Iowa	278
WCCM	Northern Radio Mfg. Co.	Houlton, Me.	280	WKAD	Chas. Looff (Crescent Park)	East Providence, R. I.	240
WCCN	Charles Swars	Baltimore, Md.	229	WKAF	W. S. Radio Supply Co.	Wichita Falls, Texas	360
WCCO	James P. Boland	Ft. Bent, Harrison, Ind.	266	WKAN	United Battery Service Co.	Montgomery, Ala.	226
WCCP	The Radio Shop, Inc.	Memphis, Tenn.	250	WKAP	Dutce W. Flint	Cranston, R. I.	360
WCCQ	Yashburn Crosby Co.	Nashville, Tenn.	236	WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	220
WCCR	C. H. Meuster	Providence, R. I.	246	WKAR	Michigan Agriculture College	East Lansing, Mich.	280
WCBT	Clark University, Collegiate Dept.	Worcester, Mass.	238	WKAU	Laconia Radio Club	Laconia, N. H.	254
WCBU	Arnold Wireless Supply Co.	Arnold, Pa.	254	WKBF	Dutce Wilcox Flint	Cranston, Rhode Island	286
WCBV	Tullahoma Radio Club	Tullahoma, Tenn.	252	WKY	Wky Radio shop	Oklahoma City, Okla.	360
WCBW	George F. Rankin, Jr., and Maitland Solomon	Macon, Ga.	226	WLAG	Cutting & Washington Radio Corp.	Minneapolis, Minn.	417
WCBX	Radio Shop of Newark (Herman Lubinsky)	Newark, N. J.	233	WLAL	Naylor Electrical Co.	Tulsa, Okla.	360
WCBY	The Forks Electrical Shop	Buck Hill Falls, Pa.	268	WLAP	Wm. V. Jordan	Louisville, Ky.	286
WCBZ	Coppotelli Bros. Music House	Chicago Heights, Ill.	248	WLAP	Arthur E. Shillings	Kalamazoo, Mich.	283
WCCD	Washburn Crosby Co.	Twin Falls, Idaho	236	WLAW	Police Dept. City of New York	New York, N. Y.	220
WCEE	Charles E. Erbstein, Villa Olivia	near Elgin, Ill.	536	WLAX	Putnam Electric Co.	Greencastle, Ind.	231
WCEK	Stix-Baer-Fuller D. G. Co.	St. Louis, Mo.	275	WLB	University of Minnesota	Minneapolis, Minn.	278
WCX	Free Press	Detroit, Mich.	517	WLBL	Wisconsin State Dept. of Markets	Stevenspoint, Wis.	278
WDAE	Tampa Daily Times	Tampa, Fla.	360	WLS	Sears Roebuck & Co.	Chicago, Ill.	345
WDAF	Kansas City Star	Kansas City, Mo.	411	WLW	Crosley Mfg. Co.	Cincinnati, Ohio	423
WDAG	J. Laurence Martin	Amarillo, Tex.	263	WMAC	J. Edw. Page (Olive B. Meredith)	Cazenovia, N. Y.	261
WDAH	Trinity Methodist Church (South)	El Paso, Tex.	268	WMAF	Rorton Hills Radio Corp.	Dartmouth, Mass.	360
WDAR	Lit. Brothers	Philadelphia, Pa.	395	WMAH	General Supply Co.	Lincoln, Nebr.	254
WDAT	Samuel W. White	Worcester, Mass.	360	WMAK	Norton Laboratories	Lockport, N. Y.	273
WDAY	Radio Equipment Corp.	Fargo, N. Dak.	244	WMAL	Trouton Hardware Co.	Trenton, N. J.	256
WDBA	Fred Ray	Columbus, Ga.	236	WMAN	First Baptist Church	Columbus, Ohio	286
WDBB	A. H. Waite & Co., Inc.	Taunton, Mass.	229	WMAQ	Chicago Daily News	Chicago, Ill.	448
WDBC	Kirk Johnson & Co.	Lancaster, Pa.	258	WMAV	Alabama Polytechnic Institute	Auburn, Ala.	250
WDBD	Herman Edwin Burns	Martinsburg, W. Va.	268	WMAZ	King-highway Presbyterian Church	St. Louis, Mo.	280
WDBF	Robert G. Phillips	Youngstown, Ohio	246	WMAZ	Marcer University	Macon, Ga.	281
WDBH	C. T. Scherer	Worcester, Mass.	258	WMAZ	Commercial Appeal	Memphis, Tenn.	509
WDBI	Radio Specialty Co.	St. Petersburg, Fla.	226	WMU	General Supply Co.	Washington, D. C.	273
WDBJ	Richardson Wayland Electric Corp.	Rosnoke, Va.	229	WNAK	Shard Stores	Boston, Mass.	278
WDBL	Wisc. Dept. of Markets	Stevens Point, Wis.	278	WNAL	University of Oklahoma	Norman, Okla.	254
WDBN	Electric Light & Power Co.	Banner, Me.	252	WNAL	Omaha Central High School	Omaha, Nebr.	258
WDBO	Rollins College Inc.	Winter Park, Fla.	240	WNAF	Wittenberg College	Springfield, Mo.	275
WDBP	Superior State Normal School	Superior, Wis.	261	WNAR	First Christian Church	Butler, Ohio	231
WDBQ	Morton Radio Supply Co.	Ealem, N. J.	234	WNAT	Lennis Brothers Co. (Frederick Lennis)	Philadelphia, Pa.	250
WDBR	Tremont Temple Baptist Church	Boston, Mass.	256	WNAX	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WDBS	B. M. K. Radio Corp.	Dayton, Ohio	283	WXC	Dept. of Plant and Structures	New York, N. Y.	526
WDBT	Taylor Book Store	Hatfield, Pa.	236	WOC	Midland College	Lima, Ohio	260
WDBV	The Strand Theatre	Fort Wayne, Ind.	258	WOAE	Midland College	Fremont, Nebr.	280
WDBW	The Radio Deu.	Columbus, Tenn.	268	WOAF	Tyler Commercial College	Tyler, Texas	360
WDBX	Otto Bar.	New York, N. Y.	233	WOAG	Apollo Theatre (Bolviders Amusement Co.)	Bolviders, Ill.	273
WDBY	North Shore Congregational Church	Chicago, Ill.	258	WOAI	Southern Equipment Co.	San Antonio, Texas	385
