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RADIO NEWS

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RADIO IN 1935

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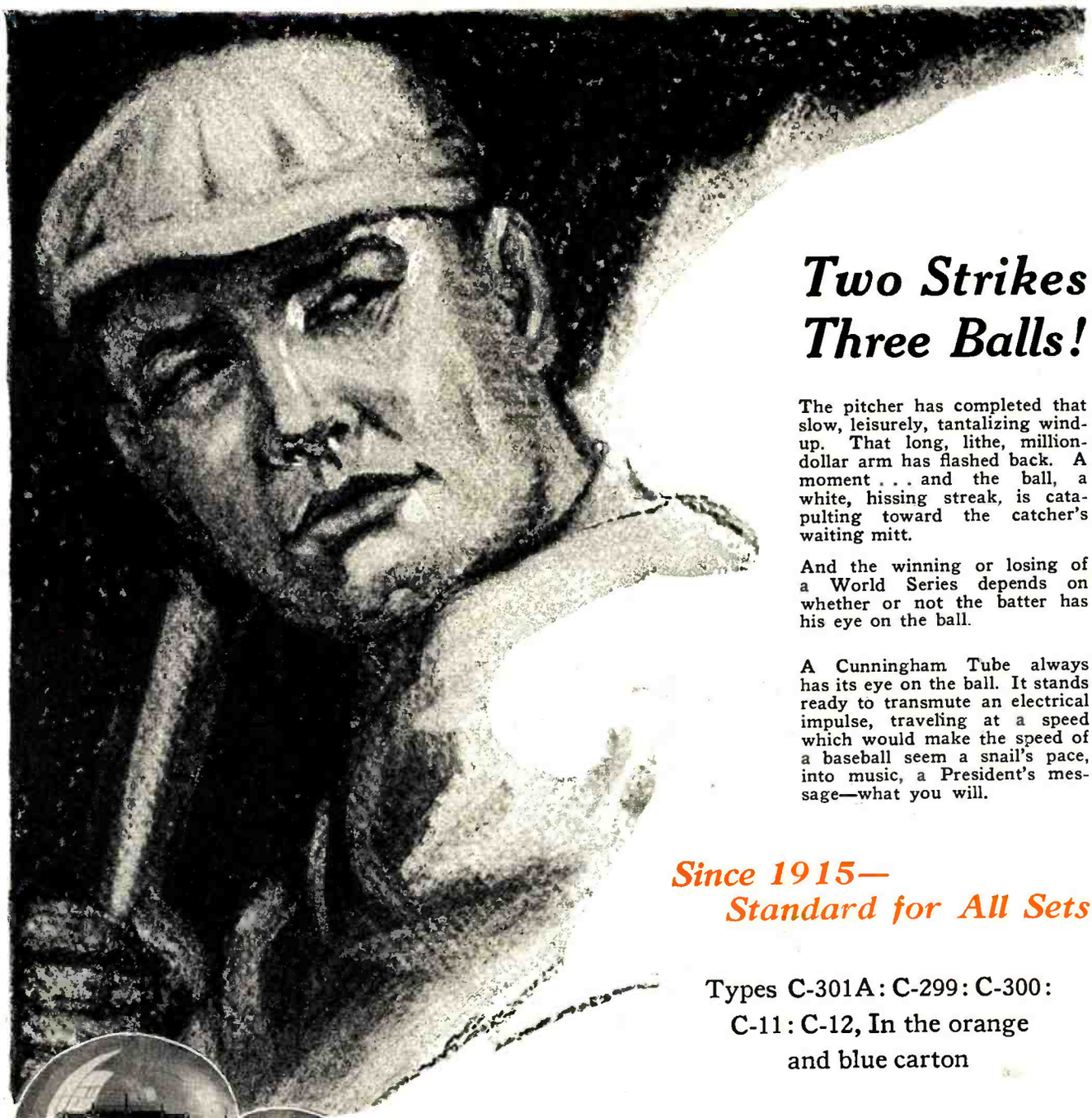
RADIO'S GREATEST MAGAZINE

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF

SCIENCE and INVENTION THE EXPERIMENTER MOTOR CAMPER & TOURIST



Two Strikes Three Balls!

The pitcher has completed that slow, leisurely, tantalizing wind-up. That long, lithe, million-dollar arm has flashed back. A moment . . . and the ball, a white, hissing streak, is catapulting toward the catcher's waiting mitt.

And the winning or losing of a World Series depends on whether or not the batter has his eye on the ball.

A Cunningham Tube always has its eye on the ball. It stands ready to transmute an electrical impulse, traveling at a speed which would make the speed of a baseball seem a snail's pace, into music, a President's message—what you will.

Since 1915—
Standard for All Sets

Types C-301A: C-299: C-300: C-11: C-12, In the orange and blue carton

Price $3.00 each

Cunningham RADIO TUBES

Home Office:
182 Second Street,
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E. T. Cunningham Inc.

NEW YORK
CHICAGO

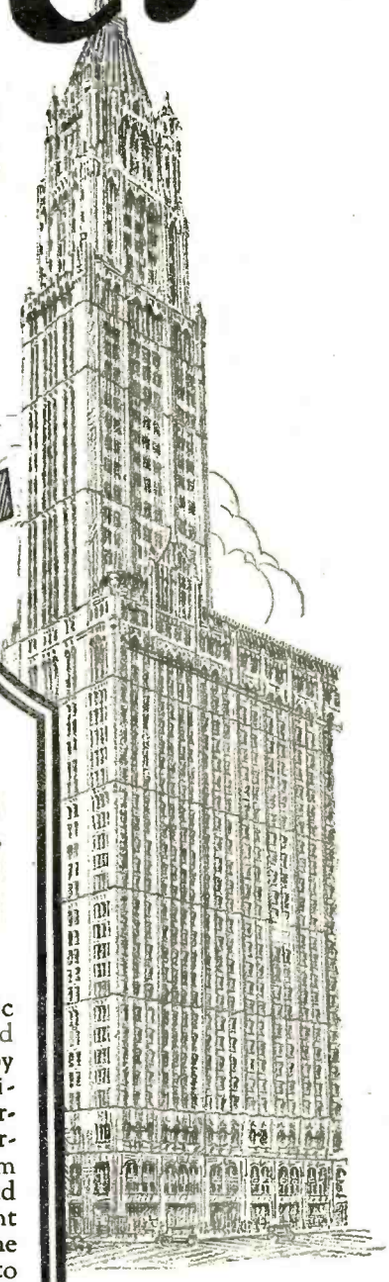
Patent Notice: Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.

Another Famous TOWER

Equal to the BEST regardless of price

Tower Scientific LOUD-SPEAKER

$8.50



Surely a Wonderful TOWER TRIUMPH

Unquestionably the greatest Loud Speaker Value ever offered, giving the quality and volume to be found in the most expensive speakers, but priced within the reach of all. The same true (cello like) tone that has made Tower's Scientific Phones the World's most popular headset is characteristic of the NEW TOWER LOUD SPEAKER.

The many features include magnets that lift 2 lbs. 10 oz., diaphragm of specially constructed material, perfect non-vibrating fibre horn, finished in beautiful golden bronze with 10" bell.

Tower's Scientific Phones are tested and approved by Government licensed Radio Operators, thus guaranteeing uniform tone, quality and accuracy. Weight only 8¼ ozs. The logical 'phone to buy.

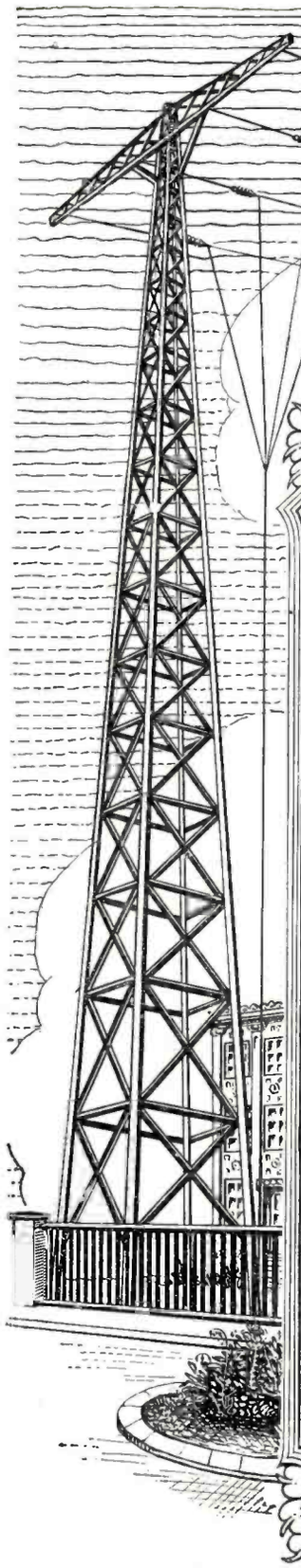
On sale at all good dealers from coast to coast.

The Woolworth Bldg., New York City, is the tallest office building in the world being 792 feet high, containing 60 stories, and having an estimated weight of 206,000,000 pounds.

THE TOWER MFG. CORPORATION

98 BROOKLINE AVE. Dept. U BOSTON, MASS.

Worlds Greatest Loud Speaker Value



RADIO NEWS

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VOLUME 6 NUMBER 11

CONTENTS

MAY, 1925

In Our Next Issue

An Entirely New Development in Radio Receivers.

A new idea by means of which it is possible for broadcast listeners to get all low wave stations from 200 to 300 meters and the higher waves from 300 to 600 meters without crowding on the dial, and without the present interference.

* * *

A Symposium on the Theories of Fading.

By Leon L. Adelman

A discussion of all the theories so far put forward in explanation of one of radio's greatest enigmas. The article also takes into consideration all the theories regarding the propagation of radio waves.

* * *

Design Your Own Low Loss Coils.

By Sylvan Harris

Sylvan Harris tells the readers of RADIO NEWS how to design and make their own low loss coils for radio receivers. No longer do you have to take the word of the salesman. Design your own inductances and know they are the most efficient possible.

* * *

A New Non-Radiating Regenerative Receiver.

By Sander Stern

A new application of an old principle allows the use of radio's most efficient principle without the accompanying annoyance to the neighbors.

In This Issue

RADIO NEWS is published on the 10th of each preceding month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries, $3.00 a year. U. S. Coin as well as U. S. Stamps accepted (no foreign coins or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., INC.

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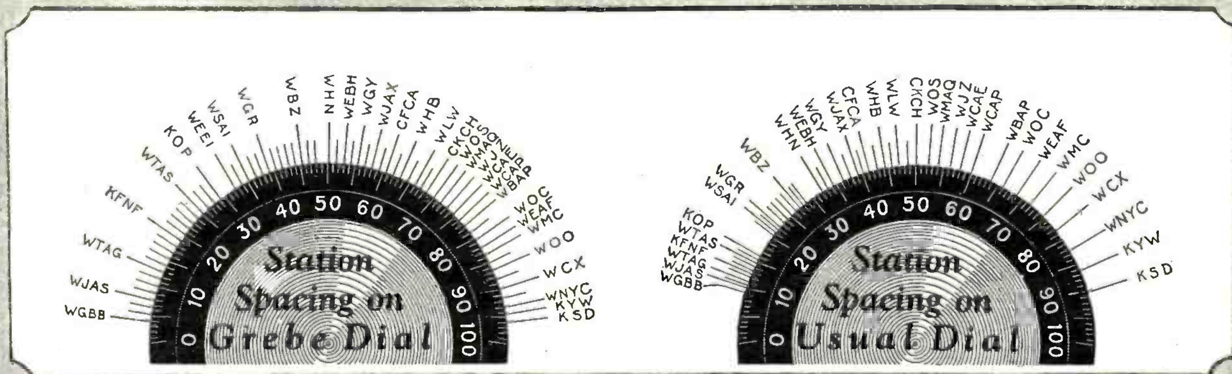

Why Tuning is So Easy with the Grebe

S-L-F (straight line frequency) *Condensers*—exclusively Grebe—make unnecessary the crowding of short-wave stations to the lower dial numbers.

On the Grebe dial all stations have equal spacing. There is as much leeway in tuning-in a short as a long-wave station. Sharp tuning is quick, easy and certain.

Each station is found on the same settings on all dials.

With other exclusive Grebe features—such as *Binocular Coils* and *Volume Control*—the Synchrophase presents the very latest in radio receiver development.

Unlike sets made of assembled parts, every detail of the Synchrophase is designed and built in our factory in order that we may control the quality and workmanship. For this reason all parts co-ordinate perfectly and make possible the unsurpassed performance of the Synchrophase.

The cabinet is beautifully designed and built of solid mahogany, highly polished and with delicately embossed gold escutcheons.

Ask your dealer for a demonstration

A. H. Grebe & Co., Inc.
Van Wyck Blvd., Richmond Hill, N. Y.
Western Branch: 443 So. San Pedro Street, Los Angeles, Cal.

Only perfection in every detail can give perfection to the whole.

Doctor Mu

The GREBE SYNCHROPHASE
TRADE MARK

GREBE RADIO
TRADE MARK
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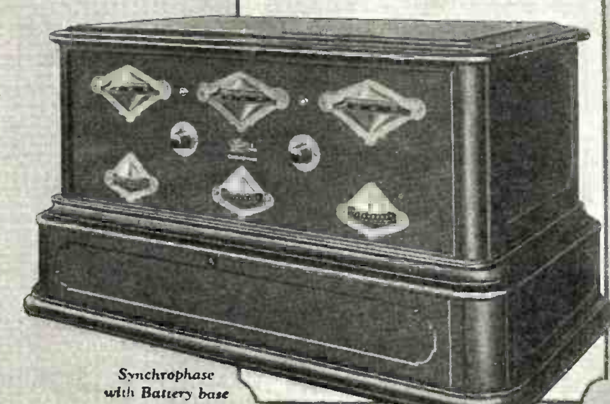


Synchrophase with Battery base

All Grebe apparatus is covered by patents granted and pending.

This Company owns and operates Station WAHG

INDEX TO ADVERTISERS

RADIO NEWS READERS' BUREAU

Time and Postage Saver

IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in RADIO NEWS.

If there is any Manufacturer not advertising in this month's issue of RADIO NEWS, from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

..... TEAR ALONG THIS LINE .....

RN-5-25

READERS' SERVICE BUREAU,
Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of RADIO NEWS.

☞ DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

NAME	ADDRESS (Street — City — State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

NAME	ADDRESS (Street — City — State)	

Your own name here .....

☐ If you are dealer check here.

Address .....

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

The Finer Side of Radio

A Song That Reached Home

A great baritone sang with uncommon fervor to his enraptured listeners

The melody seemed to string a golden chain of words for some responsive heart

It reached ten times a million hearts

For as the music faded into silence the singer said GOOD NIGHT, MOTHER!

And then we knew that song had gone straight and true to someone somewhere in that vast invisible audience

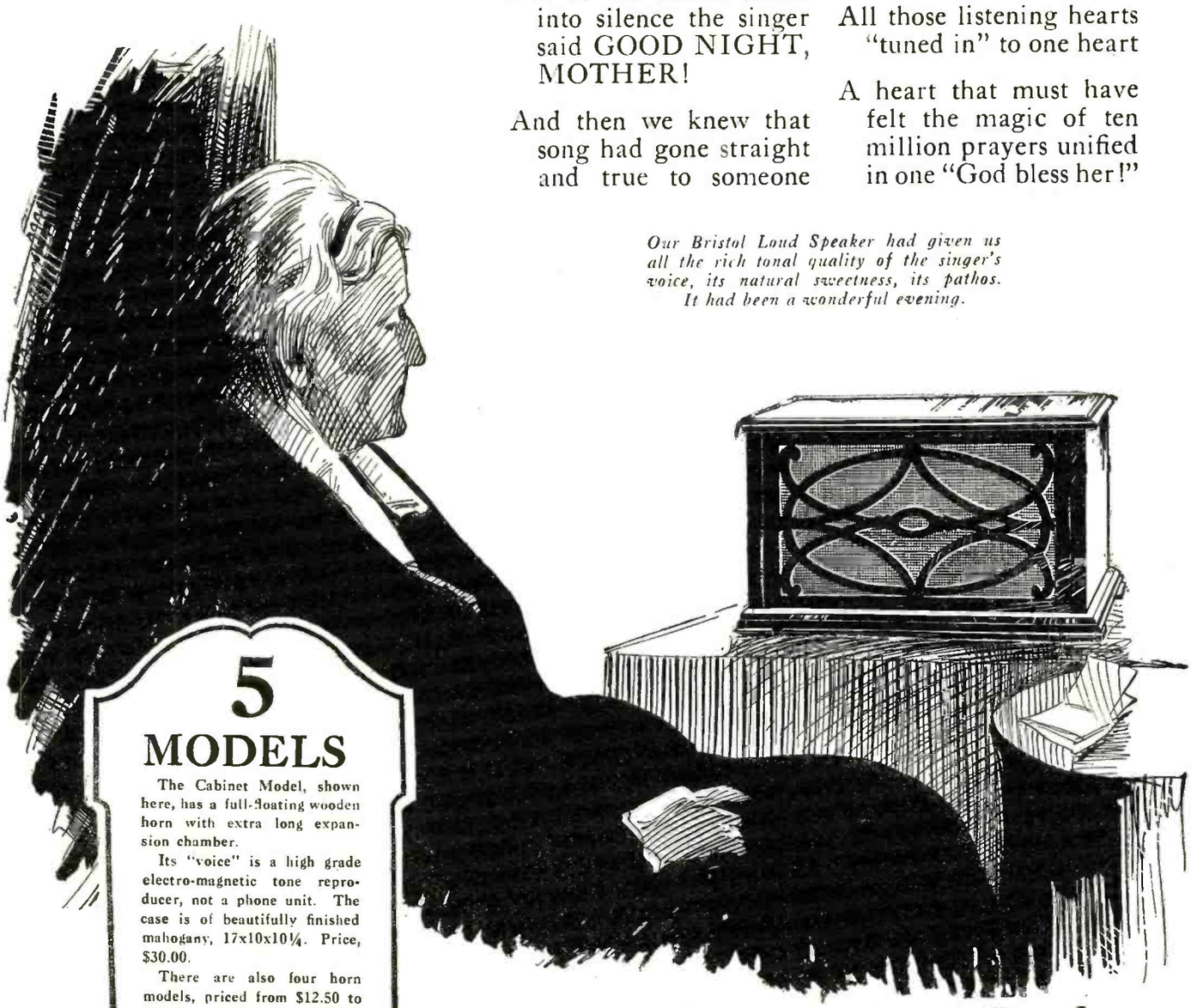
Someone whose tear-dimmed eye saw not the wonderful singer but a little boy whose tousled head lay on her breast

And in that spell of mother love which makes millions kin

All those listening hearts "tuned in" to one heart

A heart that must have felt the magic of ten million prayers unified in one "God bless her!"

Our Bristol Loud Speaker had given us all the rich tonal quality of the singer's voice, its natural sweetness, its pathos. It had been a wonderful evening.



5 MODELS

The Cabinet Model, shown here, has a full-floating wooden horn with extra long expansion chamber.