WDBZ	Boy Scouts, City Hall	King tower, N. Y.	233	WOAN	Vaughn Conservatory of Music (James D. Vaughn)	Lawrenceburg, Tenn.	360
WDM	Church of the Covenant	Washington, D. C.	234	WOAO	Lyrdion Mfg. Co.	Mishawaka, Ind.	360
WDZI	J. L. Bush	Tuscola, Ill.	278	WOAR	Ludskow, Henry F.	Kenosha, Wis.	229
WEAA	F. D. Fallon	Elgin, Ill.	517	WOAS	General Supply Co.	Wilmington, Del.	242
WEAC	American Telephone & Telegraph Co.	New York, N. Y.	492	WOAV	Pennsylvania National Guard, 2d Battalion, 112th Infantry	Eric, Pa.	242
WEAH	Wichita Board of Trade	Wichita, Kans.	280	WOAW	Woodmen of the World	Omaha, Nebr.	526
WEAI	Cornell University	Ithaca, N. Y.	286	WOAX	Falkry J. Wolf	Trenton, N. J.	240
WEAJ	University of South Dakota	Vermillion, S. Dak.	283	WOC	Palmer School of Chiropractic	Davenport, Ia.	484
WEAM	Borough of North Plainfield (W. Gibson Buttfield)	North Plainfield, N. J.	286	WOI	Iowa State College	Ames, Ia.	360
WEAN	Shepard Co.	Providence, R. I.	273	WOO	John Wanamaker	Philadelphia, Pa.	509
WEAO	Ohio State University	Columbus, Ohio	360	WOR	L. Bamberger and Co.	Newark, N. J.	405
WEAP	Mobile Radio Co.	Mobile, Ala.	263	WOS	State Marketing Bureau	Jefferson City, Mo.	441
WEAU	Davidson Bros.	Dayton, Ohio	275	WOB	Tennessee State College	State College, Pa.	266
WEAV	Irvington (Will Horowitz, Jr.)	Houston, Texas	360	WPAC	Donaldson Radio Co.	Oklmulkee, Okla.	260
WEAY	Beewood Co.	St. Louis, Mo.	273	WPAJ	Doolittle Radio Corp.	New Haven, Conn.	268
WEBA	Electric Shop	Highland Park, N. J.	233	WPAL	North Dakota Agricultural College	Agricultural College, N. D.	283
WEBC	Walter Cecil Bridges	Superior, Wis.	242	WPAL	Superior Radio & Telephone Equipment Co.	Columbus, Ohio	286
WEBD	Electrical Equipment and Service Co.	Anderson, Ind.	246	WPAU	Ward Battery and Radio Co.	Beloit, Kans.	236
WEBE	Roy W. Walker	Cambridge, Ohio	248	WPAU	Concordia College	Moorhead, Minn.	286
WEBH	Edgewater Bench Broadening Station	Chicago, Ill.	370	WPAZ	John R. Koch (Dr.)	Charleston, W. Va.	273
WEBI	Walter H. Gibbons	Chicago, Ill.	242	WPAZ	The Municipal Office of Atlantic City	Atlantic City, N. J.	296
WEBJ	Third Avenue Railway Co.	Saltbury, Md.	273	WQA	Frank W. Beale, Jr.	Parkburg, Pa.	260
WEBP	E. J. Pedicor	New York, N. Y.	242	WQAA	Antioch College	Amarillo, Texas	234
WEBT	The Dayton Coop. Industrial High School	Dayton, Ohio	270	WQAC	Moore Radio News Station (Edmund B. Moore)	Springfield, Vt.	275
WEBU	DeLand Piano & Music Co., 139 Boulevard St.	DeLand, Fla.	258	WQAF	Sandusky Register	Sandusky, Ohio	240
WEBW	Beloit College	Beloit, Wisc.	283	WQAM	Electrical Equipment Co.	Miami, Fla.	283
WEBX	John E. Cain, Jr.	Nashville, Tenn.	263	WQAN	Seranton Times	Beranton, Pa.	280
WEBY	Hobart Radio Co.	Rosindale, Mass.	226	WQAO	Calvary Baptist Church	New York, N. Y.	360
WEEL	The Edison Electric Illuminating Co.	Boston, Mass.	303	WQAP	Abilene Daily Reporter (West Texas Radio Co.)	Abilene, Texas	360
WEET	Fulbert-Still Elec. Co.	Boston, Mass.	263	WQAS	Radio Equipment Company	Lowell, Mass.	266
WEW	St. Louis University	St. Louis, Mo.	290	WQAX	Calumet Rainbo Broadcasting Co.	Peoria, Ill.	448
WFAA	Dallas News & Dallas Journal	Dallas, Texas	476	WQJ	The Rice Institute	Houston, Tex.	256
WFAM	Times Publishing Co.	St. Cloud, Minn.	273	WRAA	The Radio Club (Inc.)	Laporte, Ind.	224
WFAN	Hutchinson Electric Service Co.	Hutchinson, Minn.	286	WRAL	Northern States Power Co.	St. Croix Falls, Wis.	248
WFAY	University of Nebraska, Department of Electrical Engineering	Lincoln, Nebr.	275	WRAM	Lombard College	Galesburg, Ill.	244
WFBB	Eureka College	Eureka, Ill.	240	WRAN	Black Hawk Electrical Co.	Waterloo, Iowa	236
WFBC	First Baptist Church	Knoxville, Tenn.	250	WRAN	St. Louis Radio Service Co.	St. Louis, Mo.	263
WFBD	Getzmann Baptist Church	Philadelphia, Pa.	234	WRAT	Antioch College	Yellow Springs, Ohio	242
WFBE	John An De Walle	Seymour, Ind.	226	WRAW	Avenue Radio Shop (Horace D. Good)	Reading, Pa.	238
WFBG	T. Wm. F. Cable Co.	Altoona, Pa.	261	WRAX	Flaxon's Garage	Gloucester City, N. J.	268
WFBI	Concourse Radio Corporation	New York, N. Y.	273	WRBC	Immanuel Lutheran Church	Valparaiso, Ind.	278
WFBJ	St. John's University	Collegeville, Minn.	236	WRC	Radio Corp. of Am.	Washington, D. C.	469
WFBO	Wyana Radio Co.	Raleigh, N. C.	255	WREO	Reo Motor Car Co.	Lansing, Mich.	288
WFBR	Fifth Inf. Md. Nat'l Guard, 5th Reg. Army	Baltimore, Md.	452	WRHF	Washington Radio Hospital	Washington, D. C.	256
WFBT	Gloucester Co. Civic League	Pitman, N. J.	231	WRH	Doron Bros	Hamilton, Ohio	360
WFBU	Ainsworth-Gates Radio Co.	Cincinnati, Ohio	309	WRI	Trouton Hardware Co.	Schenectady, N. Y.	270
WFBV	Signal Officer	Ft. Ben Harrison, Ind.	258	WRM	University of Illinois	Urbana, Ill.	273
WFBY	Knox College	Galesburg, Ill.	254	WRR	Police and Fire Signal Department	Dallas, Tex.	261
WFZ	Strawbridge and Clothier	Philadelphia, Pa.	395	WRW	Tarrytown Radio Res. Labs.	Tarrytown, N. Y.	273
WGAL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa.	248	WSAB	Boutheast Missouri State Teachers College	Cape Girardeau, Mo.	275
WGAQ	Yourses Hotel	Shreveport, La.	252	WSAC	Clemson Agricultural College	Clemson College, S. C.	360
WGAZ	South Bend Tribune	South Bend, Ind.	360	WSAD	J. A. Foster Co.	Providence, R. I.	261
WGCB	Harry H. Carman, 217 Bedell St.	Freeport, N. Y.	244	WSAI	United States Playing Cards Co.	Cincinnati, Ohio	309
WGCB	First Baptist Church	Memphis, Tenn.	266	WSAJ	Grove City College	Grove City, Pa.	258
WGCS	Gimbel Brothers	Philadelphia, Pa.	316	WSAN	Allentown Call Publishing Co.	Allentown, Pa.	229
WGCT	Furness University	Greenville, S. C.	236	WSAP	Seventh Day Adventist Church	New York, N. Y.	263
WGI	American R. & R. Co.	Medford Hills, Mass.	360	WSAR	Doughty & Welch Electrical Co.	Fall River, Mass.	254
WGL	Thos. F. J. Howlett	Philadelphia, Pa.	360	WSAU	Camp Marlenfeld	Chesham, N. H.	229
WGN	The Tribune Co.	Chicago, Ill.	370	WSAV	C. W. Vick Radio Construction Co.	Houston, Tex.	360
WGR	Federal T. and T. Co.	Buffalo, N. Y.	319	WSAY	Irving Austin (Port Chester Chamber of Commerce)	Port Chester, N. Y.	233
WGY	General Elec. Co.	Schenectady, N. Y.	380	WSAZ	Chas. Electric Shop	Pomeroz, Ohio	258
WHAA	University of Wisconsin	Madison, Wis.	275	WSB	Atlanta Journal	Atlanta, Ga.	429
WHAD	State University of Iowa	Iowa City, Iowa	284	WSL	S. and M. Elec. Co.	Utica, N. Y.	273
WHAG	Marquette University	Milwaukee, Wis.	280	WSOE	School of Engineering	Milwaukee, Wis.	246
WHAH	University of Cincinnati	Cincinnati, Ohio	222	WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	248
WHAM	Haer Supply Co.	Joplin, Mo.	283	WTAC	Penn Traffic Co.	Johnstown, Pa.	360
WHAR	University of Rochester (Eastman School of Music)	Rochester, N. Y.	283	WTAF	Louis J. Gallo	New Orleans, La.	242
WHAS	Seaside House	Atlantic City, N. J.	275	WTAL	Toledo Radio & Electric Co.	Toledo, Ohio	252
WHAY	Courier-Journal & Louisville Times	Louisville, Ky.	400	WTAM	Willard Borate Battery Co.	Cleveland, Ohio	390
WHAZ	Wilmington Electrical Specialty Co.	Wilmington, Del.	360	WTAN	Cambridge Radio & Electric Co.	Cambridge, Ill.	242
WHBB	Rensselaer Polytechnic Institute	Troy, N. Y.	380	WTAP	Q. H. Van Gordon & Son	Cass, Wis.	220
WHBC	Washburn College	Washburn, Mo.	226	WTAR	Reliance Electric Co.	Norfolk, Va.	280
WHK	Radiovox Company	Cleveland, Ohio	283	WTAS	Charles E. Erbstein	Elgin, Ill.	286
WHN	George Schubel	New York, N. Y.	360	WTAT	Edison Electric Illuminating Co.	Boston, Mass. (portable)	244
WHO	Bankers Life Co.	Des Moines, Ia.	526	WTAU	Ruegg Battery & Electric Co.	Tecumseh, Nebr.	242
WHIB	Joslyn Automobile Co.	Rockford, Ill.	252	WTAW	Agricultural & Mechanical College of Texas	College Station, Tex.	280
WIAC	Galveston Tribune	Galveston, Texas	360	WTAX	Williams Hardware Co.	Streator, Ill.	231
WIAD	Howard H. Miller	Philadelphia, Pa.	254	WTAY	Q. H. Leaves Broadcasting Station	Oak Park, Ill.	283
WIAK	Journal-Stockman	Omaha, Nebr.	278	WTB	L. M. Greenleaf	Greenville, N. J.	220
WIAP	Furness Publishing Co.	Marion, Ind.	226	WTG	Kansas State Agricultural College	Manhattan, Kans.	273
WIAS	Home Electric Co.	Burlington, Iowa	283	WTX	H. G. Saal Co.	Chicago, Ill.	268
WIK	K. & L. Co.	McKeesport, Pa.	234	WVAD	Wright & Wright (Inc.)	Philadelphia, Pa.	360
WIL	Continental Electric Supply Co.	Washington, D. C.	350	WVAE	The Alamo Ball Room	Joliet, Ill.	242
WIP	Gimbel Bros	Philadelphia, Pa.	509	WVW	Ford Motor Co.	Dearborn, Mich.	273
WJAB	American Electric Co.	Lincoln, Neb.	229	WVWJ	Detroit News (Evening News Assn.)	Detroit, Mich.	517
WJAD	Jackson's Radio Engineering Laboratories	Waco, Texas	353	WVWL	Loyola University	New Orleans, La.	260
WJAG	Norfolk Daily News	Norfolk, Nebr.	283	WVWA	Michigan College of Mines	Houghton, Mich.	244
WJAK	Clifford L. White	Greenwood, Ia.	254				
WJAM	D. M. Perham	Cedar Rapids, Iowa	268				