Its "voice" is a high grade electro-magnetic tone reproducer, not a phone unit. The case is of beautifully finished mahogany, 17x10x10¼. Price, $30.00.

There are also four horn models, priced from $12.50 to $25.00. Send for Bulletin 3022-S. Ask your dealer to demonstrate them on the Bristol Comparophon.

BRISTOL AUDIOPHONE Loud Speaker

The Bristol Company Waterbury, Connecticut

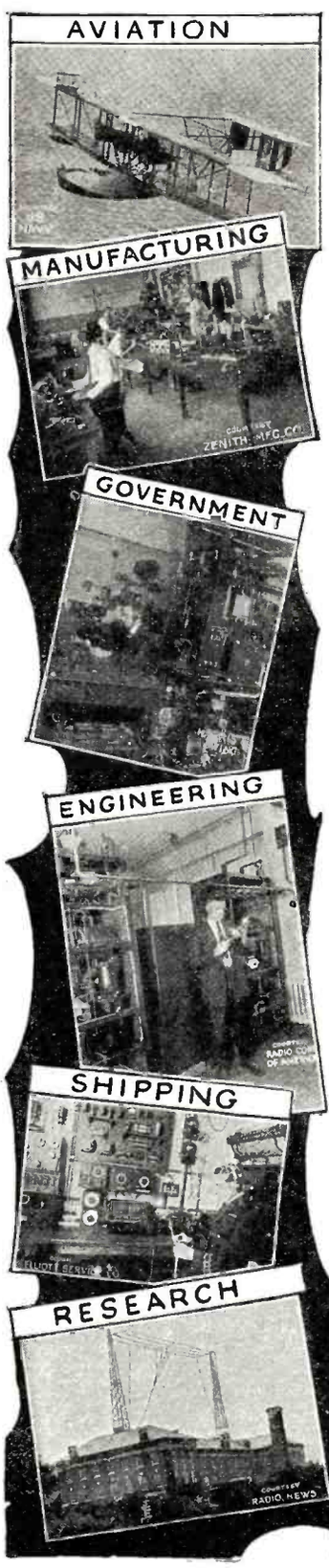
FOR 36 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS

Earn $75 to $200 a Learn at Home

The astounding growth of Radio has created thousands of wonderful opportunities for earning big money. Millions upon millions of dollars are being spent every year since broadcasting has become so popular. Radio is indeed sweeping the world like a forest fire!

A few years ago only a very small number of men were actively engaged in Radio. Today, with but few exceptions, these men are holding key positions in this marvelous new industry. In the same way, the young men and ambitious boys who get into Radio now will be the leaders a few years hence. The opportunities right now are a hundred times greater than they were ten years ago.



Recognized Radio Experts In Urgent Demand

Trained experts—not just half trained amateurs—are needed for the many big paying positions which have developed as a result of the tremendous expansion of Radio. Broadcasting stations are constantly needing operators, stores are sadly in need of trained experts as salesmen, installers, repair men, demonstrators. Factories need inspectors, assemblers, testers and executives.

These are just a few of the opportunities. Radio operators on board ship travel all over the world without one cent of expense, see historically important places, meet prominent people on board ship, mingling with the passengers and earning salaries equal to $200 a month in any land job. How often you've dreamed of travel, of being able to talk from experience of gay Paris, the beauties of the Mediterranean sunset, the awe of Egypt's pyramids. As a radio operator you can see them first hand.

Hundreds of Big Paying Positions Open Right Now - in Radio !

Hardly a week goes by without our receiving calls for our graduates. This is how some of them read: "We need the services of a competent Radio engineer"; "We want men with executive ability in addition to Radio knowledge to become store managers"; "We require the services of several resident demonstrators."

PROOF!

Pay Increases Over $100 a Month

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10.000 too much for the course.
(Signed) A. N. Long,
Greensburg, Pa.

Doubles Salary

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.
T. Winder,
Grand Junction, Colo.

Strong Praise for N. R. I.

The N. R. I. course is by far the best. I have made very good money and enjoy myself in the Radio game. A thorough training from the N. R. I. will set any man well on the road to happiness and prosperity in the Radio world.
Lawrence Vanek,
Iowa City, Iowa.

Earns $50 to $83 a Week

I enjoyed every one of your lessons and had no trouble whatever. I earn $50 to $83 a week besides a commission on sales. Your course not only enabled me to get bigger pay but broadened my education as well.

Michael De Marco,
Boston, Mass.

FREE Instruments

This 1,000-mile Regenerative receiving set is included in our course without charge. Our book, "Rich Rewards in Radio," tells you all about the practical training given with it.

Week as a Radio Expert in Spare Time

MORE PROOF!

$405 In One Month

I cleared up $405 in one month recently. Not so bad—is it—for a fellow who just completed your course a short time ago. I sure have been coining the dough. I never will regret the money I paid for your course.
Emmet Welch,
Peculiar, Mo.

From $15 to $80 a Week

Before I enrolled with you I was making $15 a week on a farm. Now, I earn from $2,080 to $4,420 a year and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.
(Signed) George A. Adams.
Tamaqua, Pa.

Triples Salary

I am earning three times as much as before enrolling and I have clean interesting work that takes me to all parts of the globe. I tell you, boys, it's Radio for me.
Arthur Herke.
Vancouver, B. C.

Earns College Education

I entered the maritime service of the Radio Corporation of America and served several months on board ship. I not only had the advantages of visiting foreign countries at no cost to me but I was also able to save enough money to pay for my tuition to college.
G. E. Rogers,
Troy, N. Y.

The big radio firms are coming to us for their men—they call on us first because they know that our graduates are one hundred per cent. trained experts—they are Recognized Radio Experts.

Earn Big Money While Learning

No matter if you know nothing at all about Radio or electricity, you can easily and quickly become an expert. Age is no drawback. Our method of teaching makes it fascinating and interesting to learn the mysteries of this new science. Instruments for practical training given FREE with this course are shown at the bottom of this page.

Scores of our students earn big money during their spare time after finishing the first few lessons. Mathew Waldron made $150 in one month—Fred W. Sullivan, of Fall River, Mass., made $84.60 in three weeks. Graduate D. H. Suite, Newport, Ark., says: "While taking the course I did assembling, repairing, installing and made approximately $900. This made my course pay for itself many times even before graduating." Student F. A. Kazmarek, Santa Cruz, California, says: "I have done over $1200 worth of business in the past two months just in spare time. I am going to go a little easy on the selling business now so I can finish my course right away." Many students more than pay for their course in this way—while they are studying.

Satisfaction is Guaranteed

Our faith in our method of training and in our ability to fit you for a bigger pay is evidenced by our guarantee to refund every cent of your money if you are not satisfied when you finish the course. The National Radio Institute, established in 1914, the first school to successfully teach Radio by mail, and now the largest Radio training organization in the world, stands behind that guarantee.

Send for FREE BOOK

We will gladly send you Free, without any obligation on your part, our book, "Rich Rewards in Radio," which gives you more facts about the big pay opportunities in Radio, tells you how we prepare you at home in spare time, and about how we are asked to fill hundreds of fine positions every year. No matter what you are doing now—no matter what your plans for the future are—send for this Free Book of wonderful opportunities. Mail the coupon NOW.

NATIONAL RADIO INSTITUTE
Dept. 13GB Washington, D. C.

for practical training at home

These parts with instructions are given for experience and practical training in making and operating regenerative receiving apparatus.

This is the world-famous Natrometer—one of the three instruments given for scientific and practical home training in mastering the code.

These parts with complete instructions are given for practice in building a receiving set of the more simple kind.

National Radio Institute,
Dept. 13GB.
Washington. D. C.

Without any obligation on my part, send me your book, "Rich Rewards in Radio," which tells all about the big-money opportunities in Radio, how spare time study will qualify me as a recognized Radio Expert and also how your Employment Service will help me get a good position.

Name ..... Age.....

Street .....

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

Did you ever build a Set that got Coast to Coast?

You can with the RICO-DYNE AUTO BALANCED

5 TUBE Tuned Radio Frequency

COMPLETE KNOCKDOWN SET

Ready to tune in within a few hours!

EXPERTS PLACE "RICO-DYNE" IN THE $100 SET CLASS

READ WHAT "RICO-DYNE" FANS WRITE US:—

"I was very careful to log every station that I tuned in on during the first week that I operated my Rico set which I built myself. I live in New York City and there are several other radio sets in my apartment house which are of the high-priced class. I find that Chicago comes in during the heavy broadcasting of New York stations much more clearly on my set than it does on theirs. Nebraska is easy to get and late at night, I have tuned in on the Pacific coast."

(Signed) T. B. NEWMAN.

"I thought you would like to know something about the very keen selectivity of your Rico Kit which I built. In my neighborhood, it is very difficult to receive stations because we are located so close to a very powerful broadcasting station. I was very much surprised when I found that the Rico selectivity is so keen that I have no trouble at all in bringing in the stations I want and tuning out the big brute so close at hand."

(Signed) J. E. HOWE.

"The Rico set which I built is a peach! It has plenty of "pep" and power. I always have to cut down on my batteries when local stations are broadcasting, for they come in much too loud. As a matter of fact, when the local stations are broadcasting I often disconnect the loud speaker and lay down the ear phones on the table and find that the programs come in so loud on the earphones alone that I hardly need the loud speaker. Distance is very easy to get on the Loud Speaker and many distant stations come in with the volume of the ordinary local."

(Signed) FRED WURZBURG.

Two Exclusive Principles Have Made RICO-DYNE the Fastest-Selling Radio Set in the Country

The combination of "RICO" CELLUWELD Low Loss Coils and variable Condensers is made mechanically perfect.

The coils are the Lorenz type and are self starting. They are the low-loss type and are Cellu-Welded to a support on the Condenser end plate.

The condensers also are the low-loss metal end plate type, the stator and rotor being insulated from each other by means of hard rubber mounting strips.

Modern broadcasting requirements demand that a tuned radio frequency set be especially selective and non-oscillating. In the "RICO" "AUTO-BALANCED" Tuned Radio Frequency Set this is accomplished by carefully setting the Coils at the factory at the neutralizing angle. This adjustment remains permanent due to the CELLUWELD process.

Due to this method of coil mounting used exclusively in RICO-DYNE Sets and Kits, there is no magnetic interference between coils and condensers.

Complete

KNOCKDOWN SET

Together with a set of

RICOFONES

All for **$38.75**

GREATEST RADIO VALUE IN HISTORY

This Is What You Get:

1—Pair Ricofones. 1—Genuine Bakelite Front Panel, completely drilled and engraved. 1—Genuine laminated Bakelite Sub-Panel—with sockets already mounted. All mounting holes properly drilled. 3—Auto Balanced Tuned Radio Frequency Units—perfectly matched and balanced. 3—Beautiful 4-inch Dials. 1—Variable Grid Leak and .00025 M.F. Condenser. 1—4 to 1 Audio Transformer. 1—2 to 1 Audio Transformer. 1—.002 Fixed Mica Condenser. 1—.006 Fixed Mica Condenser. 2—Single Circuit Jacks. 1—Filament Control Switch. 1—30-ohm Rheostat. 1—10-ohm Rheostat.

FOR THOSE WHO WANT TO BUY ONLY THE

RICO-DYNE KIT

Here Is Just What They Want:

It seems unusual that with the tremendous volume, selectivity and distance-range of the Rico Auto Balanced set, it should be so simple to construct. Yet, nevertheless, this is true. We have letters from fans who tell us that they constructed their Rico set within a few hours. The plans which accompany the Rico Kit are so simple that we believe this is so. Any beginner need only to read English in order to construct the Rico set. This Kit contains 3 Auto Balanced Tuned Radio Frequency Condensers, inductance Units, factory matched, book of instructions and drilling template. You can't go wrong!

$16.50

RICO-DYNE HAS SET NEW RECORDS IN RADIO!

NOT A CENT DOWN COUPON!

RADIO INDUSTRIES CORP., R.N. 5
131 Duane Street,
New York City.

Gentlemen:—
As my dealer cannot supply me, please send me C. O. D.:—

☐ COMPLETE KNOCKDOWN SET—$38.75
☐ KIT,—$16.50

Name .....

Address .....

City ..... *State* .....

Radio

Truth in Radio

The Perfectly Tuned Radio Frequency Line

SOMERSET Radio Receivers sell easily and quickly because they are what the public *wants*—the utmost in value for their money, simplicity of operation, efficiency in results, and real beauty in appearance.

On all these counts—and more—Somerset Radio Receivers challenge comparison, feature for feature, with any others at or near their price—bar none.

It needs no argument nor persuasion—every Somerset Radio Receiver speaks for itself—a piece of fine furniture enclosing an instrument of super-craftsmanship.

Backed by the Somerset Guarantee

WE will cheerfully and promptly make good any Somerset Radio Receiver which does not fully measure up to the purchaser's expectations of quality and value. If for any reason it is found to be not exactly as represented, it should be returned for exchange or refund of the purchase price, as preferred. This guarantee means exactly what it says, without reservations.

Easy Selling Features

EVERY woman recognizes at sight the superior lines and finish of Somerset cabinets. They're distinctive in their rich two-toned, hand rubbed mahogany finish—an artistic addition to any drawing room.

The receiver is worthy of this fine setting, finest of materials and parts, superior workmanship and finish, painstaking care in the little details which mean so much in results.

For example, the single dial control on the Shelbourne and Standish models—by the use of gears, the condensers are connected and perfectly synchronized, permitting operation by a single tuning knob. Of course, this is made possible only by the most careful selection and matching of condensers, and coils, but the finished product is a revelation in easy tuning.

And Real Dealer Service

SOMERSET Dealer Service offers full cooperation and tangible, cash-drawer aid in selling Somerset Radio Receivers. Furthermore Somerset Dealer Service also includes complete service on tubes, phones, batteries, loud-speakers and aerials at regular dealer discounts.

Mail To-day for Profit Pay

YOU wouldn't pass by money that would be yours for the picking up—don't pass up this chance to earn of profit opportunity—Fill out and mail Coupon NOW.

NATIONAL AIRPHONE CORPORATION
16-22 Hudson Street, New York City

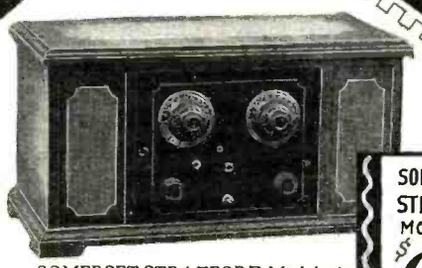
Without any obligation to me, send full details and information on the Somerset line and remarkable Dealer Service.

Name .....

Address .....

City .....

Prices subject to change without notice.

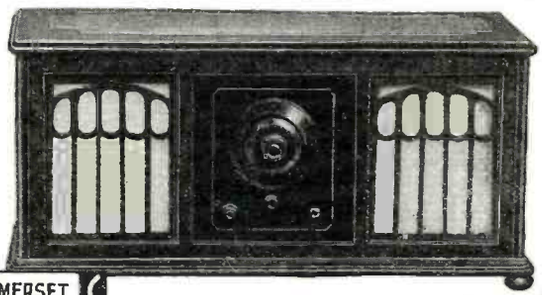


SOMERSET STRATFORD MODEL 4-A $65

SOMERSET STRATFORD Model 4A 4 Tubes—Dual Control. A superior four tube, tuned radio frequency receiver—two dial control—operates on storage battery or dry cells. Automatic filament control insures long life of tubes. The finest "low loss" condensers and the famous SOMERSET Calibrated Transformers are features. "A" and "B" battery space is provided in the handsome two-tone mahogany finish cabinet. Size 21"x15"x11" ..... **List $65**

SOMERSET MARS MODEL 5A $75

SOMERSET MARS Model 5A 5 Tubes Three Dial Control. Two stages tuned radio frequency, detector, and two stages audio frequency. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers and the famous SOMERSET Calibrated Transformers. Artistic cabinet hand-rubbed mahogany finish providing space for storage "A" and dry cell "B" batteries. Size 29" x 14" x 11" ..... **List $75**



SOMERSET STANDISH MODEL 4-C $150

SOMERSET STANDISH Model 4C 4 Tubes—Single Dial Control with built-in loud speaker. Combining a built-in loud speaker of the highest type and the four tube tuned radio frequency circuit with single dial synchronized control—all the latest and best in radio. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Ample space is reserved in this cabinet for standard size high ampere hour storage "A" batteries and dry "B" batteries. Exquisite cabinet, antique mahogany finish. Size 29"x 13"x14" **List $150**

NATIONAL AIRPHONE CORP

Manufacturers of Somerset Radio Receivers

18 HUDSON STREET, N. Y. CITY

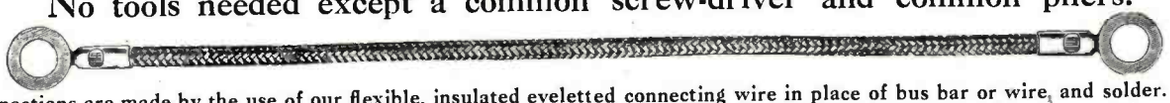
Prices West of the Mississippi—add 10%

Truth in Radio

Build Your Own Receiver—It's Easy The "No-Sod-er" Way!

Revolutionary Improvement in Assembling Radio Sets

No solder—No bare wires—No poor connections—No dissatisfaction.
No tools needed except a common screw-driver and common pliers.

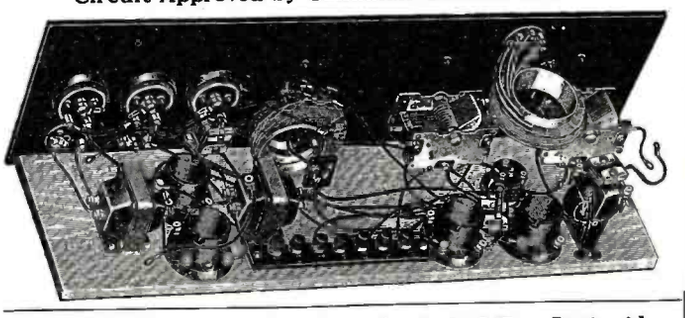


All connections are made by the use of our flexible, insulated eyeletted connecting wire in place of bus bar or wire, and solder. And in a fraction of the time usually required when using the old fashioned way. And when the job is done it is neat and your connections are tight.

4-Tube Roberts Knock-Out $48.56 Postpaid

Circuit Approved by Canadian Government

Kit X K 9215 Range 3500 Miles



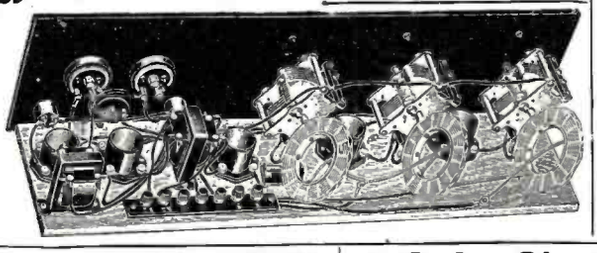
Celebrated circuit developed by Walter Van B. Roberts and Radio Broadcast Magazine. Arthur H. Lynch, Editor, says: "It is the best we have ever seen—and we have seen and operated almost every type made and used during the past 12 years. **It has pulled in 46 stations on a loud speaker with 2 tubes, using an indoor antenna.** Its signals have been heard through the air more than a quarter of a mile. Tube for tube, dollar for dollar, and result for result, we will stack it up against any receiver for home construction ever described by any radio publication, and gamble that it comes out a winner. It is not merely the best 4-tube receiver, but **the best by a very good margin.**" The Canadian Government has endorsed and recommends it. Read below the kind of parts you get. Price includes large cabinet. Order it. **You won't be making a mistake.** Shipped on approval, no money in advance.