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**We Need Men—Can You Qualify?**

Ozarka representatives make real money because they give real values and deliver a real service. For instance, there is a 4-tube Ozarka instrument for loud speaker operation, giving wide range of reception at \$39.50. Our men demonstrate Ozarka Instruments and install. The instrument makes the sale easy by its performance. We train you to know radio and our methods, make you worthy to wear the Ozarka hutton as our accredited representative. Previous experience is not necessary. In fact we prefer to do our own educating. If you have a clean record, are industrious, and have saved up a little cash, here's a real opportunity, if you can qualify for an exclusive territory. We already have 2247 representatives. Territory going fast.



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**4 Tube Sets As Low \$39.50**



February 7, at Midnight  
LISTEN TO RADIO AGE  
From KYW

## "Up the Ladder" With The Beginner

(Continued from page 27)

circuit diagrams show the proper hookup. Note that there is no connection from the primary to the secondary.

### Amplification

AUDIO amplification consists of amplifying the low frequency currents. The method employed consists essentially of a series of audion amplifiers arranged electrically so that the amplified output of each tube is passed on successively to the next, to be amplified again. Each tube with its passing-on coupling is referred to as a stage, or "step" in the amplifier.

As magnification of tube and battery noises and other disturbances of this nature are proportional to the magnification of the signal received, the number of audio frequency stages which are advisable is two, possibly three.

Several methods of linking tubes are possible; for instance, resistance, inductance or transformer coupling. The latter method is by far the most popular, although the resistance coupled amplifier is rapidly gaining great favor, where volume is a second consideration.

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If you are interested in buying a Radio Set. Radio Equipment or Radio Supplies of any kind at greatly reduced prices, send for our **FREE BOOKLET**

We can save you money no matter how large or small a set you intend to buy.

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Special 4-Volt Radio Storage Battery,	6.00
6-Volt, 60 Amp. Radio Storage Battery,	7.00
6-Volt, 80 Amp. Radio Storage Battery,	8.00
6-Volt, 100 Amp. Radio Storage Battery,	9.50
6-Volt, 120 Amp. Radio Storage Battery,	11.50
6-Volt, 140 Amp. Radio Storage Battery,	13.00

We ask for no deposit. Simply send name and address and style wanted. Battery will be shipped the day we receive your order Express C. O. D., subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Act quick. Send your order today—NOW.

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1215 South Wabash Ave.  
Dept. 1 Chicago, Ill.



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Your OWN Name and Address Printed Freely Thank You Cards bear what YOU like. Station glad to put on numbers at your request. Thank your favorite stations. Special cards that get ATTENTION. All the RAGE, 100—\$1.00; 200—\$1.60; 300—\$2.00; 600—\$3.00; 1000—\$4.00. **FREEBIES!** If pay with order, **MONEY REFUNDED!** If Not Delighted Quality cards. High grade printing. Send no money—just pay postman when you get cards. Order **NOW!**

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## DEVICES

displaying this seal have been tested and approved by the RADIO AGE INSTITUTE.

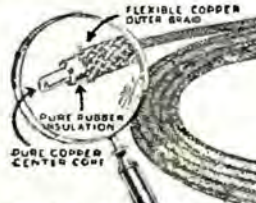
The apparatus illustrated and described below have successfully passed our tests for February, 1925.



Test No. 30. **FEDERAL TYPE 201-A VACUUM TUBE.** This tube was submitted for test by the Service Lamp Co., 112-114 Trinity Place, New York City, N.Y. Due to the efficient manner in which the tube is packed, it arrived in good condition. Although no tests were made to determine the life of the tube, it gave very good results. It is well manufactured according to all the latest practices and gave excellent results as a detector amplifier and oscillator. The filament consumption at five volts was one quarter ampere and ninety to one hundred and twenty volts can safely be used on the plate. Tested and approved by RADIO AGE Institute.



Test No. 31. **THE DAVEN SUPER-AMPLIFIER.** The Daven Radio Corporation of Newark, N. J., submits one of their super-amplifiers for testing purposes. We have found by actual experience that the tone quality of this amplifier far surpasses any other method of amplification that is now practiced. Tube noises were eliminated to a very great extent; in fact they were negligible. Its consumption of "B" battery current was less than half of the amount consumed by amplifiers of the ordinary type. The amplifier is delivered all wired and ready to install in the set. Arrived in excellent condition, and passed the tests and requirements of RADIO AGE Institute.



Test No. 32. **THE MUSSELMAN SELECTIVE ANTENNA.** Submitted by the Cycle Mfg. & Supply Co., Chicago, Ill. This type of antenna wire is a radical departure from the usual type of wire used in antenna construction. It is constructed with a center core made of solid copper of 4200 circular mills capacity; over this a 1-32 inch rubber insulation of high quality; over the whole is an outer cover of braided copper wire, tinned to prevent corrosion, with a capacity of 4800 circular mills. When this wire is used as a straight aerial and not as a loop, the outside copper tinned braid, because of its surface, acts as an ideal wave collector. Arrived in good condition, and satisfactorily passed the tests and requirements of RADIO AGE Institute.



Test No. 33. **BREMER TULLY LOW LOSS CONDENSER.** Sent to us for test by the Bremer Tully Mfg. Co., 531 So. Canal St., Chicago, Ill. After many tests we have found this condenser to be truly of the low loss type. When tested on laboratory instruments, it was practically impossible to measure any losses. The style of construction is rugged and dependable. The manner in which the rotor plates are assembled prohibits of high resistance leaks. Satisfactorily passed the requirements of RADIO AGE Institute.





**RADIO'S WONDER CIRCUIT!**  
4 Tubes Do the Work of 7 in the  
**Telmaco P-1 Receiver**

Coast to coast reception. Aerial, loud speaker and batteries self-contained. Carry from room to room—take it anywhere. Ask your dealer or write us. Free descriptive folder.

Radio Division

**TELEPHONE MAINTENANCE CO.**  
20 S. Wells Street, Dept. C, Chicago, Ill.  
Quality Radio Exclusively Since 1918

**I Make the Best CHOCOLATE BARS**

Mints and Chewing Gum. Be my agent. Everybody will buy from you. Write today. Free Samples.  
MILTON GORDON, 576 Jackson St., Cincinnati, Ohio



**BUILD-UP**  
**MICA CONDENSER**  
Patent Pending

insure high efficiency and the Build-Up feature enables the operator to obtain any definite capacity from .0005 to .006 by simply adding extra plates of copper and mica to the Build-Up base.

Each alternate copper and mica plate has a capacity of approximately .0002 Mfd.

Build-Up Mica Condensers of the following capacities, each assembled complete in carton, at the following prices:

Capacity	List price
.00025 Mfd.	50c
.0005 "	50c
.001 "	55c
.002 "	60c
.0025 "	65c
.005 "	70c
.006 "	75c

Extra envelope containing 20 copper and mica plates, or sufficient to build up a condenser from .00025 to .006, list price 25c.

Table showing required number of plates needed for any capacity is furnished with each condenser.

Ask your dealer—or order direct

**CHAS. SCHINDLER**  
1404 W. Delaware Ave., Toledo, Ohio



12 Cells  
54 Volts  
Solid Rubber Case

**\$3.50 SPECIAL**

**INTRODUCTORY PRICE**  
For a limited time only, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for \$3.50. Regular Retail Price is \$5.50. You save \$2.00 by ordering NOW. A finer battery cannot be built than the

**World Storage "B" Battery**  
(12 CELLS—24 VOLTS)

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.

**A Superior Battery** Equipped With Solid Rubber Case Has heavy duty 21-8 in. x 11 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and escape of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

**SEND NO MONEY**

Just state number of batteries wanted and we will ship per order is received. EXTRA OFFER: Batteries in series 195 volts, \$10.00. Pay Expressman after examining batteries, 5 per cent amount 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  
1219 S. Wabash Ave., Dept. B1 Chicago, Ill.