5-Tube Sickles' Tuned Radio Frequency $42.93 Postpaid

Kit X K 9216 Range 3500 Miles

If you wish the finest 5-tube set to be had, here it is. We have produced a receiver as nearly perfect as possible with present day radio engineering principles. To do this we have adopted low loss principles throughout thus reducing all losses to the minimum. **Special Features:** Simple to construct and operate; highly efficient; low loss design throughout; self-neutralized; extremely sensitive over long and shorter distances; clearness; dependability; selectivity; non-reradiation. Tuned Radio Frequency is popular. You want this latest and best model. Shipped on approval, no money in advance.

MUCH FOR LITTLE



Advantages of Our "No-Sod-er Method"

No solder.
Clean—not "messy."
No expense for soldering iron or supplies.
Dependable.
Positively firm connections—none faulty as in using solder which often easily jars loose.
Less resistance or loss than in using solder.
Absolutely safe.
Positively never any danger of short-circuiting as our "No-Sod-er" connectors are insulated with woven thread over rubber.
Terminals are uniformly neat.
No loss of time in making connections—unnecessary to use care in placing, since they may touch each other without short-circuiting.
Easily handled—unbreakable. No special care needed in handling as all are insulated.
A Kit can be wired in a fraction of the time required for wiring with bus bar and solder.
Convenient.
On our improved blueprints the binding posts are numbered in pairs so you may quickly and easily attach the connector properly.
Quickly fastened. No skill or knowledge required.

The Simplest and easiest method ever devised!

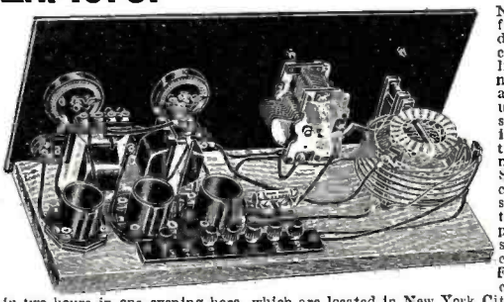
"No-Sod-er"

MAKES SET-BUILDING EASY

(Trade Mark Reg. U. S. Pat. Off.)

3-Tube LoLos Explorer $30.25 Postpaid—Kit X K 6996

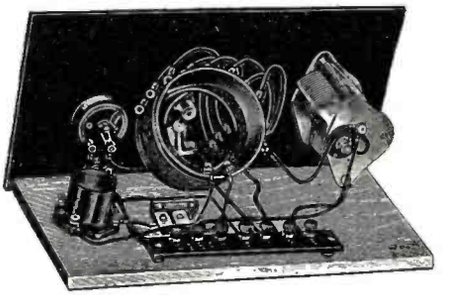
Range 1000 Miles on Loud Speaker



Nothing new-fangled or freaky about this wonderful new low loss receiver. Its great secret lies in the fact that nearly all losses are done away with, using energy usually wasted in other sets—hence the astonishing results in distance, volume and clearness. **Special Features:** Sensitivity; selectivity; clearness of reception; simplicity of construction and operation; dependability; low loss design; long distance reception; great volume. Fifteen stations were received on loud speaker in two hours in one evening here, which are located in New York City, Philadelphia, Pittsburgh, Cleveland, Elgin and Chicago, Ill., St. Cloud, Minn., and Davenport, Iowa. Cuts right through local stations. Sure to please. Order it on approval, no money in advance.

1-Tube Single-Circuit $11.79 Postpaid

Kit X K 9182 Range 1500 Miles



Has many advantages over other types. Just right for one who wants a set to learn with without having to invest very many dollars. Think of the low cost. Probably the most popular circuit. Simple to construct with our "No-Sod-er" connecting wires. You can do it in a half hour or so. Look at the picture. See how few wires. Simplest to operate. Receives up to 1,500 miles in favorable conditions. Sweet tone. Plenty of volume. This offer as well as all of our offers of Kits includes a nice, roomy cabinet. Order this Kit and let us become acquainted. You will be pleased. Shipped on approval, no money in advance.

SEE OFFERS OF ACCESSORIES ON NEXT PAGE

We Give You the Best Parts Made

Look at this list of well-known, high-grade, standard, dependable, satisfaction-giving parts which we use in our line of superior Kits as detailed in our catalog which will be sent to you free on request: genuine **Bakelite-Dilecto** panels, **Sickles** coil, **Gen-Win** low loss tuner, **Hammarlund** and **X-Lab.** variable condensers, **Amplex** Grid-densers, **Chelten Midget** condensers, genuine **Bakelite** dials. **E-Z Toon** genuine **Bakelite** vernier dials. **Thordarson** transformers, genuine **Bakelite** rheostats, **Amperite** self-adjusting and **Amsco** rheostats, **Amsco** potentiometers and rheostats. **Bell** Low Loss genuine **Bakelite** sockets. **Carter** and **Improved** jacks, **Smilear** battery switches, **Bradleyleaks, Electrad** grid-leaks. **Bradleyohms, Hilco** and **Dubilier** fixed condensers, **Aristocrat** binding posts. "**No-Sod-er**" flexible insulated connecting wires, and other articles of the same high class. **Please Compare Quality when Comparing Prices.**

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ORDER DIRECT FROM THIS PAGE, WE SHALL PLEASE YOU

WE SHIP IN 24 HOURS SATISFACTION GUARANTEED

RADIO SPECIALTY CO., Kit Div. 6795, No. 25-A West Broadway, N.Y.

You Need This Catalog

of "Build Your Own" Radio Receiver KITS

Shows you how *you* can easily assemble your own set without the troublesome bus bar and solder and in a fraction of the time required the old fashioned way.

"No-Sod-er"
MAKES SET-BUILDING EASY

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No Money in Advance

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Satisfaction Guaranteed or Money Back

36 *pages —live with interest* Size of Catalog 7 x 10"

Go Into Business for Yourself
Make Radio Receivers for Others

Catalog Contains Detailed Offers

of the following Kits and many Parts and Accessories. All Kit Prices include large Cabinet.

RASCO KITS

UNASSEMBLED RECEIVERS		Our Price Postpaid*		
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XK9188	Rasco 5-Tube FAMOUS T. R. F.	40.89	38.07	78.96
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XK9182	Rasco 1-Tube SINGLE-CIRCUIT	11.79	10.77	22.56
XK9183	Rasco 3-Tube SINGLE-CIRCUIT	21.65	25.55	47.20
XK9219	Rasco 1-Tube THREE-CIRCUIT	17.69	13.93	31.62
XK9218	Rasco 3-Tube THREE-CIRCUIT	30.49	25.55	56.04
XK9216	Rasco 5-Tube SICKLES T. R. F.	42.93	38.07	81.00
XK4477	Rasco 6-Tube TROPADYNE	60.50	52.88	114.38
XK9211	Rasco 5-Tube WORK-RITE NEUTRODYNE	38.95	53.37	92.32

Other Popular Kits

UNASSEMBLED RECEIVERS		Our Price Postpaid*		
Kit No.	Name	Parts	Accessories	Complete
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XK9161	ACME Model S, 5-tube	70.00	55.68	125.68
XK9205	ERLA, 1-tube	17.31	17.60	34.91
XK9206	ERLA, 2-tube	25.81	25.11	50.92
XK9207	ERLA, 3-tube	34.56	32.98	67.54
XK9208	ERLA, 4-tube	38.93	38.23	77.16
XK9209	ERLA, 5-tube	43.31	51.75	95.06
XK9210	ERLA, 5-tube (for loop aerial)	43.31	52.62	95.93
XK9170	FRESHMAN MASTERPIECE, 5-tube	34.56	41.73	76.29
XK9181	HANSCOM SUPER, 6-tube	39.37	82.28	121.65
XK9166	HARKNESS COUNTERFLEX, 3-tube	31.97	31.41	63.38
XK9165	HARKNESS REFLEX, 2-tube	29.10	26.30	55.40
XK9155	MELCO SUPREME, KD-24, 4-tube	78.75	34.56	113.31
XK9156	MELCO SUPREME, KD-25, 5-tube	87.50	38.06	125.56
XK9195	RASLA REFLEX, 1-tube	20.12	18.04	38.16
XK9196	RASLA REFLEX, 2-tube	30.62	29.48	60.10
XK9197	RASLA REFLEX, 3-tube	36.75	32.98	69.73
XK9168	WORK-RITE DE LUXE NEUTRODYNE, 5-tube	58.18	42.61	100.79

*We pay transportation on everything but batteries.

Your Own Receiver and Accessories without Charge

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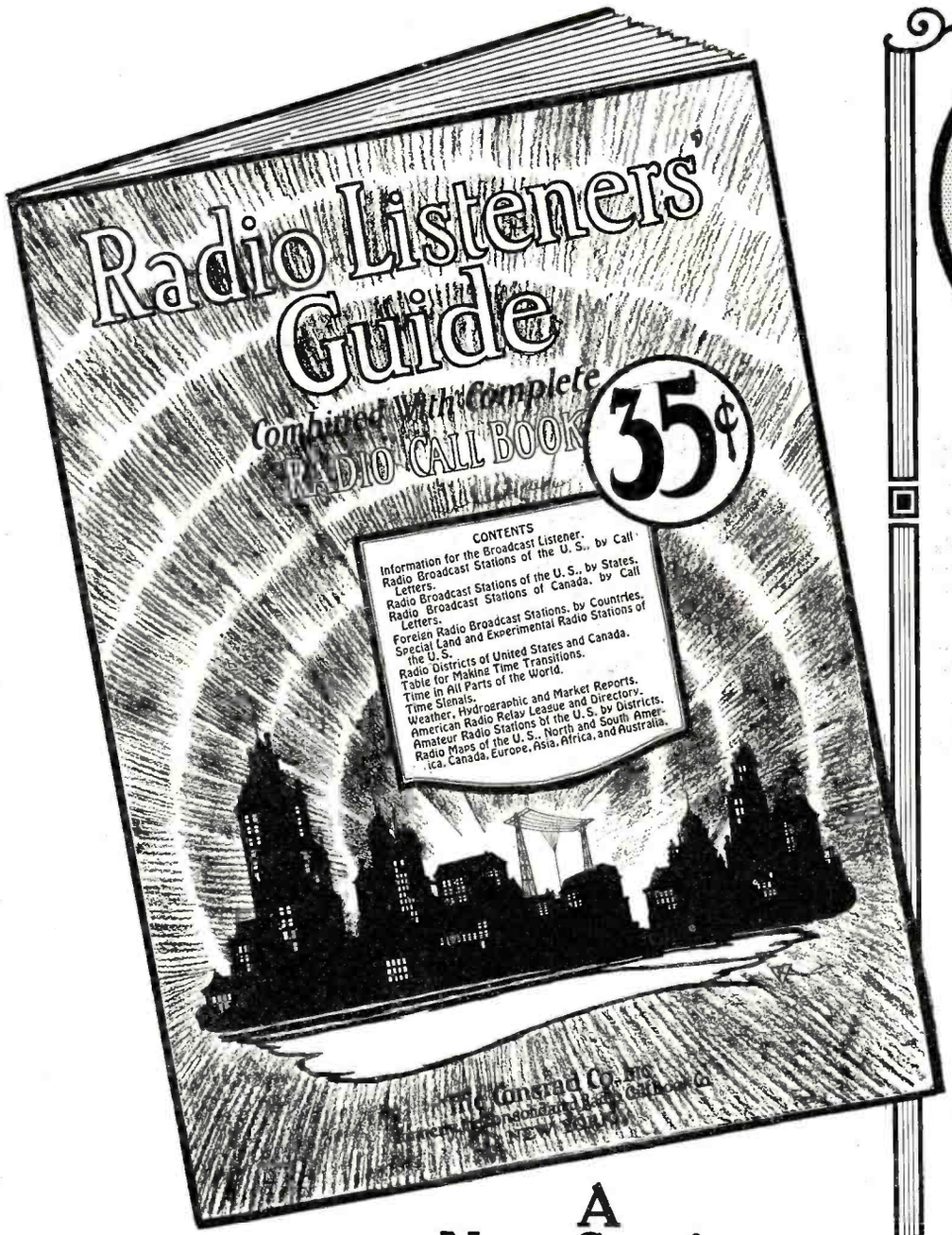

A New Service

Conrad has developed a special service for every user of the New Conrad "Radio Listeners' Guide and Call Book" that is designed to enable you to keep your station call record up to the minute, in line with all changes in stations and any new stations that are assigned call letters from month to month.

It consists of monthly, detailed supplement sheets carrying all information in regard to the call letters of new stations and changes of old ones.

By means of this service, you can keep a practical, complete record of broadcast stations at all times.

There is a special coupon in every copy of the "Radio Listeners' Guide and Call Book" offering the purchaser the opportunity of subscribing to this six months service for the low price of 50c.

IF YOUR DEALER CANNOT SUPPLY YOU USE THIS COUPON

The Conrad Co., Inc., 233 Fulton St., New York, N. Y.

Gentlemen: I am unable to obtain a copy of the "Radio Listeners' Guide and Call Book" in my town. I am enclosing 35c, for which kindly send me a copy direct.

Name .....

Address .....

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R.N. 5

Conrad

35¢

Radio's finest and most complete Call Book

There has never been any radio book for the amateur, the engineer or the regular radio broadcast listener exactly like this great Consrad edition.

Here is a book for *everybody*, covering all the information any listener needs to most thoroughly enjoy a radio program. It tells how to use and operate a radio set to the best advantage. It tells where, by whom, and on what wave length every radio broadcast station of the United States is operated, etc.

Altogether there are 114 pages filled to the brim with practical data. There is not a page of advertising—all text material for the user.

This is the one radio book that should be at the side of every radio receiving set in operation.

Table of Contents

114 Large Pages of Real, Practical Information—No Advertising

Size 9 by 12 inches.

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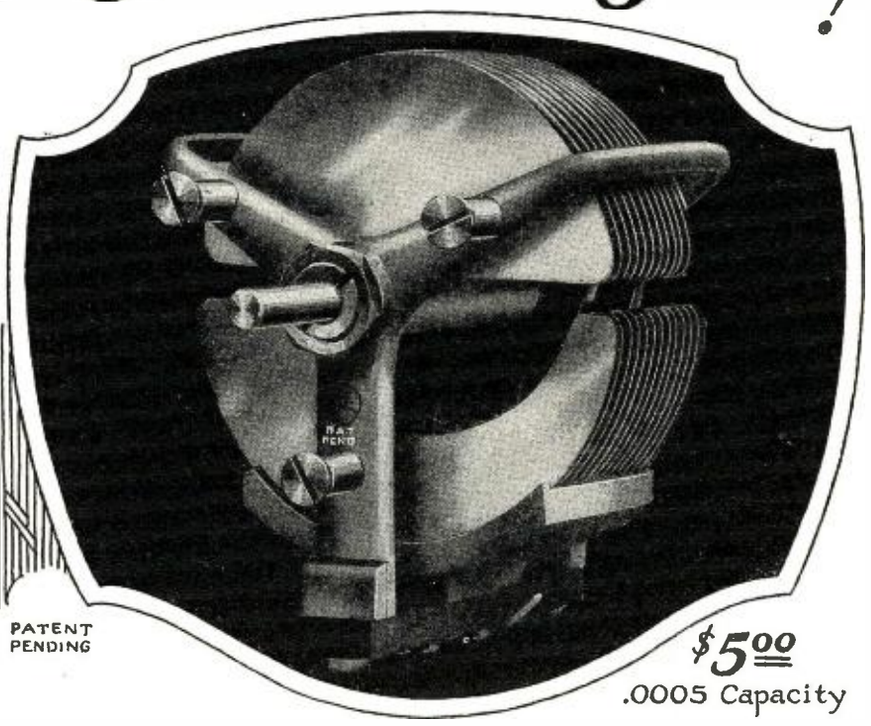
The Consrad Co., Inc.
233 Fulton Street
New York, N.Y.

Lacault Scores Again!

The new Ultra-Lowloss condenser is the latest improved radio device designed by R. E. Lacault, formerly Associate Editor of Radio News, the originator of Ultradyne Receivers and now Chief Engineer of Phenix Radio Corporation.



ULTRA-LOWLOSS CONDENSER

LIKE every Lacault development, this new Ultra-Lowloss Condenser represents the pinnacle of ultra efficiency—overcomes losses usually experienced in other condensers.

Special design and cut of stator plates produces a straight line frequency curve, separates the stations of various wave lengths evenly over the dial range, making close tuning positive and easy.

With one station of known frequency located on the dial, other stations separated by the same number of kilocycles are the same number of degrees apart on the dial.

In the Lacault Ultra-Lowloss Condenser losses are reduced to a minimum by use of only one small strip of insulation, by the small amount of high resistance metal in the field and frame, and by a special monoblock mounting of fixed and movable plates.

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

Design of low loss coils furnished free with each condenser for amateur and broadcast frequencies showing which will function most efficiently with the condenser.

ULTRA-VERNIER TUNING CONTROL

Simplifies radio tuning. Pencil-record a station on the dial—thereafter, simply turn the finder to your pencil mark to get that station instantly. Easy—quick to mount. Eliminates fumbling, guessing. Furnished clockwise or anti-clockwise in gold or silver finish. Gear ratio 20 to 1.

Silver $2.50 Gold $3.50

R E L

This seal on a radio product is your assurance of satisfaction and guarantee of Lacault design.

To Manufacturers Who Wish to Improve Their Sets

The Ultra-Lowloss Condenser offers manufacturers the opportunity to greatly improve the present operation of their receiving sets.

Mr. Lacault will gladly consult with any manufacturer regarding the application of this condenser to any circuit for obtaining maximum efficiency.

PHENIX RADIO CORPORATION, 114 EAST 25th ST., NEW YORK

New OZARKA Junior Model Fully Equipped—$100

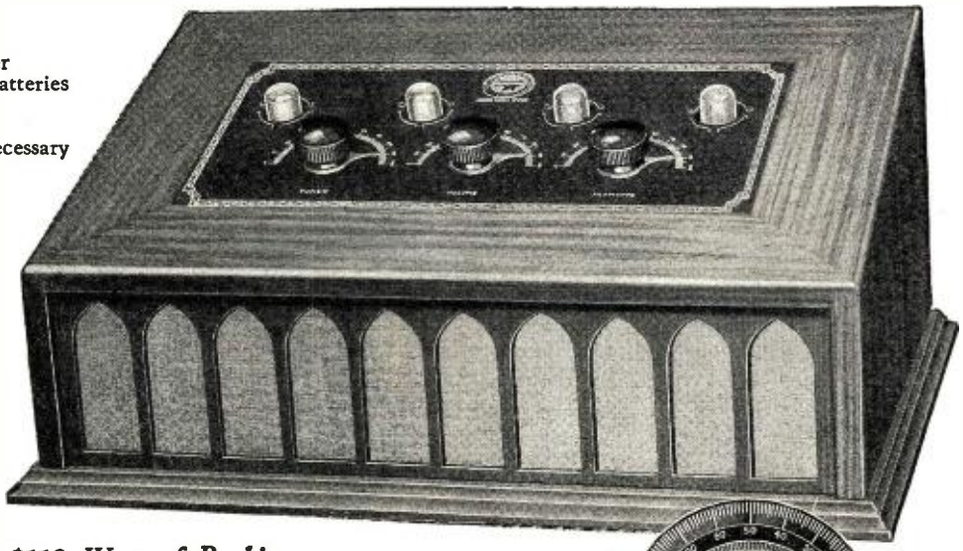
COMPLETE WITH
- Four No. 199 Tubes
- Built-in Hy-Power Loud Speaker
- Four Eveready 22½-volt "B" Batteries
- Three Eveready Dry Cells
- One Eveready "C" Battery
- Aerial Equipment, everything necessary

NOTHING MORE TO BUY.