**SAVE \$2.00 BY ORDERING NOW!**

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| 1 "A" Batteries                              | 57 Couplers, loose            | 114 Indicators, polarity          | 168 Patent attorneys                   | 221 Solder salts                      |
| 2 Aerial protectors                          | 58 Couplers, molded           | 115 Inductances, C. W.            | 169 Phone connectors, multiple         | 222 Solder solution                   |
| 3 Aerial insulators                          | 59 Couplers, vario            | 116 Insulation, molded            | 170 Phonograph adapters                | 223 Spaghetti tubing                  |
| 4 Aerials                                    | 60 Crystal alloy              | 117 Insulation material           | 171 Plates, condenser                  | 224 Spark coils                       |
| 5 Aerials, loop                              | 61 Crystal holders            | 118 Insulators, aerial            | 172 Plus, coil                         | 225 Spark gaps                        |
| 6 Amplifiers                                 | 62 Crystals, rough            | 119 Insulators, composition       | 173 Plus, telephone                    | 226 Stampings                         |
| 7 Amplifying units                           | 63 Crystals, mineral          | 120 Insulators, fibre             | 174 Pointers, dial and knob            | 227 Stators                           |
| 8 Ammeters                                   | 64 Crystals, synthetic        | 121 Insulators, high voltage      | 175 Poles, aerial                      | 228 Stop points                       |
| 9 "B" batteries                              | 65 Crystals, unmounted        | 122 Insulators, cloth             | 176 Potentiometers                     | 229 Switch arms                       |
| 10 Batteries (state voltage)                 | 66 Crystals, mounted          | 123 Insulators, glass             | 177 Punching machines                  | 230 Switch levers                     |
| 11 Batteries, dry cell                       | 67 Decks, radio               | 124 Insulators, hard rubber       | 178 Reinartz set parts                 | 231 Switch points                     |
| 12 Batteries, storage                        | 68 Detector units             | 125 Insulators, porcelain         | 179 Regenerative set parts             | 232 Switch stops                      |
| 13 Battery chargers                          | 69 Detectors, crystal         | 126 Irons, soldering              | 180 Receiver caps                      | 233 Switches, aerial                  |
| 14 Battery clips                             | 70 Detectors, fixed crystal   | 127 Jacks                         | 181 Rectifiers, battery                | 234 Switches, battery                 |
| 15 Battery plates                            | 71 Dial, adjusters            | 128 Filament control              | 182 Resistance leaks                   | 235 Switches, filament                |
| 16 Battery substitutes                       | 72 Dials, composition         | 129 Jars, battery                 | 183 Resistance units                   | 236 Switches, ground                  |
| 17 Bezels                                    | 73 Dials, hard rubber         | 130 Keys, transmitting            | 184 Rheostat bases                     | 237 Switches, inductance              |
| 18 Binding posts                             | 74 Dials, rheostat            | 131 Knobs                         | 185 Rheostat strips                    | 238 Switches, panel                   |
| 19 Binding posts, insulated                  | 75 Dials, metal               | 132 Knock-down panel units        | 186 Rheostat, automatic                | 239 Switches, single and double throw |
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| 24 Broadcasting equipment                    | 80 Dry cells                  | 137 Loud speakers                 | 191 Rheostats, power                   | 244 Transformers, modulation          |
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| 26 Buzzers                                   | 82 Electrolyte                | 139 Lugs, battery                 | 193 Rods, ground                       | 246 Transformers, push-pull           |
| 27 Cabinets                                  | 83 Enamels, battery           | 140 Lugs, terminal                | 194 Rotors                             | 247 Transformers, radio frequency     |
| 28 Cabinets, battery                         | 84 Enamels, metal             | 141 Measuring instruments         | 195 Scrapers, wire                     | 248 Transformers, variable            |
| 29 Cabinets, loud speaker                    | 85 End stops                  | 142 Megohmmeters                  | 196 Screw drivers                      | 249 Transmitters                      |
| 30 Carbons, battery                          | 86 Eyelets                    | 143 Meters, A. C.                 | 197 Screws                             | 250 Tubes, vacuum—peanut              |
| 31 Cat whiskers                              | 87 Experimental work          | 144 Meters, D. C.                 | 198 Schools, radio                     | 251 Tubes, vacuum—two element         |
| 32 Code practicers                           | 88 Fibre sheet, vulcanized    | 145 Mica                          | 199 Sets, receiving—cabinet            | 252 Tubes, vacuum—three element       |
| 33 Coils                                     | 89 Filter reactors            | 146 Mica sheets                   | 200 Sets, receiving—crystal            | 253 Tuners                            |
| 34 Coils, choke                              | 90 Fixtures                   | 147 Milliammeters                 | 201 Sets, receiving—knock-down         | 254 Variocouplers, hard rubber        |
| 35 Coils, coupling                           | 91 Fuse cut outs              | 148 Minerals                      | 202 Sets, receiving—Neutrodyne         | 255 Variocouplers, molded             |
| 36 Coils, filter                             | 92 Fuses, tube                | 149 Molded insulation             | 203 Sets, receiving—portable           | 256 Variocouplers, wooden             |
| 37 Coils, grid                               | 93 Generators, high frequency | 150 Molybdenum                    | 204 Sets, receiving—radio frequency    | 257 Variometers, hard rubber          |
| 38 Coils, honeycomb                          | 94 Grid choppers, rotary      | 151 Mountings, coil               | 205 Sets, receiving—reflex             | 258 Variometers, molded               |
| 39 Coils, inductance                         | 95 Grid leak holders          | 152 Mountings, condenser leak     | 206 Sets, receiving—regenerative       | 259 Variometers, wooden               |
| 40 Coils, Reinartz                           | 96 Grid, transmitting leak    | 153 Mountings, end                | 207 Sets, receiving—Reinartz           | 260 Varnish, insulating               |
| 41 Coils, stabilizer                         | 97 Grid leaks, tube           | 154 Mountings, grid leak          | 208 Sets, receiving—sectional          | 261 Voltmeters                        |
| 42 Coils, tuning                             | 98 Grid leaks, variable       | 155 Mountings, honeycomb coil     | 209 Sets, receiving—short wave         | 262 Washers                           |
| 43 Condenser parts                           | 99 Grinders, electric         | 156 Mountings, inductance switch  | 210 Sets, receiving—super-regenerative | 263 Wave meters                       |
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| 45 Condensers, antenna coupling              | 101 Ground rods               | 158 Neutrodyne set parts          | 212 Slate                              | 265 Wire, aerial                      |
| 46 Condensers, by-pass                       | 102 Handles, switch           | 159 Nuts                          | 213 Shellac                            | 266 Wire, braided and stranded        |
| 47 Condensers, coupling                      | 103 Head bands                | 160 Ohmmeters                     | 214 Sliders                            | 267 Wire, copper                      |
| 48 Condensers, filter                        | 104 Head phones               | 161 Oscillators                   | 215 Socket adapters                    | 268 Wire, insulated                   |
| 49 Condensers, fixed (paper, grid, or phone) | 105 Head sets                 | 162 Panel cutting and drilling    | 216 Sockets                            | 269 Wire, Litz                        |
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| 52 Condensers, vernier                       | 108 Horns, composition        | 165 Panels, hard rubber           | 219 Soldering paste                    | 272 Wire, tungsten                    |
| 53 Contact points                            | 109 Horns, fibre              | 166 Parts                         | 220 Solder flux                        |                                       |
| 54 Contacts, switch                          | 110 Horns, mache              | 167 Paste, soldering              |  |                                       |
| 55 Cord tips                                 | 111 Horns, metal              |                                   |  |                                       |
| 56 Cords, for head sets                      | 112 Horns, wooden             |                                   |  |                                       |
|  | 113 Hydrometers               |                                   |  |                                       |