THERE IS A REASON

This instrument is sold direct from the factory to you thru our own factory representative; therefore, our selling expense is less. No middlemen's profit to pay.

Compare Ozarka quality with every other instrument on the market—compare prices and you'll quickly realize how you can secure the highest radio quality possible at prices which are as low as the lowest. More than this, all Ozarka instruments are backed by the Ozarka service.



$110 West of Rockies
$135 in Canada

This button identifies Ozarka representative in your city—is your assurance of complete radio satisfaction.

Let our factory representative bring the No. 299 to your home

FIND OUT in your own home, by tuning this instrument yourself, just what distance, volume and tone it will deliver. All the Ozarka factory representative asks is an opportunity to let you prove to your own satisfaction that the Ozarka Junior No. 299 is the greatest radio value for $100.00.

THE Ozarka Junior No. 299 meets an insistent demand for a radio instrument, operating on dry cells which will deliver plenty of volume from long distances — with loud speaker and batteries all enclosed—an instrument of quality which is a handsome article of furniture and yet all complete for $100.00.

Cabinet is 23 inches long, 15 inches deep, 6¾ inches high at the front and 10 inches high at the back; waxed walnut finish, same as used on high priced furniture. Panel is of etched bronze with dull gold markings. Most convenient shape and size possible to make tuning easy.

Entire front has open grill in attractive design, lined with gold cloth — built-in large goose neck loud speaker of wood veener equipped with powerful loud speaker unit, not a head phone unit, but a power unit weighing 3½ pounds, giving a volume and tone unexcelled in any loud speaker.

Door in back enables dry cells, "B" and "C" batteries to be put in place inside—not a wire in sight — even aerial and ground come in thru the back. Tuned radio frequency circuit especially designed to produce full efficiency from dry cell tubes No. 199. Operates on any outside aerial or on an inside aerial run around the room behind the picture moulding.

The Ozarka representative will gladly bring the instrument to your home—he won't tell you what it will do—he won't tune it himself, but he will let YOU do all the tuning. If, by your own operating, you are not thoroughly convinced that the Ozarka Junior No. 299 is just what you want, then you are under no obligations whatsoever.

If the instrument itself will not prove its value to you, then no salesman can do it — Ozarkas will sell themselves if given the opportunity.

Ozarka factory representatives are trained directly under Ozarka engineers so that they know every detail of Ozarka instruments and can correct any trouble which may ever come up. If you put an Ozarka in your home, it will work perfectly; more than this, a trained Ozarka representative will keep it working perfectly.

Ozarka instruments and Ozarka service mean perfect radio satisfaction to you.

Why not ask us for the name of the nearest Ozarka representative—give us the name of your county, we'll gladly do it.

Attractive Openings for a Few More Representatives

THE Ozarka Junior No. 299 is a typical Ozarka value—made possible by the Ozarka plan of selling thru direct factory representatives. This is only one example—the Ozarka line offers other types of four tube instruments as low as $39.50 (without accessories); an exceptional opportunity for men of the right caliber to establish themselves firmly in a profitable radio business of their own.

The Ozarka organization today consists of 3100 men who are making from $50 to $300 per week. More men are needed in open territory; men who are willing to learn what we are willing to teach them; men who recognize that they must learn how to correct troubles if they expect to make a success of selling radio instruments.

This work can be started in your spare time—evenings are the best time to sell radio. As you learn you will grow, and it will only be a question of time until it will pay you to give Ozarka all your time and own a business of your own—be independent.

Exclusive territory is given to men who have proven that they can handle it successfully. Your profit is immediate, because Ozarka instruments will sell themselves if a demonstration is arranged for. The amount of capital required is small, but some is absolutely necessary. No knowledge of radio is necessary—all we ask is willingness and patience to learn, and that you are somewhat mechanically inclined.

There are many men who work hard but don't seem to get ahead—radio offers just what such men have been looking for—a business of their own which can be started small but one that will grow slowly but surely if established on a firm service basis such as taught by Ozarka, Inc.

Isn't such an opportunity well worth enough of your time to write and tell us about yourself? You'll find that we will gladly discuss this matter with you—it may be the turning point in your life. If interested write today and ask for our Ozarka Plan No. 100. **Don't fail to mention the name of your county.**

OZARKA, Inc., Chicago, Ill.

804 Washington Boulevard

RADIO NEWS

H. GERNSBACK, Editor and Publisher
SYLVAN HARRIS, Associate Editor

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 6 MAY, 1925 No. 11

"Mental Radio"

By HUGO GERNSBACK

SINCE broadcasting has become worldwide, a peculiar effect has made itself felt upon a number of individuals, the effect increasing at a rate that is viewed with concern in many quarters. Government officials, doctors, editors, and many other professional people are continually annoyed by persons with this new delusion. The writer, for instance, receives an average of from ten to fifteen letters every week from various people who are possessed of this affliction, and he sees, in the course of a month, a number of individuals who call upon him in person.

The correspondence or the talk usually centers around the following, and the symptoms in most cases seem to be uniformly the same. The receiver of the "mental radio" messages in all cases states that he or she has received "radio" messages steadily, every day, for a stretch of several years. Sometimes, the radio message is of a spiritual, uplifting nature, but more often, and most numerously, the messages are of the persecuting sort, where the message purports to come from an enemy trying to do the recipient harm.

Close questioning of the interviewed subjects nearly always brings forth the information that the "messages" are strongest at night before the subject goes to sleep, or that he is awakened by them. The voices in all cases appear to be real and loud and are supposed to startle the subject to such a pronounced degree that he or she thinks a sort of invisible loud speaker is located in the room. The radio messages are always supposed to be broadcast by modern radio transmitting apparatus, usually operated by the enemies of the subject.

OF course, every scientifically inclined person who receives correspondence of this sort promptly relegates it to the waste basket. The condition of the subject is, to be sure, very well understood by psycho-analysts, psychiatrists and alienists. No good, however, will ever come of just calling these subjects insane, or unbalanced. The writer, who has talked to a number of them, has found that in many cases they are very rational in points other than the one delusion. Nearly always these people know nothing at all of science or radio, and view the new radio art with great awe. They often have the idea that radio is only another form of mental telepathy. The writer is quite certain that if these deluded people understood the fundamentals of the radio science they could easily be cured, provided the mentality of the subject is such that he or she could grasp the facts.

It is usually a good plan to refer such a person to a good radio primer, or elementary radio text, written in such language that even the layman can understand it. There are a number of such books procurable at present. If the subject can be made to read them he will usually come to see that, as far as mental radio is concerned, it is non-existent and is simply an hallucination.

The writer desires to cite the following case which came under his observation some months ago.

The subject was a middle-aged woman, rather irrational in general, and from her appearance seemed to be highly nervous. Subject was unmarried. She complained of radio messages coming to her at all times of the day and night, particularly at such times when she was riding in street cars, subways or railways. Subject was also kept awake by these continuous messages, all purporting to come from some relatives who wished her bodily harm. The supposed messages kept increasing continuously as she grew older. Subject said that when putting cotton into her ears the messages would stop, sometimes, but not always.

The case was listened to attentively and patiently, and at no time was disbelief shown. The writer then gave the subject an ordinary magnet taken from an old telephone receiver which he happened to have in his desk. He asked her to keep this magnet under her pillow while she was sleeping, and to report within two weeks. The subject promptly returned within two weeks and reported great improvement. Still further improvement was reported within another two weeks, the writer having suggested that the subject sleep with ears tightly closed. Although she was to report at a later date, she never returned, evidently having been cured.

Here was an auto-suggestion case, pure and simple, for our scientific readers will readily understand that the magnet had nothing whatever to do with the case. It was simply that the subject believed in the cure and was affected by it. A piece of wood would have been just as effective as the magnet.

Naturally, not all cases can be treated alike, and where the subject is irrational to a high degree, it would not do to practice such a method. The best way is to try to explain to afflicted persons, in simple language, why radio cannot possibly have any effect whatsoever on the human brain. If any cases come to your observation, the subject might be told the following:

RADIO, at the present time, can be broadcast only by one means, and that is electromagnetic, commonly called radio waves. In order to send out such waves, it is necessary to have a sending or transmitting station. No one is allowed to have such a station unless he is licensed to do so by the Government. The Government has the names and addresses of all such stations. Not only has the Government such information, but the Radio Inspectors of each nine Districts watch carefully over all stations, to see that they are not misused. By means of radio receiving instruments, the Department of Commerce readily keeps tab on all stations, and it is practically impossible for anyone to send any messages whatever on an unlawful wave-length without being almost immediately caught. In other words, amateurs and private individuals are restricted to a certain wave-length which they cannot overstep without immediate penalty. Broadcast stations have another wave-length, while ship and shore stations have still another. All of these stations are under constant surveillance, not only by the Government, but by all who have receiving sets. So it will be seen immediately that if someone were sending out threats or meaningless messages, he would be almost instantly detected, because of the hundreds of thousands of receiving sets scattered around every nook and corner of the country and, for that matter, all over the world. It will thus be seen that, so far as radio transmission is concerned, the subject afflicted with mental radio must be convinced that there can be nothing to it.

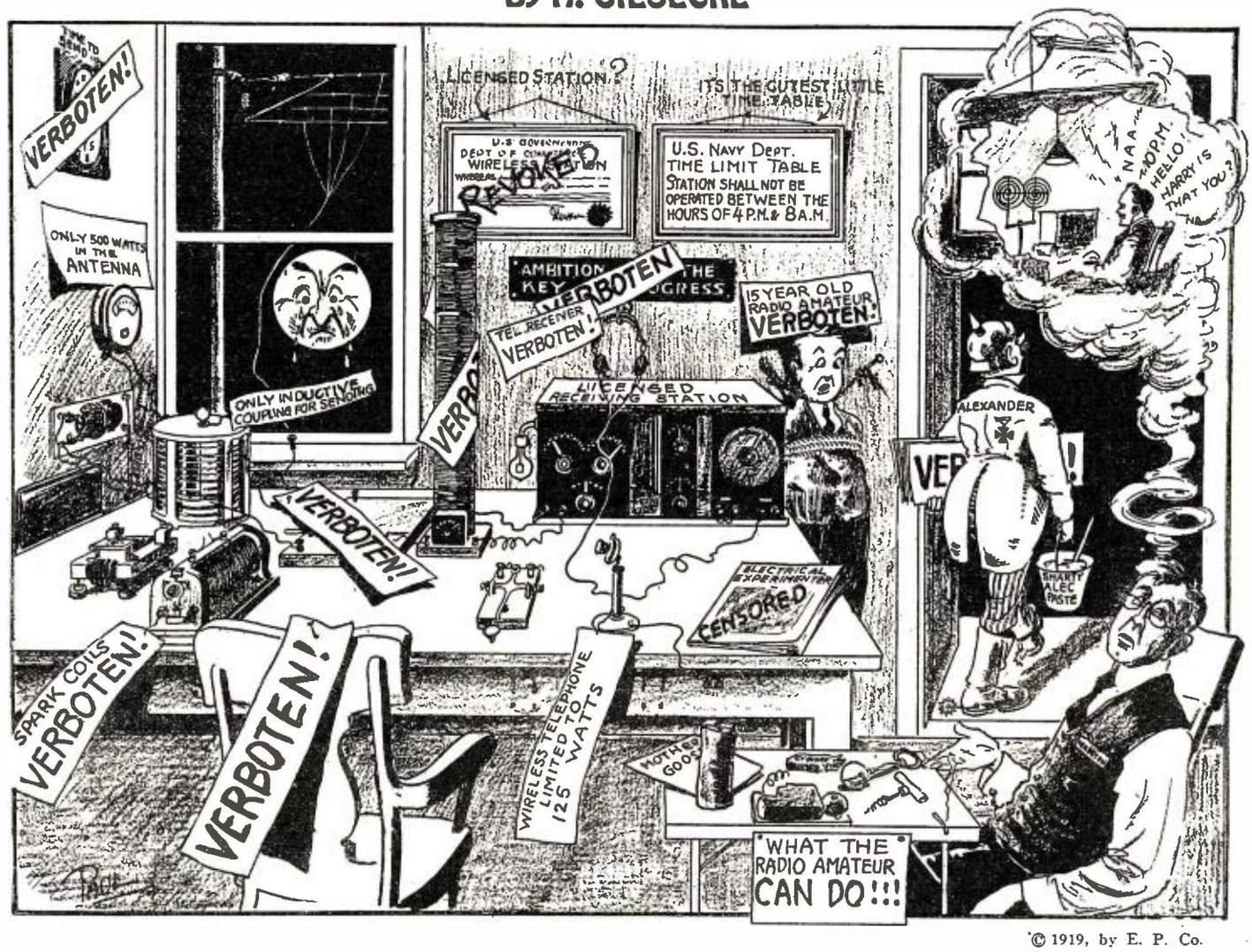
Now let us see why it is impossible for the human mind to receive without instruments and apparatus any outside radio message. If you are located even as close as a mile from the most powerful receiving station, the energy which is received on a collecting antenna is so infinitesimal that it amounts to less than 1/100,000 of a fly-power. In order to detect such a message, it is necessary to use, even in the simplest radio apparatus, certain instruments that must magnify this weak message enormously. The crystal detector and a pair of telephone receivers of the simplest radio set may be compared to a fairly good microscope, and even then the received energy is so small that one must have the telephone receivers pressed close to the ears in order to hear the radio message at all.

On the other hand, the human brain is so constituted that it is impossible for it to receive radio messages without the intermediary of some apparatus such as a detector and telephone receivers. For instance, if one is totally deaf, and a locomotive sounds its whistle within a block, he cannot hear the sound. If you are totally blind, you cannot see and cannot receive luminous impulses. You cannot feel a coin without touching it with some part of your body.

Now, then, sound waves are of a low order of vibration, vibrating at the rate of from eight to 20,000 oscillations per second, after which we can hear them no longer. Broadcast radio waves vibrate at the rate of from about 30,000 to 300,000,000 cycles per second, while light waves vibrate at the average rate of approximately 600,000,000,000,000. It will be seen from this that radio waves have a vibration much too high to be heard by the human ear, while they are not fast enough to be seen by the eye. Lengthy laboratory experiments have shown that human beings, and animals for that matter, are so constituted that they have no organs by which they can receive radio or electromagnetic waves unaided. Radio waves must be rectified and no organ in the body, not even the brain, can do this.

"Black Listening is Theft"

By H. GIESECKE



You are wrong. This is not in darkest Prussia, where everything is verboten (forbidden). It merely represents an American amateur station A. D. 1919, when the Alexander amendment becomes a law. (The accompanying caption appeared under the original cartoon in the February, 1919, issue of the ELECTRICAL EXPERIMENTER.)

WHEN in the fall of 1923 newspapers announced that the first German broadcast station had begun its transmission in Berlin, and that everyone, by a payment of the prescribed license, could become a participant in the broadcasting, not every reader knew to what the new order of things referred. But far less did they understand the technique of the installation, nor the legal and police regulations which underlaid the new public service.

The situation soon changed. Like mushrooms shooting up out of the soil, new technical journals and handbooks appeared, awakening, especially in the young, the most lively interest in the technique of receiving sets, showing with what astonishingly simple apparatus broadcasting could be caught out of the ether. That, in addition to this, a license was required, very few knew; if they did know it, they went on their way without thinking about it. What business was it of the Government if one strung some wires in his residence and wound coils? Neighbors did it, his companions in school and many acquaintances also. Was he to pay money for that, and in considerable amounts? What harm did it do anybody if a few more people listened when the transmitter was broadcasting? And if one finally did get caught, what dreadful thing could happen?

So in a few months a great number of illegal hearers (schwarzhörer) were developed, an army whose exact strength is unknown today, but which in number is several times as great as the list of paying participators. Through this action, which spread like a plague through all ranks of the populace and led innumerable people to evading the license fee, the progress of broadcasting was greatly endangered, as is perfectly evident; indeed, experts were able almost to predict the day when the broadcast stations, for lack of means, would have to cease their operations unless some fundamental change was made.

THE NEW LAW

How such a fundamental change can be carried out and must be carried out, present developments show. In order to make everyone a participant, including those with small pecuniary resources, the license fee must be lowered and the registration made easier. To the investigators and technically educated groups who wish to work productively in radio, the possibility must be given to carry out their work under acceptable conditions and finally a law must be prepared that will clarify the legal position, and provide real punishment for those who erect or operate a receiving set without license.

In the spring of 1924 a new regulation like this—and yet more—appeared in the "Ordinance for the Protection of Broadcasting." It included a special paragraph that ordained punishment for the possessors of secret receiving sets if within four weeks after the promulgation of the law, they neglected to apply for license at the German Reich's Post Office. No less than 75,000 old and young infringers seized upon the opportunity to bring their illegal sets into a legalized status, thus in the eyes of the law to escape culpability, and to acquire their own self-respect. This great operation of purification on account of the fundamental nature thereof, spread into all nooks and corners of the German state, so we might suppose that it would put an end to the trouble of illegal listeners, outside of a few hopeless cases, once for all. This was the case in England. Should it be otherwise in Germany?

Unfortunately, these expectations were not realized. After a few months certain indications caused the suspicion that the foolish "bootleg" hearing was again beginning to spread far and wide. This time, extenuating circumstances did not favor the transgressors. Information from the police indicate that the evil is not rooted out today. Ignorance of the law after long repeated announcements in word and writing can no longer be cited as the cause of anyone's evasions. Even the amount of the license, which is reduced to two marks (50 cents) a month, can scarcely be an inducement for violating the law. Besides, the regulations for registering as a licensed participant are made very much simpler, so that the busiest person has no further grounds to evade the law on account of difficulties of registration. The

The Situation of German Listeners

FOR American readers the accompanying article makes amazing and most humorous reading. At first it might be thought that this was the outburst of a fiction writer. On the contrary, it is a verbatim translation from the German radio magazine, *Der Deutsche Rundfunk*. The article appeared in their issue of January, 1925. We are reproducing the article merely to show how radio enthusiasts fare in other countries.

In most of the European countries radio still is *"Verboten."* The short-sightedness of some of these European states is simply astounding. When it is considered that in the United States during 1924 over $350,000,000 in radio material was sold, enriching the country tremendously by this new industry, it seems nothing short of suicidal for the countries of the Old World to assume such archaic methods.

The tax collected from radio listeners, we are sure, must prove a tremendous detriment to the development of the art and, as the accompanying article shows, the most rigid laws do not seem to curb bootleg receiving stations.

The United States derives its income from the radio industry by means of the income tax, because the more business done by the industry, the better the Government will fare. But the European governments evidently desire to collect the tax not only from the manufacturer but from the individual as well. This, in the past, has proven nothing short of disastrous, because the European countries are far, far behind the United States in either the manufacture of instruments or number of radio listeners. And for every one of the European broadcast stations, the United States has ten.

We were not always free in America, either, for that matter. The writer remembers well his fight in 1912 to have the radio amateur recognized, and how, finally, part of an editorial in his magazine, MODERN ELECTRICS, became incorporated into the *Radio Act of* 1912, giving the American amateur rights that he did not have before.

Later, in 1919, other attempts were made to curb the amateur, notably the famous Alexander Bill. This bill was not acceptable to the radio fraternity nor to the writer, who, as editor of the ELECTRICAL EXPERIMENTER—the forerunner of RADIO NEWS—caused to be sent to the authorities in Washington several hundred thousand letters from radio amateurs scattered all over the country. A cartoon of that period (February, 1919) appears on the opposite page.

It is needless to say that the Alexander Bill never passed. If it had, the chances are that radio in the United States would never have attained its present extension.

The cartoon is chiefly interesting because it was published by the writer in 1919, long before the German, and for that matter, before all the other European radio laws went into effect. Some day the European radio broadcast listeners and radio amateurs will wake up, organize and demand a free ether. Not until then will radio in Europe expand.

HUGO GERNSBACK.

need of radio investigators from the technical standpoint which formerly so often was the inciting cause of their desire to work for the benefit of all receivers, what of this?

Even this reason disappears since the legal permission to construct one's own detector and the regulation of the amateurs' operations gives to everybody the opportunity to bring out his knowledge and capabilities in a legal way. Nothing else remains except dishonorable motives, the joy of the ill-disposed, the desire to enjoy without pay where others pay, the well-known desire to beat the Government out of what really ought to go to it.

A QUESTION

Should the Government pass unchallenged these illegal actions and allow them to gain further ground? Should it permit this structure built up by assiduous work to be undermined, that from day to day a widespread net of secret radio receivers extended further and further—which might, eventually—its extent not being known, become the greatest danger for the Government?

The microphone of the broadcast station gave the answer, when, in the second half of October, it was announced to audiences of hundreds of thousands, that the war against secret broadcast receivers was to be taken up with all might and that the German Post Office for this purpose had notified their branches in future, in every case of the discovery of unlicensed receiving sets, to mete out the fullest extent of punishment, with the tearing down and confiscating of the secret sets. Not once, but a number of times this warning was broadcast and simultaneously by notifications was spread abroad in the technical press and in the daily papers, so that every illegal hearer undoubtedly received full notice and knowledge that the day of mercy was over.

Have all broadcast "wild men" (funkwilder) taken note of the meaning of these announcements? No! Numerous court proceedings show it. He who follows the daily papers and radio magazines carefully will know full well that within a few weeks, since this proclamation, already over 100 court sentences have been pronounced, and several infractors sent to prison.

Certainly this strong-armed action will in the course of time bear good results and will repress the rail-birds. But is it not a sad sign of the times that so many people, and among them many who are otherwise considered good citizens in their daily lives, must, by police and governmental power, be forced to give up their light-fearing work, although they know what the consequences are? Should we not have a citizen-like feeling, that in our Fatherland, struggling hard and depending on itself alone, the private person is of less importance than the community at large? In the immense Hall of the Great German Radio Exhibition, in every radio exhibit which shall show and has shown what German technical industry and the German power of work have brought about, the walls are hung with numerous placards with a few words, "Illegal Hearing Is Theft" (Schwarzhören ist Diebstahl). Many read the warning; many will take it to heart. But only when the meaning of this sentence has come to the cognizance of *everybody*, who now is fishing in murky waters, when every illegal hearer clearly knows that his action is a rotten, *despicable* one which injures the people at large, then only will it first be possible to root out the illicit hearing completely and radically.

WHAT is the remedy for the European situation as pictured herewith?

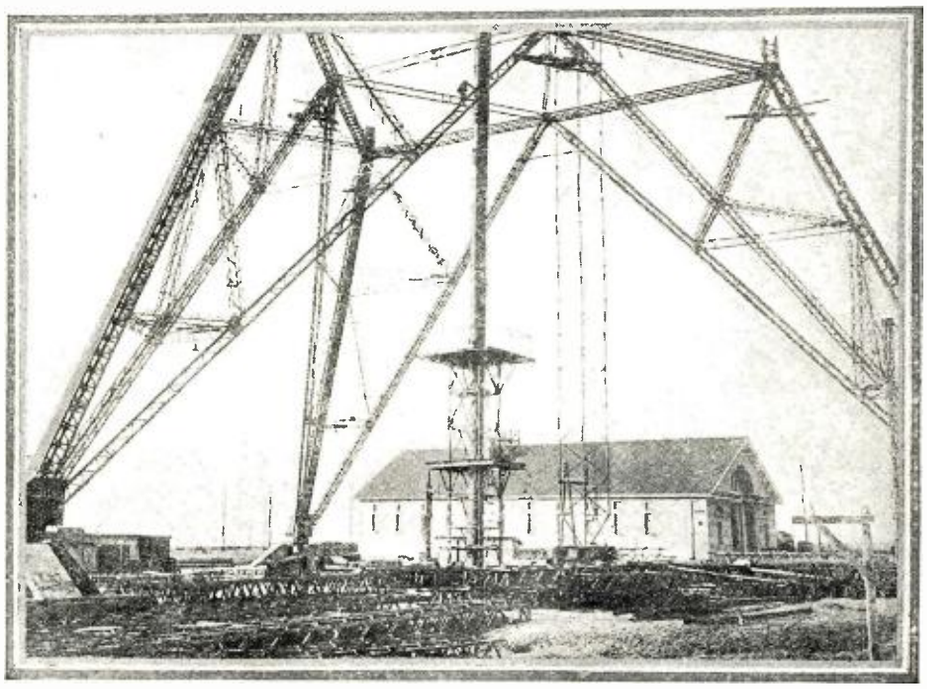
RADIO NEWS suggests that the same ideas as were used in 1912 by American radio amateurs and by the present publishers of RADIO NEWS to effect a free ether for the various European countries be adopted.

There was a time when it was not lawful in either France or England for any amateur to transmit code. It took a long fight to convince these two governments that they should allow transmission by their subjects. The right to transmit was won by the amateurs through their combined efforts and through correct organization of their radio clubs.

It seems to us that if the European radio editors would form broadcast listeners' clubs throughout their countries and call for membership, it should not take very long to get enough petitions to have their governments take favorable action. If there are enough petitioners, no government can long overlook the wishes of a great majority of their subjects.

The United States has proven that radio broadcasting can attain unprecedented proportions without burdening the listener with

(*Continued on page* 2185)



At least, Germany is not asleep in the matter of erecting broadcast stations. Above is a view of the base of a new tower—to be 800 feet high—of a new Berlin station.

Radio and the Copyright Problem

By HIRAM L. JOME

Mr. Jome, of the economics and sociology department of Denison University, explains lucidly the present status of the fight between the broadcasters and music publishers.

The fight between the music publishers and the broadcasters is just another case of squeezing the public, helpless between them.

THE founders of our government saw that in order to have a strong development of American culture and science it was necessary to protect the property rights of authors and inventors. Therefore, they inserted in our Constitution the following section: "[Congress shall have power] To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Several points must be noted concerning this provision. In the first place, copyright is not a natural right, like life and liberty. Though Congress has acted under this enabling clause with acts and amendments protecting the work of an author, still it may withdraw this protection at any time without doing violence to the Constitution. The section says "May."

In the second place, though this section is undoubtedly for the benefit of the individual, the public interest is paramount.

Under the United States Copyright Act, approved March, 1909, the author, dramatist, composer or other person entitled to such protection, is given, among other privileges, the exclusive right to print, reprint, publish, copy, vend and translate the copyrighted work, as well as the exclusive right to publicly perform for profit.

"PUBLICLY PERFORM"

The big issue arises as to the meaning of the exclusive right to publicly perform for profit. What is a public performance? What is a performance for profit?

"A performance is public," says Arthur W. Weil, in his "American Copyright Law," "when there is present a sufficient number of the public who would, presumptively, also go to a performance licensed by the author, as a commercial transaction, so that it may be said that, theoretically, at least, the author has sustained a monetary loss."

A large number of questions immediately suggest themselves: If I buy a phonograph record, on which a royalty of two cents has already been paid to the owner of the copyright, what rights have I? I may certainly play it on the victrola by myself. I may play it in the presence of members of my family; I may invite in a few neighbors and relatives to hear and enjoy the new selection. I may announce a housewarming and invite the entire community to my house and then play the record for the entertainment of my company.

Now, suppose I buy a hotel, restaurant or movie theatre. I play the victrola in the dining room of the hotel or auditorium of the theatre. I charge for the meals or for admission to the theatre. The music forms a part of the dinner. May I play this record without incurring further liability to the owner of the copyright? Exactly where does private performance end and public performance begin? When does a performance become one for profit?

Suppose now I played this new record into the microphone of the transmitting apparatus of a broadcast station, which sends the music out upon the waves to an unseen audience of thousands scattered over a wide territory. Is this a public performance? Is it a public performance for profit?

If the reader will visualize these situations, he will understand the crux of the copyright problem.

The Federal Courts have for some time been grappling with these questions. The Shanley Company conducted a public restaurant in New York City. Songs were sung and music was played for the entertainment of the patrons. The diners, of course, paid for their meals, but there was no direct charge for the musical entertainment. The song, "Sweethearts," was sung in this place. The owner of the copyright asked for an injunction restraining the proprietor from having this song rendered, claiming that his property rights were being invaded. In the lower Federal Courts the author failed to get relief on the ground that, since no admission was charged, there was no public performance of "Sweethearts" for profit.

The author appealed the case, however, and it finally reached the Supreme Court for final decision. This Court, speaking through Justice Holmes, said in part: "If the rights under the copyright were infringed only by a performance where money is taken at the door they are very imperfectly protected. Performances not different in kind from those of the defendant (the restaurant owner) could be given that might compete with and even destroy the success of the monopoly that the law intends the plaintiff to have. It is enough to say that there is no need to construe the statute so narrowly. The defendant's performances are not for charitable purposes. They are part of a total for which the public pays, and the fact that the price of the whole is attributed to a particular item which those present are expected to order, is not important. It is true that the music is not the sole object, but neither is the food, which probably could be got cheaper elsewhere. The object is a repast in surroundings that to people having limited powers of conversation or disliking the rival noise give a luxurious pleasure not to be had from eating a silent meal. If music did not pay, it would be given up. If it pays, it pays out of the public's pocket. Whether it pays or not, the purpose of employing it is profit, and that is enough." And he therewith reversed the decision of the lower Court.

A certain theatre owner employed a pianist to play appropriate music at his movie performances. The pianist was given discretion as to what selections he should perform. The pianist played "Tulip Time" from "Ziegfeld's Follies 1919." No charge was made for the music, but a charge, of course, was made for admission to the theatre. The owner of the copyright sought an injunction restraining the theatre owner from playing this selection. The Federal District Court granted the injunction, holding that the playing of copyrighted music by a pianist in a picture theatre was an infringement of the copyright.

COPYRIGHTS AND BROADCASTING

With the advent of radio broadcasting it became necessary for these stations to furnish music for the musicians to send out upon the air. It would conceivably be possible to make up a good popular program from the free list (on which copyright

(*Continued on page* 2166)

Don't Believe It

By JAY HOLLANDER

Here are presented some interesting facts on a phase of radio not often discussed. It sounds a warning as well as giving a laugh.

WHAT sins are committed in the name of science! With every advance that is made, 17 mountebanks and fakirs immediately rush out, figure some way of using it to their own ends, and go forth in the highways and byways seeking whom they may devour.

IF you have friends who wish to invest money with questionable apparatus, hand them the accompanying article. Radio readers can do a vast amount of good in educating their less technical friends.

In the meanwhile, for publishing the article on the Neurophonometer, "Dr." George D. Rogers has sued RADIO NEWS for one million dollars in the courts of San Antonio, Texas. If Mr. Rogers ever collects his million dollars, or any part of it, we promise him that we shall peddle his Neurophonometer for the rest of our lives.

When the article first appeared, "Dr." Rogers sent the Editor a letter from which we quote the following:

"I am very anxious that this instrument shall be sold on merit alone, so I hereby accept your challenge, so that I may have the opportunity of demonstrating it to you that you and the Board (composed of physicists, physicians and radio engineers) may have the opportunity of knowing the exact work done by it.

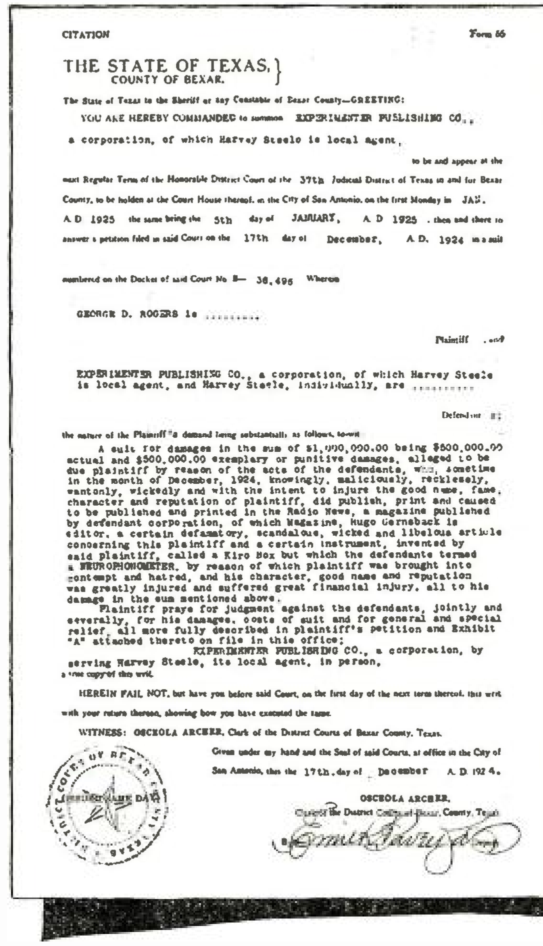
"I only ask that the investigation be made in accordance with accepted laws of physics. In other words, all I ask is a fair chance with physicists, physicians and radio engineers, and the X-ray to demonstrate to Chiropractic contentions.

"I am thoroughly convinced that I have a thoroughly scientifically constructed and operated instrument, that does all that we have claimed for it to do; if I have not I would be glad to learn different. You are quite sure that I have not; therefore, I am glad for this opportunity of learning from men of unquestionable authority which of us is right.

"I am so sure that you are a big, broad-minded man, and that the provisions I ask are perfectly fair and agreeable with you, that I am starting arrangements so that I can come to your city, whenever you designate."

Upon receipt of this letter, RADIO NEWS put it up to Mr. Rogers to name his own time, giving us two weeks advance notice of his coming. Although we have been patiently awaiting the arrival of Mr. Rogers, he seems to have had a sudden change of mind, sending the notice of the million dollar suit to New York in lieu of himself, the reason, of course, being that he had to save his face in his community and thought this was a cheap way of getting out of it.

Our invitation is still open, and Rogers has confirmed our opinion of him by not coming to New York, although he promised to do so. We are still waiting. —*Editor.*



CITATION Form 66

THE STATE OF TEXAS, COUNTY OF BEXAR.

The State of Texas to the Sheriff or any Constable of Bexar County—GREETING:

YOU ARE HEREBY COMMANDED to summon EXPERIMENTER PUBLISHING CO., a corporation, of which Harvey Steele is local agent, to be and appear at the next Regular Term of the Honorable District Court of the 37th Judicial District of Texas in and for Bexar County, to be holden at the Court House thereof, in the City of San Antonio, on the first Monday in JAN. A.D. 1925 the same being the 5th day of JANUARY, A.D. 1925, then and there to answer a petition filed in said Court on the 17th day of December, A.D. 1924 in a suit numbered on the Docket of said Court No. B— 38,496 Wherein

GEORGE D. ROGERS is .... Plaintiff and

EXPERIMENTER PUBLISHING CO., a corporation, of which Harvey Steele is local agent, and Harvey Steele, individually, are .... Defendant

the nature of the Plaintiff's demand being substantially as follows, to-wit

A suit for damages in the sum of $1,000,000.00 being $500,000.00 actual and $500,000.00 exemplary or punitive damages, alleged to be due plaintiff by reason of the acts of the defendants, who, sometime in the month of December, 1924, knowingly, maliciously, recklessly, wantonly, wickedly and with the intent to injure the good name, fame, character and reputation of plaintiff, did publish, print and caused to be published and printed in the Radio News, a magazine published by defendant corporation, of which Magazine, Hugo Gernsback is editor, a certain defamatory, scandalous, wicked and libelous article concerning this plaintiff and a certain instrument, invented by said plaintiff, called a Kiro Box but which the defendants termed a NEUROPHONOMETER, by reason of which plaintiff was brought into contempt and hatred, and his character, good name and reputation was greatly injured and suffered great financial injury, all to his damage in the sum mentioned above.

Plaintiff prays for judgment against the defendants, jointly and severally, for his damages, costs of suit and for general and special relief, all more fully described in plaintiff's petition and Exhibit "A" attached thereto on file in this office;

EXPERIMENTER PUBLISHING CO., a corporation, by serving Harvey Steele, its local agent, in person, a true copy of this writ.

HEREIN FAIL NOT, but have you before said Court, on the first day of the next term thereof, this writ with your return thereon, showing how you have executed the same.

WITNESS: OSCEOLA ARCHER, Clerk of the District Courts of Bexar County, Texas.

Given under my hand and the Seal of said Courts, at office in the City of San Antonio, this the 17th day of December A.D. 1924.

OSCEOLA ARCHER, Clerk of the District Courts of Bexar County, Texas

A Million Dollar Suit

Our readers will remember the famous "Dr." Rogers' *Neurophonometer*, which we exposed in our December, 1924, issue. At that time we made a $1,000 challenge to demonstrate the Rogers Neurophonometer before a body of twelve scientists. If these twelve men decided that the Neurophonometer claims were founded upon scientific truth, RADIO NEWS was to pay Rogers the sum of $1,000, plus transportation to and from New York.

Although Rogers promised to come on to New York, he evidently had a change of heart, and, in order to save his face in his community, started his million dollar suit, facsimile of which appears above.

Their scientific adaptations are worthless except to line their own pockets with the dollars of the gullible ones who work harder with their hands than they do with their brains and common sense.

It is worse than even the estimable Barnum thought. There is not only one born every minute, there is one fleeced also.