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\* Tested and Approved by RADIO AGE \*



# With the Manufacturers

## American Bosch Enters Radio Field

The long expected entrance into the radio field on the part of the American Bosch Magneto Corporation will become an actual fact in January, when that well known automotive accessory concern announces to the Radio trade, the Bosch NoBattery.

The new unit, as the name implies is a device for the supply of current to radio sets without recourse to batteries.

Although the new unit is eventually to be supplied in four or five types to take care of the various characteristics and requirements, the first available type will be for the supplying of so-called B current—it will secure its original electrical energy from the house lighting circuit which, in the majority of cities and towns, is of the alternating type.

It is the purpose of Bosch to also introduce a complete NoBattery line, but, among the first to be announced, following the present effort, will be a combination unit for the purpose of supplying both so-called A and B energy and thereby eliminating from radio one of the most outstanding causes of annoyance, trouble and mystifying reasons for loss of efficiency and unsatisfactory reception.

The Bosch NoBattery, which it is expected will be available in January, is to be known as the BAN type, and will supply B current from 110-115 volt alternating lines, at 50-60 cycles.

It uses less current than an ordinary 25-watt bulb and delivers a steady, even flow of current, at a constant voltage, the detector plate voltage being variable.

## New Crystal Acts as Battery

Conspicuous among new ideas being introduced into radio is the Miller Battery Crystal, an invention of A. H. Miller, originator of B-Metal and president of the A. H. Miller Radio Co., of Detroit.

Much is claimed for this new crystal, which acts in the capacity of a battery when charged with what Mr. Miller has named "Pep Powder."

Crystals rectify radio signals in proportion to their different resistance in opposite directions. The greater the difference, the greater their rectifying properties. These properties have been amplified in the Battery Crystals by charging or electrifying the crystal and keeping it electrified to a certain potential.

In local work, with a one tube reflex set, about four times the volume received by the use of ordinary crystals is obtained from the Battery Crystal. In fact, there is enough volume to operate a loud speaker with ease. On long distance work, stations one thousand miles away are reached on one tube reflex sets using Miller Battery Crystals. Furthermore, reception is as distinct and loud as received in local work with ordinary crystals.

Such claims for crystals seem startling but the Battery Crystal seems to have brought forth a new era in crystal work. This little crystal has power enough to deliver 25 to 50 millivolts right into the most sensitive part of the circuit, which is in turn amplified.

With each Battery Crystal, there is a generous supply of Pep Powder included. Enough can be purchased for 50 cents to last the user 10,000 hours.

## New U. S. L. Condenser.

In order to meet the demand for a finer product, David Wald, president of the United Scientific Laboratories, Inc., 92 East 10th St., New York City, producers of the famous U. S. L. line of Radio apparatus, has again set to task and designed a line of low loss condensers, which spell the last word in mechanical refinement and construction for such an article. The years of experience, designing and building electrical motors, apparatus and radio parts has fitted Mr. Wald to design apparatus with the utmost precision and skill. The new low loss condenser is the result of these years of manufacturing experience and has the unique and sound principles of construction, as may be found in the highest grade apparatus.

Rigid frame construction without depending upon insulation as part thereof, thereby eliminating all possible chances of misalignment, is one of the features of the new condenser. Straight-line capacity is obtained by scientific construction of rotor and stator plates, which are made of a special grade of brass. Pigtail connection on rotor insures absolute electrical contact with rotor.



**HONEYCOMB COILS**  
The Universal all-wave inductance. Back and front panel mountings. Send 25c for Super Het., R. F. and Honeycomb Coil Circuits and Complete Catalog. e  
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## Notice

We are exclusive sales representatives for manufacturers of cabinets, tubes and storage batteries.

The RECO 4 tube tuned radio frequency set is built for and sold by us exclusively. This set is equal to any five or six tube set on the market. Long distance stations brought in with volume and clarity.

The "RECO" Low Loss, Straight Line variable condenser will soon be ready for distribution. The prices will be reasonable. Watch for our ad in this paper every month.

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The Benson Wave Filter eliminates annoying interferences. It is of the inductive coupled type. Mounted in a beautiful leather covered cabinet with an engraved bakelite panel.

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FITS ALL TYPES OF BUILDINGS

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6 Ft. Mast \$5 Pair  
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Dealers and Jobbers—Write for Proposition



# RADIO AGE ANNUAL

## for 1925

# Now Ready!

*With a Thirty-Two Page Blueprint Section of Record-Breaking Hookups!*

**AT LAST!** THE RADIO AGE ANNUAL for 1925 is ready! After months of preparation, a bigger, better and more attractive book than ever is ready for RADIO AGE'S great army of set builders.

THE ANNUAL for 1925 is the result of three years of constant research work and experiments by the staff members and writers of RADIO AGE. It is the cream of the radio hookups that have made their appearance since the birth of radio and have won lasting favor with America's millions of radio enthusiasts.

One hundred and twenty pages of new hookups, construction articles, and kindred subjects in the radio field compose the unusual contents of the RADIO AGE ANNUAL for 1925. No other book has ever been printed approaching its excellence. No other book can be found that will give you such a variety of hookups and "How to build" articles.