In every branch of science there has been this regular fleecing of the people who read the Sunday supplements telling of the wonders of the latest developments of the serious scientific investigators. They read these more or less lurid accounts of the latest miracle of the laboratory and test tube, but remember nothing of the account except the dreams of the newspaper hack which were injected into the reports of the scientist in order to get the account past the editor and to give room for the striking illustrations in colors.

The net result is that the reader has an idea that the novel discovery—usually touted as the savior of the world which will do everything from curing tuberculosis to shining the nickel on the kitchen stove—is a great miracle of science and capable of all the results postulated for it.

So the gentlemen of the large diamond stud and the sleek hair have their market all ready for them. Their work is simple, the usual procedure being somewhat as follows: They buy a piece of the apparatus, remove it from the case it was housed in at the factory and place it in another with a number of added controls; then they install several blue, green, red and yellow lights, for the purpose of making the ensemble more awesome, and go out and begin to heal the diseases or solve the problems of the world.

Radio has probably grown a larger crop of these particular gentry than any other science. This is so probably because it is a bit closer to the ordinary idea of the occult than any of the others. No matter how the details are explained, there is still the fact that the waves travel through the something called by consent, the ether. And the most anyone knows of this stuff is that it goes through glass and is where even air isn't. This point makes the whole situation sort of eerie to the everyday man in the street, who is accustomed to the realities of corned beef and cabbage.

So when he reads of a scientist who has cured a sort of cancerous growth on a geranium by means of a sort of short wave radio set, after he has seen the imposing before and after photos, he is thoroughly convinced that science has made another stride. It takes, therefore, very little persuasion on the part of a well-dressed, seemingly prosperous man to convince him that investment in the new Radio Cancer Hospital will be a short cut to a five figure bank account. "For," says he of the prosperous look, "do we not control all rights to the use of short waves to cure this dread disease for which physicians have been seeking a cure vainly for, lo, these centuries past?"

Now the fact that the scientist was working toward an end and was writing simply of his early experiments did not seem to enter the head of the man asked to buy. The scientist was absolutely correct in his assertions, but his claims were nothing like those of the salesman. There is a deal of difference between a geranium and a human being!

And it is convincing enough to send him home for a hurried conference over the dinner dishes with his wife. The result is that he gets a finely engraved certificate with a lot of extra fine printing and a gorgeous gold seal—and a bit of costly knowledge as to the character of "science" in particular and salesmen in general.

And the worst part of it is that his own disappointment at being skinned—to use the good old Anglo-Saxon—causes him to immediately reach the conclusion that *all* science is on the same order, viz., something which will allow slick city salesmen to make a living at the expense of the hard-working man. So advance of the art is hindered.

For several months past there has been a small but very pretentious show room and suite of offices situated on one of the avenues near Pennsylvania Station in New York City. The sole purpose of the men in this office and of the grand and complicated—and always well polished—apparatus which line its walls, is to convince the ever inquisitive and anxious public that a few radio

(*Continued on page 2126*)

History of Radio Inventions

By A. H. MORSE, A.M.I.E.E., Member I.R.E.*

We are happy to present to our readers a new and important work, entitled "History of Radio Inventions," by A. H. Morse, which is beginning in this issue.

This book, which is now running serially in RADIO NEWS, will be published afterwards in book form, in both the United States and England.

It will prove a gold mine to those interested in the history of all important radio inventions and will serve as a reference book to inventors and experimenters in the future.

Mr. Morse has been careful to give every patent number throughout the text, as well as all reference data, so anyone interested in any particular phase of radio development will have little trouble in locating important data.

—EDITOR.

INTRODUCTION

The term "Radio" is used herein to connote radio telegraphy and radio telephony, and not merely broadcasting.

The bibliography of radio is already very extensive, and while it contains much of a trashy or partisan order, the balance very well covers the technical aspects of the subject to date. There should, however, be room for a book which presents the subject in a novel or more lucid way, or for one that considers it from a new point of view; and it is in the latter class that it is hoped that this book will find a place.

Within the last few years the radio field has been invaded by many thousands of persons who know nothing of its evolution, and are therefore sometimes unable to distinguish between what is new and what is old. The consequence is that they waste much time and money in re-inventing old devices, and in evolving others to circumvent imagined patents on inventions long since in the public domain. The case of the spider-web coil may be cited as an example. This will be found to have been illustrated and described several years before the Great War, but was heralded as a novelty two or three years ago. It is one of the author's objects to help to correct the perspective of these newcomers; and it is hoped that this book will be of some assistance also to British and American Patent Agents and Attorneys (new to the art), Inventors, Experimenters, Journalists, Radio enthusiasts and "Whymen" generally, on both sides of the Atlantic.

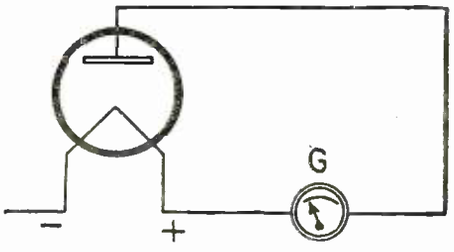


FIG. 1

Edison's original diode patented long before the advent of radio.

The evolution of the radio art is traced herein, mainly through the patent office records of inventions in use today, or their lineal forebears. As a consequence, many inventions of great merit and one-time promise receive little or no mention; and, except in a few cases, where inventions are cited merely as evidence of the contemporary knowledge of the art, the selection has been made, not by the author, but by the test of utility. It may be observed that this test has proved too much for some of the most heralded inventions.

Since so much reference is necessarily made to patents of invention, it may be well to warn the reader that an invention is not always novel, useful or practicable because it is patented.

While the loose practice of using the words "took out a patent," instead of "was awarded a patent," is to be unequivocally condemned, it must be admitted that the former often express a near-truth, particularly in connection with a new art, and in certain countries.

Patent Office Examiners are only human, and when they accept an application for a patent, it merely means that they know of, and have succeeded in tracing, nothing to upset the inventor's claims. Of course, in large settled countries, where there are specialist examiners for every art or branch of an art, a patent has more significance than it has in a new or undeveloped country, where a few examiners have to deal with applications for patents in relation to all the arts. Moreover, it is a fact that, until a few years ago—and perhaps they exist today—there were administrations which would, and often did, take an "inventor's" money for a patent on a "perpetual-motion" or "self-driving" machine. The U. S. Patent Office requires a working model with such applications, which is equivalent to refusal.

In any country a patent of invention is merely a "scrap of paper" until it has been supported by a law suit; and it is a wise inventor who knows whom to sue. Being blind, justice is only too liable to be influenced by a cloud of "expert witnesses," the which cost much money.

If over much attention appears to have been given to the arc, it is because, by reason of its simplicity and freedom from patent restrictions, it may continue to have extensive application; even if its present disabilities are not mitigated, which is unlikely. (There has been some improvement since this was written.)

In the hope that he may thereby help to correct some of the misapprehensions to which expression is so persistently given in the lay press, the author has ventured to look forward a little, and to hazard some opinions on the lines of future development.

Wherever the British or American—as the case may be—"equivalent" of a patent is known to the author, reference is given to it herein. It must not be assumed, however, that such "equivalent" covers the same patent protection in the two countries; because, in many cases, there is a wide discrepancy in this respect. When a patent number is prefixed (or suffixed) by (?), it means that the author has not personally verified the reference.

The author is gratefully indebted to the courtesy of the Commissioner of Patents at Washington, D. C., and to the Controller of His Majesty's Stationery Office at London, for permission to reproduce the extracts from American and British patent specifications respectively, which appear herein; and to the Director, U. S. Bureau of Standards, for the photo and diagrams illustrating the chapter on Beam and Short-wave Radio.

The author's thanks are also due to Messrs. E. A. B. Snoaden, H. F. White, H. R. Rivers-Moore and R. E. H. Carpenter, of London, for assistance in procuring reference to certain publications, not available in Montreal; and to the publishers for their courtesy and kindly advice on the arrangement of the subject matter.

Montreal, December, 1924.

CHAPTER I

THE PAST

In connection with patents of invention, there is a somewhat commonly used metaphor to the effect that one cannot get a patent on the use of an umbrella to keep off the sun. This, however, cannot be said to apply to the radio art; for instance, J. A. Fleming was awarded a perfectly good patent on the application to radio of a well-known effect and instrumentality; and H. H. C. Dunwoody secured an equally good one on the similar application of a hitherto unsuspected property of carborundum. In each case the invention was of a high order of commercial utility, since the former led to one of the greatest developments in the evolution of the art, while the latter sustained the art during one of the most needy periods of its application to commerce, and is still in extensive use.

The evolution of radio has been characterized by comparatively few original inventions of outstanding merit and commercial utility; and by fewer still that, for one reason or another, have found any practical application, until they were about 10 years old. Moreover, the borrowings from other arts have been all too few and tardy.

In this chapter we will endeavor to note in chronological order the discoveries and inventions which are more or less strictly relevant to the present state of the art; omitting those which have or had no important practical application, regardless of their academic merit.

1678. Christian Huygens, a Dutch mathematician and physicist, propounded the undulatory theory of light.

1843. Professor Joseph Henry communicated to the American Society that he had succeeded in magnetizing needles at a distance of 220 feet.

1867. Ruhmkorff perfected the "Ruhmkorff coil" which 35 years later was used almost exclusively in wireless stations.

James Clerk-Maxwell propounded the electro-magnetic theory of light. This theory confirmed and extended that of Huygens, and was supported by mathematical proofs which form the basis of radio engineering today.

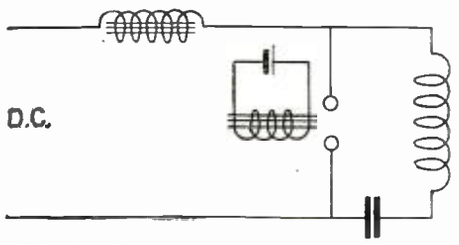


Fig. 3. This is the forerunner of all the present-day arc transmitters.

1879. Professor D. E. Hughes, of London, gave a private demonstration of the

*Late Supt. Dom de Forest Wireless Telegraph Co. and United Wireless Telegraph Co.; Engineer, Marconi's Wireless Telegraph Co.; Wireless Adviser, Indo-European Telegraph Co.; Managing Director, Marconi Wireless Telegraph Company of Canada.

transmission and reception of radio signals up to a distance of several hundred yards. Those present were W. H. Preece, Sir. Wm. Crookes, Sir W. Roberts-Austen, Professor W. Grylls Adams and Mr. W. Grove. Early in the following year Professor Hughes gave a similar demonstration to a professor of Cambridge, who stated that all the phenomena could be explained by known electro-magnetic induction effects. This so discouraged Hughes that he decided not to publish the results of his experiments until he was in a position to prove that he was making use of hitherto unknown phenomena. Consequently, his experiments were not made public for many years; meantime the phenomena had been identified by others, and commercially applied by Marconi. In 1899, in commenting on Hughes' work, Sir Wm. Crookes said: "It is a pity that a man who was so far ahead of all other workers in the field of wireless telegraphy should lose all the credit due to his great ingenuity and prevision." In later years Hughes might have had recognition of his work, but he resolutely refused.

1883. Professor A. E. Dolbear, of Boston, evolved a system in which he proposed to use an elevated aerial, earthed through the secondary of a Ruhmkorff coil, having a telephone transmitter and battery in series with the primary. He also proposed in 1886 to elevate his aerial by means of a kite and to put a Morse key instead of a telephone transmitter in the primary circuit (see U. S. Pats. 350,299 and 355,149), which were acquired by the United Wireless-DeForest Company.

Thomas A. Edison, of New Jersey, applied for an American patent on a diode for use in the voltage control of electric lighting systems. (U. S. Pat. 307,031.) This invention caused considerable scientific interest, but does not seem to have had much practical application. (See Proc. Royal Society, London, Vol. xlvii, 1889-90, p. 118. J. A. Fleming.) (Fig. 1.)

1885. Edison proposed the use, in an inductive system of wireless telegraphy, of an elevated and earth aerial for land stations, and an inverted and earthed "L" aerial for ship stations. (Fig. 2*a, b, c.*) (U. S. Pat. 465,971.) He also proposed the use of balloons covered with conducting foil and connected through transmitting or receiving apparatus to earth. (Fig. 2*d.*)

1888. Professor Rudolf Heinrich Hertz, a German, demonstrated experimentally the possibility of creating electro-magnetic waves in the ether, and confirmed their identity with those, which according to Clerk-Maxwell's theory, were the conveyors of light. Apparently Hertz was unaware of Hughes' earlier experiments with a microphonic detector and a telephone, because he (Hertz) used for a detector a simple metallic loop containing a minute spark gap. Hertz succeeded not only in detecting the waves, but in measuring their velocity and length. He also demonstrated that they were capable of reflection, refraction and polarization.

1890. Professor Edouard Branly, of Paris, found that a "coherer" was a detector of Hertzian waves. The "coherer" effect had previously been noted and commented on by others, and it had been used by Hughes in his unpublished experiments of 1879. Although it was known at this date that the filings or granules could be decohered by tapping, no automatic provision seems yet to have been made to this end; and it was not until 1897 that Lodge disclosed that when used with a telephone, a filings "coherer" did not require to be tapped.

It is related that, in the course of some experiments to ascertain the conductivity of an iron chain under various degrees of tension, Branly noted sudden current rises, for which there was no apparent reason. In the course of his inquiries for the cause, he discovered that in another part of the building a person was making simultaneous experiments with a Ruhmkorff coil. and that—as we would now expect—there was a current rise in the chain each time the coil came into operation. The writer has not been able to verify this story. (Branly received the Nobel Physics Prize in 1921 for his researches in Radio.)

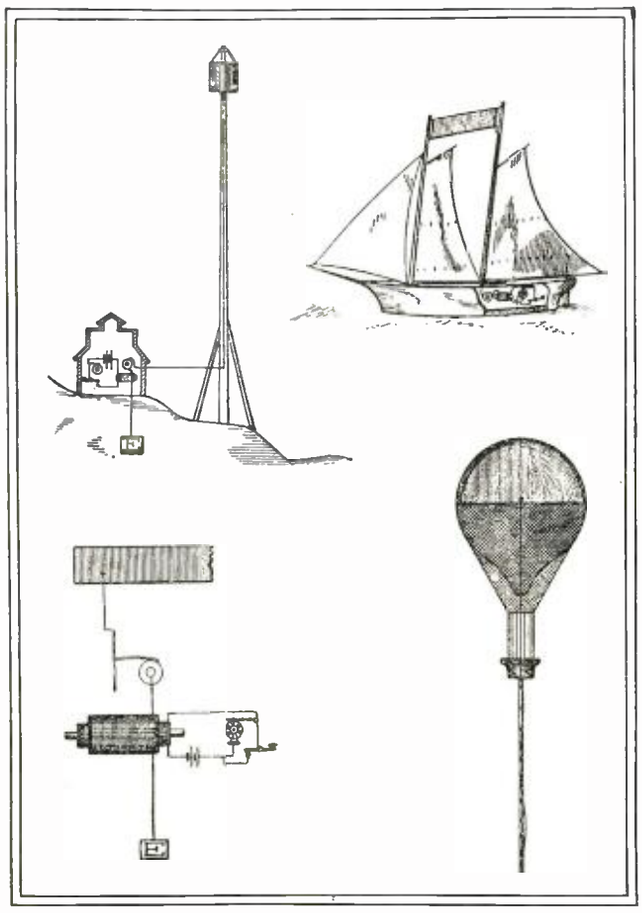
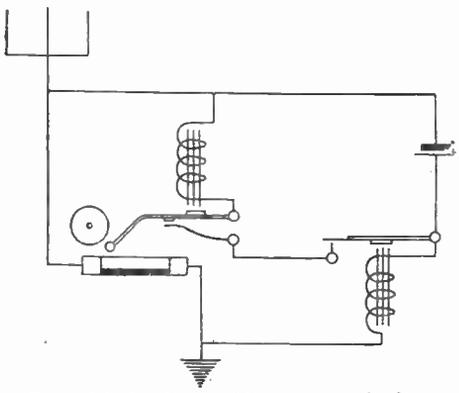


Fig. 2. Showing three antennae which Edison proposed using.

Professor (now Sir) Oliver Lodge published the results of his researches and experiments in electrical resonance or syntony, and explained that a closed oscillatory circuit was a feeble radiator and a feeble absorber.

1892. In the course of a paper in the *Fortnightly Review,* in February, Sir Wm. Crooks said: "Rays of light will not pierce through a wall, nor, as we know only too well, through a London fog; but electrical vibrations of a yard or more in wave-length will easily pierce such media, which to them will be transparent. Here is revealed the bewildering possibility of telegraphy without wires, posts, cables or any of our present costly appliances. Granted a few reasonable postules, the whole thing comes well within the realms of possible fulfilment. At present experimentalists are able to generate electric waves of any desired length, and to keep up a succession of such waves radiating into space in all directions. It is possible, too, with some of these rays, if not with all, to retract them through suitably shaped bodies acting as lenses, and so direct a sheaf of rays in any given direction. Also an experimentalist at a distance can receive some, if not all, of these rays on a properly constituted instrument, and by concerted signals messages in the Morse code can thus pass from one operator to another. . . . At first sight an objection to this plan would be its want of secrecy. . . . This could be got over in two ways. If the exact position



The original coherer with an automatic decoherer as devised by A. S. Popoff.

of both sending and receiving instruments were known, the rays could be concentrated with more or less exactness on the receiver. If, however, the sender and receiver were moving about, so that the lens could not be adopted, the correspondents must attune their instruments to a definite wave-length, say, for example, 50 yards. . . . Even now, indeed, telegraphing without wires is possible within a restricted radius of a few hundred yards, and some years ago I assisted at experiments where messages were transmitted from one part of a house to another without an intervening wire by almost the identical means here described." (A similar suggestion is reported to have been previously made by Professor R. Threlfall, of Sydney, Australia.)

Professor Elihu Thomson, of America, applied for a patent on an arc method of producing high frequency currents. His invention incorporated a magnetic blowout and other essential features of the arc of today, but the electrodes were of metal and not inclosed in a gas chamber. (See U. S. Pat. 500,630.) (Fig. 3.)

1893. Nikola Tesla lectured before the Institution of Electrical Engineers in London on "Experiments with Alternating Currents of High Potential and High Frequency," wherein he disclosed ways and means of generating the currents that were required for radio telegraphy.

1894. Professor Oliver Lodge transmitted and recorded signals across a distance of 60 yards.

1895. Professor A. S. Popoff, of Russia, used a coherer in series with an elevated aerial and ground, with a recorder in shunt with the coherer, for the purpose of studying natural electro-magnetic waves or "atmospherics." His coherer was fitted with an automatic tapper. Commenting upon his experiments (in December, 1895), he said: "I entertain the hope that when my apparatus is perfected. it will be applicable to the transmission of signals to a distance by means of rapid electric vibrations—when, in fact. a sufficiently powerful generator of these vibrations is discovered." (Fig. 4.)

1896. In June. Professor Ernest Rutherford, of Cambridge, succeeded in receiving signals over a distance of half a mile. In place of a coherer he used a magnetic detector of his own invention.

(*Continued on page* 2188)

Radio In 1935

By HUGO GERNSBACK

Member American Physical Society

THERE is today a science which may be termed the Science of Prediction. In former years one had to be a prophet to make predictions, whereas in these enlightened days it would appear that even the best historical prophets of antiquity were in reality but good scientists themselves. In other words, these worthy individuals had mastered the science of prediction themselves and by putting two and two together they often achieved remarkable results which, to the superstitious populace, seemed supernatural.

Any good astronomer today can predict with exactitude the solar and lunar eclipses for the year 1935 down to a small fraction of a minute. The mean average temperature for the United States can now be calculated six months ahead, due to recent studies of solar activity.

When it comes to predicting what radio will be in 1935, it is not necessary to make wild an improbable guesses, but by following certain laws and by building upon what has been accomplished for some years back, we can readily arrive at a result that will be fairly accurate.

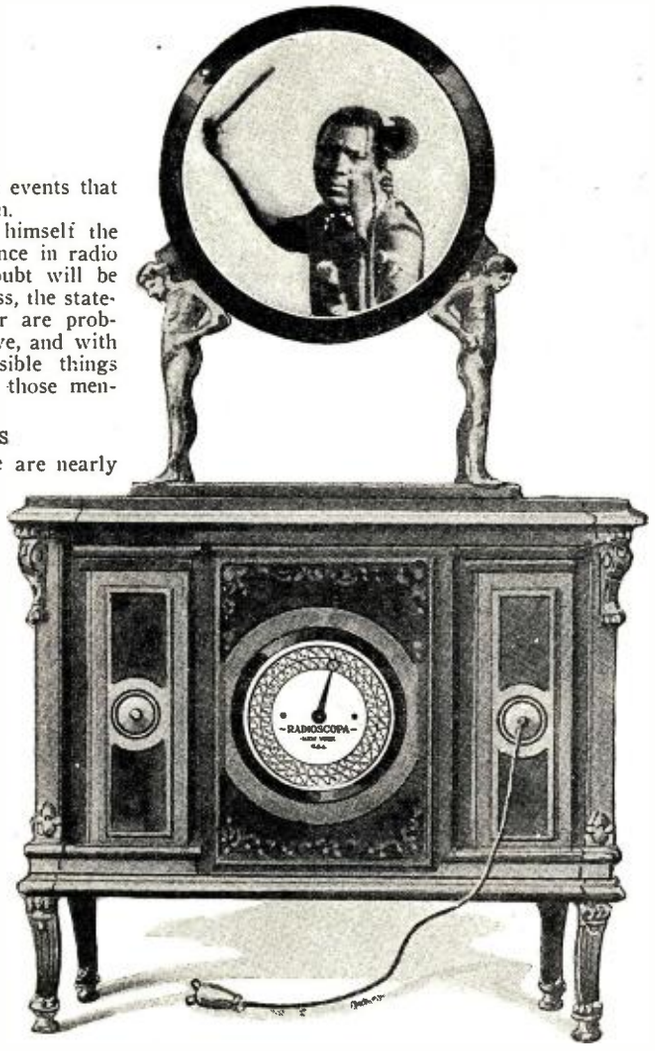
When the writer compiled his book on the radio telephone, in 1910, the first of its kind to be published anywhere, entitled, "The Wireless Telephone," he made certain statements therein, which he believed sound in view, of the then prevailing wireless art. The preface of this book is printed on this page. The writer was criticized quite a good deal, and called visionary and a dreamer by many at that time; the predictions, nevertheless, not only came true, but proved far too tame, and not visionary enough to compete with the events that actually took place later on.

So when the writer sets himself the task of predicting the advance in radio in the year 1935, he no doubt will be ridiculed again. Nevertheless, the statements that follow hereafter are probably entirely too conservative, and with 10 years, far more impossible things will have come about than those mentioned in this article.

MORE STATIONS

At the present time there are nearly 600 broadcast stations operating in this country, but we have only 150 channels in which to operate them. That means that some of the stations have to share time with others, to give them all a chance to get on the air, while some must be so far removed as not to interfere with the others.

This is a very unsatisfactory state of affairs, and the writer has pointed out a number of times before that the only solution is to reduce the wave-length for all broadcast stations. It is the writer's firm belief that in 1935 all broadcast stations will operate below 50 meters, possibly below 10 meters. At such low wave-lengths the frequency increases so rapidly that 10,000 stations can be separated 20 and more kilocycles without interfering with each other. The word "wave-length" will not be used in 1935. Rather, stations will all be known to operate under so many kilocycles, or perhaps, myriacycles (kilo meaning 1,000 — myria, 10,000). Operating at 25 meters or below, we could immediately accommodate, even today, thousands of extra broadcast stations, which would not interfere with each other in any way whatsoever. The reasons why it is not done at the present time are various.



Above is shown the tentative radio set of 1935. Here we have radio television combined with radio broadcast. Instead of using a number of dials as we do today, the user of the future radio set will have a small pear, as shown. Pressing one of the buttons revolves the pointer slowly until you get the station you desire. Releasing the pressure on the button puts the station on the loud speaker and a television apparatus begins to function at the same time. Pressing the other button will bring in foreign stations located on the inside circle, using the same pointer, the operation being identical in all cases. Separate loud speakers can, of course, be used in this set, or the screen itself upon which the televison picture shows may become the diaphram for the loud speaker.

LOSSES

Suppose one of our popular broadcast stations were to suddenly drop to 25 meters. No broadcast receiver made today could receive at such a low wave-length, because modern receivers are made to operate on a wave-length between 200 and 600 meters, or thereabouts. The writer makes the prediction that during the next few years the popular broadcast receivers will be those which will be able to tune down lower and lower. Already broadcast stations are beginning to go down in the wave band. Of course, this movement is gradual, as it should be. Such changes take time, which is a good thing, because if the changes were made overnight, all present broadcast receiving sets would be obsolete. By building better receivers to operate at lower and lower wave-lengths, each year will show an improvement over the past one, and soon we shall have nothing but low wave receivers.

At the same time the sensitivity of our sets will keep on increasing, as it has during the past 10 years. The greater amount of losses having been done away with, the efficiency having been increased, it stands to reason that the sensitivity of the set will be increased as well.

While the writer believes in the present cycle of super power, he does not believe that it will prevail in 1935, for the following simple reasons:

When Marconi first started sending across the Atlantic Ocean, it took 50 kilowatts or 67 horsepower to accomplish the feat. Most of this energy was wasted, and only a very small fraction arrived at the other side of

Preface

The present little volume is intended for the experimenter doing research work in wireless telephony and the student who wishes to keep abreast with the youngest branch of the wireless art.

The author realizes that the future use of the wireless telephone will be confined to the low power or battery system, as the present instruments, necessitating 220 and 550 volts for their successful operation, are not desirable nor practical enough for every day use.

The wireless telephone of the future must be as flexible as the wire telephone of to-day.

Every farmer will be able to operate his wireless telephone, when the sending and receiving instruments will be housed in a box a foot square, without depending on the lighting current for its operation.

The author predicts that in less than 10 years this stage will have been reached as it is bound to come sooner or later.

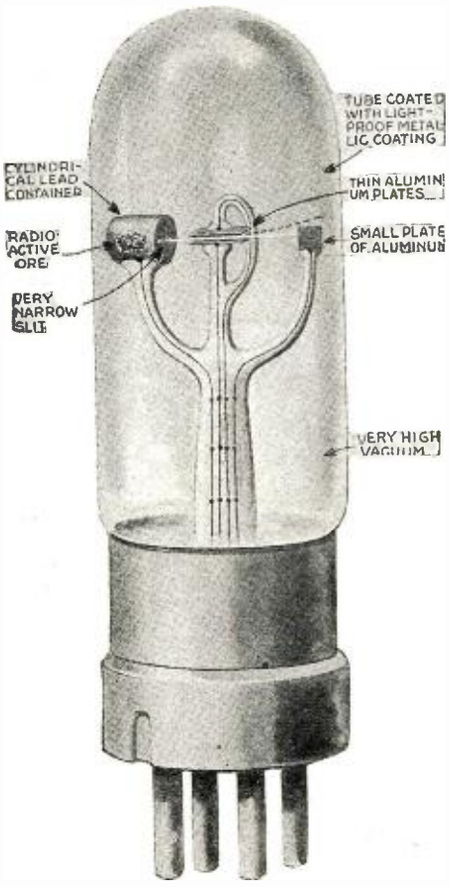
Quite a little new matter will be found in these pages and while some old matter has necessarily appeared for the sake of completeness of the book, the author trusts that the necessity of reviewing such matter will be apparent.

The author shall feel happy if this little volume will be the cause to advance the new art if ever so little, and he will be pleased to bear honest criticism and suggestions as to the contents of the book.

H. GERNSBACK.

New York.
February, 1910

A prediction made in 1910 by Mr. Gernsback in the original book, "The Wireless Telephone," which was the first of its kind published anywhere. The predictions shown in this book have already come true.



The theoretical cold vacuum tube of the future. Some experiments by a number of scientists have been made along these lines, and it is now thought possible that within the next ten years we shall have a tube that will not require an "A" battery at all, the electrons of the tube being supplied, not by a hot filament as at present, but by a radio-active substance, or perhaps in some other similar way to obtain the same result. No such tube has, of course, as yet been produced, the above illustration representing the artist's conception of the tube.

the ocean. Here we had wireless receiving instruments with fearful losses and the small amount of energy that came in was barely audible. On the other hand, the amateurs of today are sending messages across the ocean regularly with an energy of 10 watts, which is exactly two-hundredths of one per cent. of the energy that it took Marconi to do the same thing 24 years ago. In other words, with the energy inherent in a few small batteries that can be easily put into a small suitcase, and which can be readily carried about, it is now possible to transmit radio intelligence across the Atlantic ocean. Again, if conditions are right, and the transmission and reception are efficient, there is no need for super power. In 1935 a 10-watt station will be heard around the entire world. Under such conditions, with ultra-sensitive apparatus, the super power system would create havoc with receiving apparatus within a distance of a few miles, and for that reason it probably will not be used at that time.

TELEVISION

In 1935 we shall have radio television. It will be possible to see, as well as to hear, by radio. An explorer will take along with him a portable radio station and he will be able to give a lecture right on the spot in the jungle in darkest Africa or up in the unexplored regions—if such there be at that time—of the Amazon. He will explain everything he sees, and his projector will also be timed at every angle so that the listeners 10,000 or 12,000 miles away will be able to see at the same time. This television apparatus, by the way, is almost within our grasp now, thanks to the wonderful work done by C. Francis Jenkins, of Washington, D. C., and Edouard Belin, of Paris, France. The actual transmission over short distances has already been accomplished, and it remains only to put on the finishing touches.

TUBES

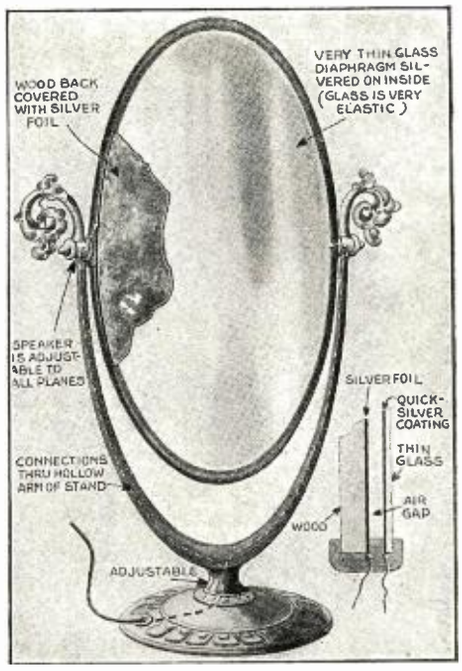
What tubes shall we use in 1935? The development of the vacuum tube since 1906 has been slow but steady. Since DeForest invented the Audion, much improvement has been made. We are still using the same tube with a number of refinements. At the present time all tubes are run by batteries, or, if operated from the 110-volt house-lighting current, an intermediate circuit is used to step down the current to the right voltage. Within the next few years we shall have a 110-volt tube, which will operate directly from the electric lighting mains, without any resistances whatever. This will be a great step forward, but to the writer's mind this is not the final solution. Engineers are working towards a further goal, and that is a cold electronic tube; in other words, namely, no more heated filaments and no more "A" batteries. It is already possible to make an electrolytic "tube" such as was invented in Germany recently, where a colloidal liquid was used, and there is, of course, no heat in this. The electronic action is between plates and grids.

A "cold" tube will probably be used by 1935, this tube containing certain gases which may become luminous under the action of the current. These tubes will probably be used on either batteries or 110-volt current, but there will be no heating current, and such tubes, therefore, will be most economical. Even if five or six such tubes should be used, the consumption of current would be so small that it would not even be registered on the house current meter.

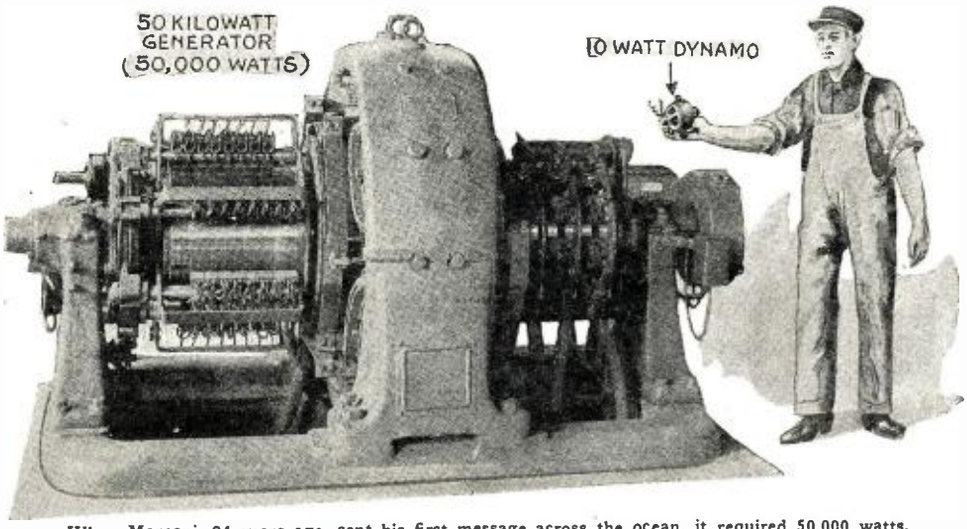
CONTROLS

The control of the radio receiving outfit of 1935 will be simplicity itself. We are getting away from too many controls, knobs and other handles, which long before 1935 will be obsolete. It was the writer, by the way, who, in an editorial in the February, 1923, issue of RADIO NEWS, was the first to advocate single control sets. It will have been noted that a few of these made themselves noticeable late in 1924, while 1925 will surely witness the advent of a great many single control sets, which seem to gain greater and greater favor with the public. The outfit shown on our cover illustration, as will be noted, has a single control, with a remote control added. At the present time it is necessary to jump up whenever you wish to tune in another station or whenever an adjustment has to be made. This ties down the listener to the set, which is not always desirable. The writer shows the remedy for this by having a pear-shaped control, as shown. The lady on the cover, by pressing a button, closes a circuit which automatically rotates the tuning controls very slowly or swiftly, depending upon the amount of pressure on the button. When the station desired is reached, the pointer on the dial revolves very slowly in the manner of a vernier until the station comes in loud and clear, at which the control is stopped. American stations will be found at the outer circumference, while foreign and trans-Atlantic stations are just below, in the red inner circle. By touching the second button on the pear-shaped control, the operator can, at will, bring in either foreign stations, or the stations of her own country. It goes without saying that the single control operates both the sounds from the station to be received and the television elements, both working in unison and automatically.

(*Continued on page* 2186)

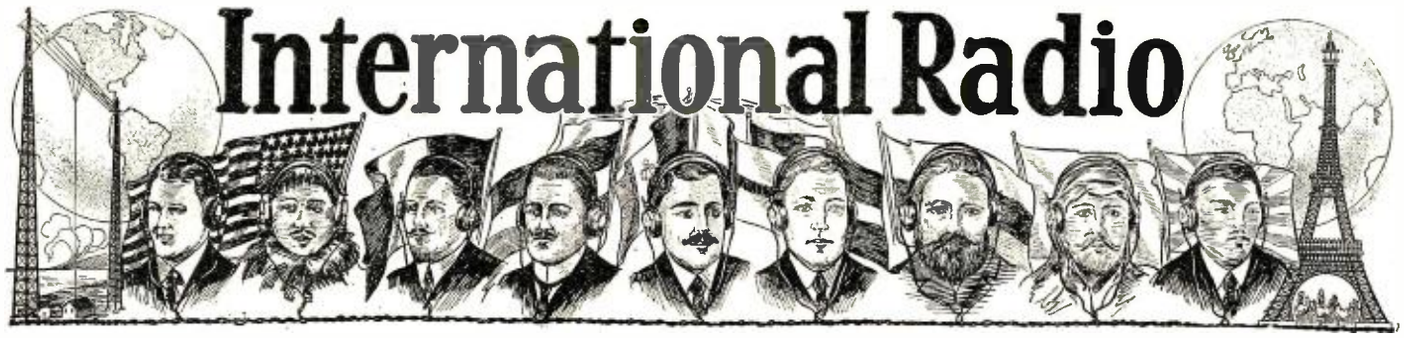


It has always been Mr. Gernsback's contention that the present loud speaker with a small diaphragm, operated on the telephone principle, is all wrong. Pictured above is theory of an electrostatic loud speaker whereby a large surface is made to vibrate on the electrostatic principle. Mr. Gernsback has himself been working on a speaker of this kind for some time and has obtained fair results. The loud speaker of 1935, in our opinion, will have a large vibrating surface instead of the small 2½ to 3 inch surface in use today.



When Marconi, 24 years ago, sent his first message across the ocean, it required 50,000 watts. The radio amateur today accomplishes the same results in a much better way by using 10 watts only; in other words, the merest fraction of the power necessary to accomplish the same thing 24 years ago. The chances are that in 1935 no broadcast station will require more than 10 watts in order to supply entertainment to listeners within a radius of several hundred miles.

International Radio



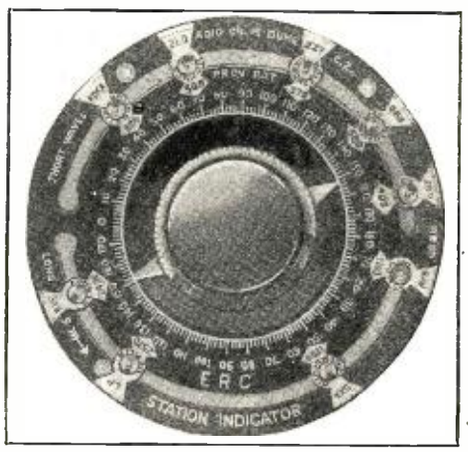
ENGLAND

A Novel Program

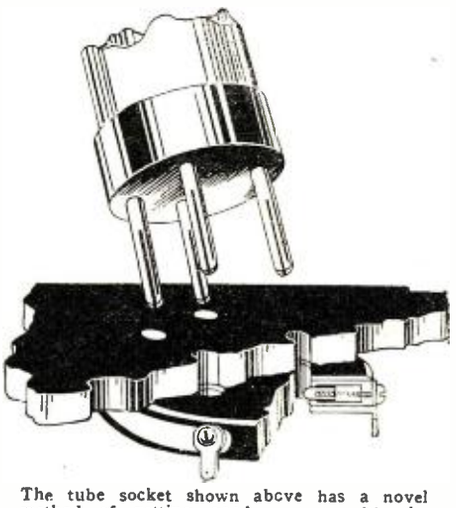
The Nottingham broadcast station recently broadcast a lecture on economics and the students who had anything to say on the subject called the station by telephone. These calls were directly connected to the amplifiers and the students in this way broadcast their criticisms of the lecture.