THE predominating feature of the RADIO AGE ANNUAL for 1925 is the big, thirty-two page blueprint section, consisting of sixteen full pages of blueprints of favorite hookups, from single tube outfits to efficient neutrodynes, reflexes and super-heterodynes. The kind of blueprints that made the RADIO AGE monthly section the talk of the radio world. Use them as *actual working drawings*. Every one of the hookups in the blueprint section and in the rest of the *Annual* has been thoroughly tested by experts in our radio laboratory.

Complete instructions for building every kind of hookup—from crystal to super-het, are found in the ANNUAL. The biggest dollar's worth ever offered for home experimenters as well as experts. The blueprint section alone is worth many times the cost of the book.

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FOR 1925**

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*Some of the Features You'll Find  
In This Wonder Hookup Book*

How to read and understand hookups.  
How to understand radio phenomena.  
Building your first simple set.  
How to select the right receiver.  
Substituting a tube for a crystal—building the first tube set.  
How to amplify any kind of set.  
Making a reflex set.  
Building your first Reinartz set.  
The renowned Baby Heterodyne No. 1.  
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RADIO AGE ANNUAL BLUEPRINT SECTION with such popular hookups as the aperiodic variometer, loop sets, feed-

back receivers, neutrodynes, reflex hookups, Baby Het No. 2, a Wonder Super-Het, and others.  
How to get rid of interference.  
How to make an amplifying unit.  
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Another super-heterodyne for the super experimenters.  
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A three-tube long distance regenerator.  
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Improving the ever popular Reinartz.  
AND MANY OTHER UP-TO-THE-MINUTE HOOKUPS AND ARTICLES.

**ORDER YOURS NOW!**

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2-25

**FIRST CALL FOR THE ANNUAL FOR 1925! NOW READY!**



# The Real Secret of Clear Tone and Quiet Operation

*told in simple, every-day terms which everyone can understand*



**S**OMETHING has recently happened to radio which makes it a much simpler, more dependable and sweeter toned instrument. That something is the *complete* elimination of internal noises by the radio inventor, Carl Pfanstiehl.

The technical means which he employed is a scientific story of great interest to radio engineers. The average radio user does not care about that. But, briefly, in popular language, this is what he did:

For years he had observed what complicated devices were being used to neutralize stray oscillations in the set, the oscillations of radio energy which cause chatter and squeaks and squeals, and often distort speech or music. Potentiometers were employed and extra condensers. These are a makeshift. They only partially succeed; and they need adjustment.

He made up his mind that some way could be found to go to the root of the trouble and eliminate it entirely, instead of merely trying to offset it.

By tracing back the oscillations to their separate sources he discovered their true nature and how to keep them out. Nobody had ever known this before.

The remedy is as simple as it is effective. All complicated devices are dispensed with. He so designed the structural relationship between coils and condensers that the stream of radio energy is perfectly controlled; there is no feedback causing stray oscillations. All the radio energy is utilized in developing the true signal. The set is internally noiseless. Speech and music come in without interference. You get a liquid clear enunciation of every syllable and a supremely pure tone.

See and hear this new system that is revolutionizing radio—the Pfanstiehl Model 7—at your dealer's. Or let us send you free descriptive booklet.

Dealers: Write for the special Pfanstiehl proposition.

**PFANSTIEHL RADIO COMPANY**  
Highland Park 22 Second Street Illinois

## Pfanstiehl

**MODEL 7 RECEIVER**

*A 5-tube Receiver using the new system of tuned radio frequency*

\* Tested and Approved by RADIO AGE \*



# 3 Tubes DO THE WORK OF 6



Crosley Trirdyn Special, \$60.00  
With tubes and Crosley Phones \$75.75

## In the CROSLEY Trirdyn

**S**INCE the inception of radio, the results obtained with Armstrong Regenerative Receivers have been the goal of comparison for all others. Trick circuits have been designed to get around the Armstrong Patent hoping to obtain results "just as good." This has resulted in the use of more tubes, necessary without, but unnecessary with regeneration. This is one reason why Crosley Radios, licensed under Armstrong U. S. Patent No. 1,113,149 have performed everywhere so remarkably on so few tubes.

The Crosley Trirdyn, employing Armstrong Regeneration combined with tuned non-oscillating radio frequency amplification and reflexed audio frequency amplification and using only three tubes, consistently gives greater selectivity, more volume and wider range than can be obtained where five or six tubes are employed without regeneration. With no regeneration, two stages of radio frequency amplification, requiring at least two additional tubes, must be employed in front of the detector tube to get the same results as furnished by one tube where regeneration is used.

Every additional tube means additional expense; an added dial to tune, greater difficulty in operation, more distortion and more tube noises. The three tube Crosley Trirdyn has only two dials. These operate but two circuits, making tuning and logging very easy.

You can't beat the results obtained from an Armstrong Regenerative Crosley Radio. A trial will convince you.

**BEFORE YOU BUY—COMPARE  
YOUR CHOICE WILL BE A CROSLEY**

For Sale By Good Dealers Everywhere

*Crosley Regenerative Receivers are Licensed under Armstrong U. S. Patent 1,113,149  
Prices West of the Rockies add 10%*

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**THE CROSLEY RADIO CORPORATION**

Powel Crosley, Jr., President

263 Sassafras St.

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Crosley Trirdyn Newport, \$85.00  
With tubes and Crosley Phones \$100.75

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Better—Costs Less  
Radio



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With tubes and Crosley Phones \$22.25

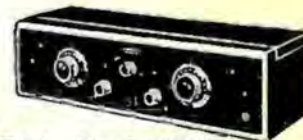


Crosley Two Tube  
Model 51, \$18.50  
With tubes and Crosley Phones \$30.25



Crosley Three Tube  
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