A Good Loud Speaker

A certain loud speaker is doing good work in Glasgow after having been through fire and water. It was on a ship when the boilers blew up. For several months it lay in sixteen fathoms of water, but was eventually recovered by a diver, and is now the equal of new after a thorough cleaning.



An English combination dial and station log is illustrated in the accompanying sketch. The station markers are slid along the slots until their arrow points to the dial setting of the station. There is a slot above and below the center of the dial so that in case stations have insufficient room for logging, because of the closeness of the wave-lengths, the indicators may be placed at the proper points.



The tube socket shown above has a novel method of getting good contact with the prongs of the tube. The small plungers that project into the prong holes are cut at such an angle that they are pushed back against the contacts when the tube is placed in the socket. When the tube is removed, the plungers return to their original positions, as there is a spring between the prong hole and the contact.

2LO Has New Home

The well known station 2LO of the British Broadcasting Co. has been moved from Marconi House to Oxford Street. The new antenna masts are 125 feet high and are 250 feet apart. However, only 70 feet of the span between the masts will be occupied by the actual antenna in order to get down to the wave-length of 365 meters. The antenna consists of two "sausages" spaced by 15-foot spreaders, each "sausage" having five wires on 3½-foot hoops. The ground connection is made directly to the framework of the building.

Radio to the Rescue

Recently Admiral Sturdee of the British Navy was to have delivered an opening address at a bazaar in Birmingham. At the last moment word was received that the Admiral could not be present, so a message was sent to the British Broadcasting Co. asking for an address by radio. The B. B. C. promptly took up the matter and persuaded Viscount Curzon to speak instead of the Admiral. The Viscount spoke from 2LO in London and his speech was reproduced by a loud speaker to the audience in the Birmingham Town Hall.

The Theatre Question

American theatrical producers are not the only ones who are worried about the broadcasting of their shows. British showmen have tried sending their shows over the air and the public liked the idea. However, as in this country, there are calamity hunters who say that radio will ruin the theatre business, totally neglecting the fact that the box office receipts took a decided jump immediately after the show had been broadcast.

JAPAN

Japan Goes On the Air

On March 1 the first Japanese broadcaster went on the air at Tokyo. This station is owned by a local broadcasting association and will carry the usual type of broadcast program. Another station is proposed at Osaka. Both of these stations are reported to be equipped for 750 watts power.

FRANCE

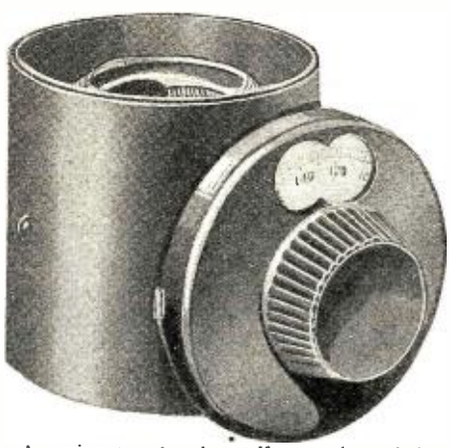
Work Started on Radio Vocabulary

At a recent meeting of L'Association de la Presse Radioelectrique in France, it was unanimously decided that the French a standard radio vocabulary, and that a committee representative of all branches of French radio should be formed.

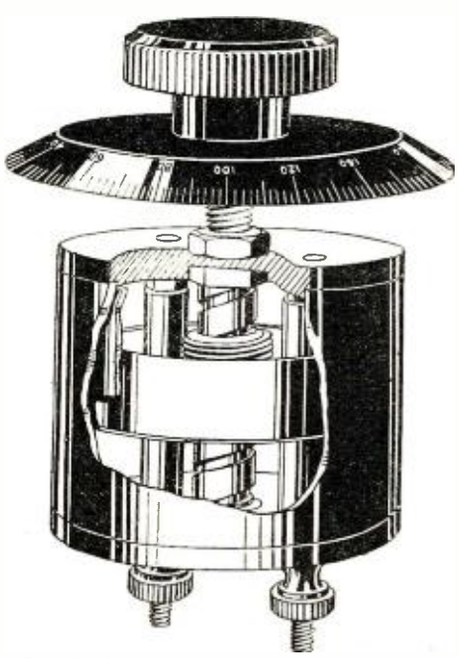
CZECHO-SLOVAKIA

A Severe Penalty

The amazing news reaches us that a radio fan in Czecho-Slovakia was sent to prison for six weeks because he built a radio set and occasionally sold parts without a license.



A variometer that has self-supporting windings which are protected by a bakelite tube recently appeared on the English market. There is need for but one hole in the panel for mounting this instrument. The scale on the dial is behind the small window and the reading is indicated by the point in the frame.

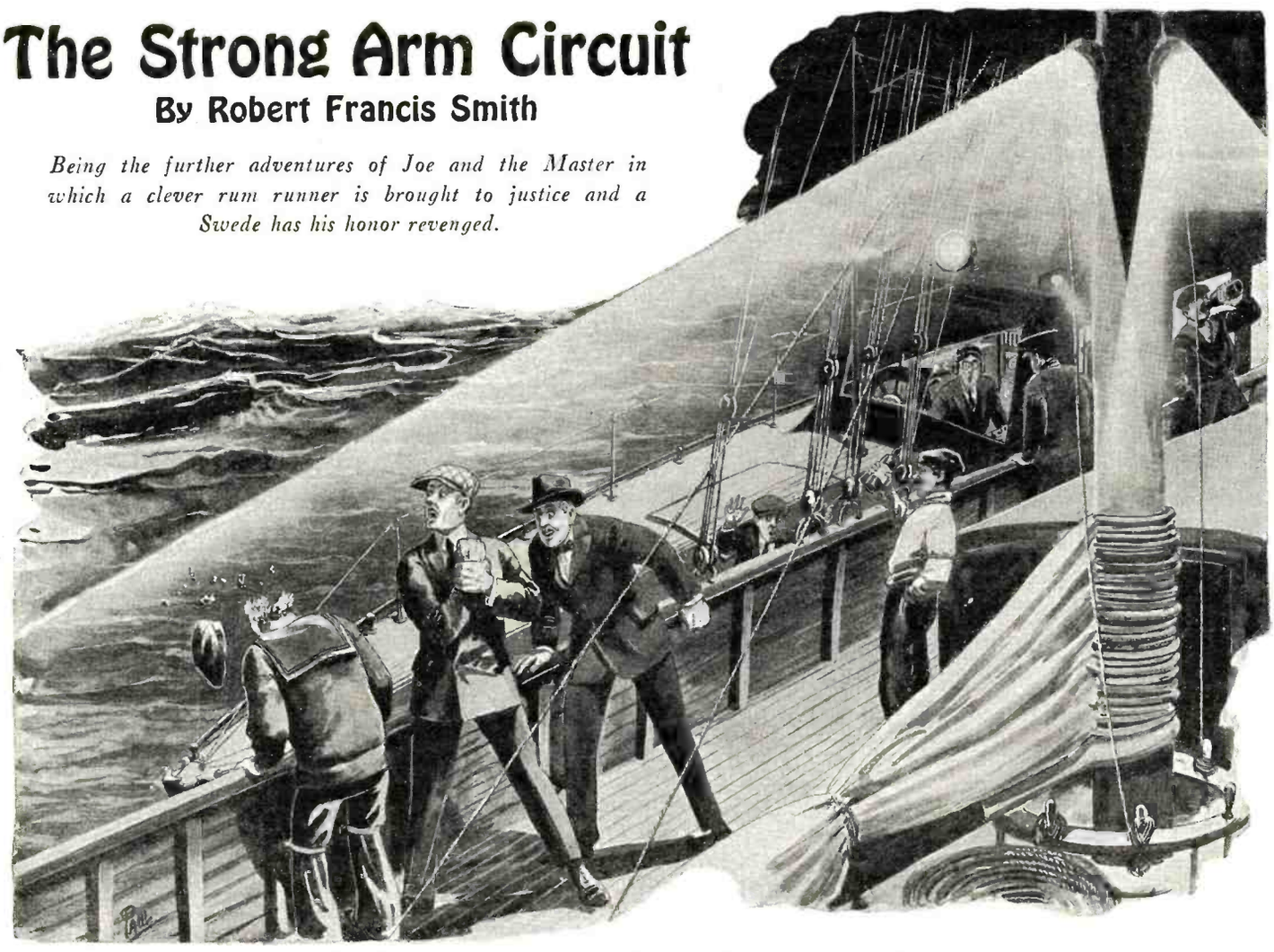


The plateless square-law condenser consists of two telescoping electrodes separated by a dielectric. The knob revolves twice during the entire travel of the movable electrode. As can be seen in the sketch, there is a fine thread on the screw that controls the moving electrode, so there is a vernier adjustment possible.

The Strong Arm Circuit

By Robert Francis Smith

Being the further adventures of Joe and the Master in which a clever rum runner is brought to justice and a Swede has his honor revenged.



The plot was out when the sailor proved to be nothing more than a wax dummy.

IN the spring a young ham's fancy lightly turns the dials to see what San Francisco's peddling. And I got 'em, too, with a crystal set, on an express train, with a hat rack for an aerial and a car truck for a ground, on a foggy night just offa Lake Erie. Have a grin with that one!

"Joe, dear," says my lost two dollars, "will you please tune in onto some jazz program? I read KDKA's got a nice one on."

"Nice what?" I replies. "A bun?"

"Try to be normal, honey," cautions the until-breath-do-us-part. "This gang needs a little shaking up."

The gang in question being a Pullman load of vaudeville actors, New York-ward bound and happy therefor, although half of 'em ain't got a split week between them and the bread line. Me and Doris, being headliners in our own dance revue—it's paid us enough money this season to make us afraid to try another next year—have six weeks of metropolitan time ahead of us and then a drowsy summer down in our seaside home at Brightmere-on-the-Deep. Naturally, we're envied, in particular by Willie.

Willie is a Norwegian gentleman who does calisthenics on top of a thirty-foot pole held by his brother Oscar. He's been with us over most of the circuit. Really, the boy's been kinda handy now and then, when aerials gets to be the question. Why, one time, back in Portland, Willie hooked one end of my aerial to the courthouse flagpole and the other end to the top of an office building and I distinctly heard every arc lamp in town. Yes, we're radio fans, and proud of it, too.

"What you bane do all summer?" inquires Willie, genial. "Fish, I bet?"

"You lose," I replies. "The little woman retails gossip and I helps The Master build radios."

"The Master?" puts in a comedian. "Sounds like an ad for a phonograph."

"The Master ain't no ad for anything except himself," I states. "He's a scientific nut, which same is different from an ordinary nut due to there being a reason for a scientific nut. Get me?"

"Ay know!" exclaims Willie, triumphant. "He bane that guy who fix my wrist watch in Los Angeles."

"Clever boy," I grins. "He read half way through Wells' Outline of History before he decided there weren't any snappy stories in it."

I should bother you with all this; to cover time rapidly, it's now a week later and we're playing a New York theatre. All's fine, and the sky's clear. That is, it's clear until The Master bursts into our dressing room.

"Joe, I need your help," he says.

"Bravo!" applauds Doris. "You're useful at last!"

I ignores the insult. "Well, what is it this time, Jerry?" I asks.

Jerry's full billing is Gerard Lawson, the somewhat belittling term we uses coming from his butlers, of which he has six, other things in proportion. He's young, has a well-groomed appearance, a wrinkled brow and a never-failing check book. Also, he is minus a sense of humor. Sometimes this is a God-send; other times, I could tell you—but never mind.

Jerry plumps himself down onto a chair and leans over.

"Folks," he says, low, "can I trust you?"

"You can trust me," says Doris. "As for Joe, use your own discretion."

"Well—look here!"

He pulls back his coat, disclosing on his vest—a star!

"My Gawd!" yelps Doris. "The boy's a dick!"

"Ssh!" warns Jerry. "Not so loud!"

I grins. "Your secret is safe," I assures him. "Now, tell us just what brought this on?"

Jerry draws his chair up close to mine and motions for Doris to listen in. Then he speaks.

"It's like this: I'm a revenue agent."

I pulls a mock faint. "To think a friend of mine'd play a dirty trick like that on me," I wails. "And just when I'm trying to smuggle in a coupla quarts from Montreal."

"Oh, be your age," snaps Doris. "Maybe Jerry can get you wholesale rates. Speak up, let's have the worst."

"Well, it's this way. I enlisted in the force, not to pursue the ordinary rum runners, but to concentrate my activities upon one certain set of bootleggers who have been successfully evading the law by what seems to be a most ingenious scheme."

"So far so nice," I says. "Go on."

"This particular gang have a ship of their own, perhaps a two hundred footer, with which they slip back and forth from somewheres beyond the twelve mile limit. Now, here's the peculiar part: this ship cannot, or at least, has never been traced. It simply vanishes, once it has left land. And it only comes in when circumstances are most propitious; when the night is moonless, or the weather bad, or the dry agents are out of town, or any chain of events makes the landing of a load of liquor easy. Of course, it is obvious that persons on land are communicating with those aboard ship, the question being, how?"

"That's easy," I says. "Radio."

"Oh, no, it's not," contradicts Jerry. "Be-

(*Continued on page* 2156)

The Inventions of Reginald A. Fessenden

PART V

FOUR brothers can have a lot of fun together. With suitable conventions almost any game can be played, even cricket and baseball. Houses then stood in grounds shielded from public view by hedges and trees, not real estate shrubbery, but honest to goodness trees, russet apple, snow apple, plum, cherry, perhaps an elm for climbing. All summer long the family took the evening meal out of doors. One might watch the others playing croquet, or later tennis, until, their match finished, he took his place, or one might sprawl on the grass and read. To us children, no matter how small it was, this was a place where one could be private, to which one could invite other youngsters, where one could perhaps build a small hut in a corner or make one's individual garden. Long after, sitting under a tree in the Darwin place in Cambridge, I was reminded suddenly of old times and wondered what children do nowadays with no choice except between indoors and the street or some public playground; and how it was that in our own country the real estate agents have been able to impress their peculiarly barren and ostentatious ideas of landscape gardening on the people who actually own the houses.

Outdoors was also our schoolroom in summer, first my mother, and later our governess Miss Ardagh, being our teacher, but the last year at Fergus I went to the public school.

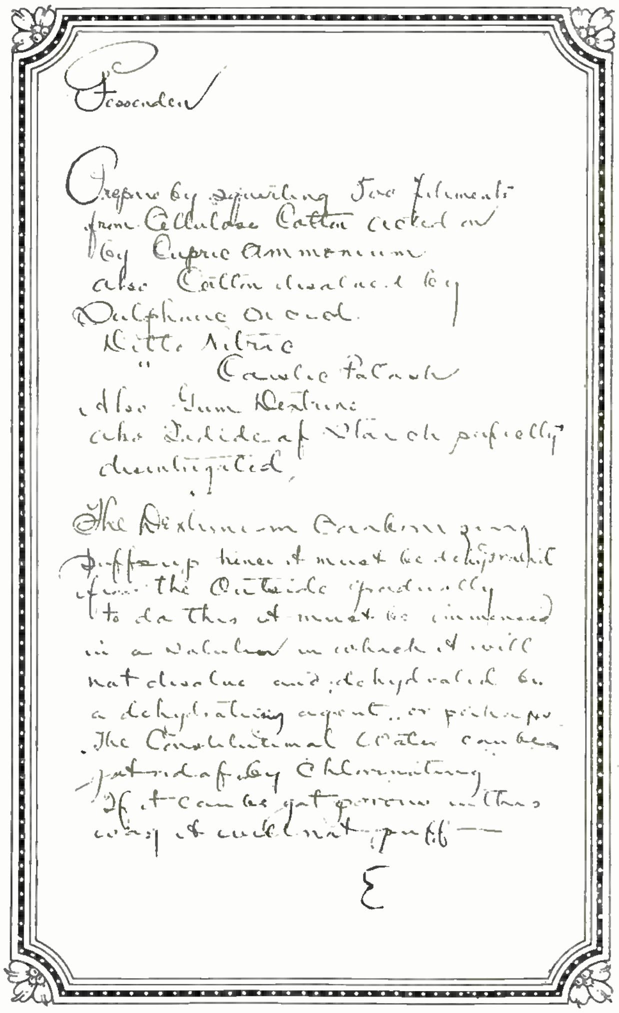
DE VEAUX MILITARY SCHOOL

Then we moved to Suspension Bridge, Ontario, and there was a scholarship vacant in DeVeaux Military School, on the other side of the Niagara River, in Suspension Bridge, U. S. Though hardly old enough, nine years, and though unable to go as a boarder as that would cost too much, the opportunity was too good to lose. The walk was rather long and the work started early so I got my own breakfast. In the fall and spring terms the sun would just be coming up as I got to a place called Mount Eagle, and it was a lovely sight and a lovely walk from then on, for the school was in extensive and wooded grounds just at the Whirlpool Rapids. But in winter it was different. Those bitter struggles across the old Suspension Bridge, forcing my way into and across the heavy winds blowing down the Niagara gorge, and holding every now and then with both hands to the railing of the footway. But it was always a good fight and I enjoyed it. Only once the experience was not so pleasant. My clock had gone wrong and I started off at one in the morning, reached the school about two, could not waken anyone and had to roost in the gymnasium until five. And it was one of those below zero nights.

It was then not so very long after the close of the Civil War, the military discipline was very strict and our inspectors were in the regular service and martinets. So there was nothing slovenly about our drill and the smartness permeated to the classrooms. But we were worked too continuously; there were no intermissions; it was always a rush at the end of a class to fall in on the drill ground or to get to another class. I never played for one minute at that school, coming as I did, and leaving immediately after classes or at noon on Saturdays.

TRINITY COLLEGE SCHOOL, PORT HOPE

The following year, 1877, I went to Trinity College School, Port Hope, Ontario, and remained there until the summer of 1879. My brothers Kenneth, Trenholme and Victor followed later. This school was modeled after the English public schools and most of the masters were public school and university men. Of the boys of about this time perhaps the best known are Dr. Osler, later of Johns Hopkins and of Oxford; and Bishop Brent, whom I remember as an especially fine classical scholar.


Fessenden/

Prepare by squirting fine filaments from Cellulose Cotton acted on by Cupric ammonium also Cotton dissolved by Sulphuric acid. Ditto Nitric " Caustic Potash Also Gum Dextrine also Iodide of Starch perfectly disintegrated.

The Dextrine on Carbonizing giving difficulty hence it must be dehydrated from the outside gradually to do this it must be immersed in a solution in which it will not dissolve and dehydrated by a dehydrating agent.. or perhaps the Constitutional water can be got rid of by Chlorinating. If it can be got porous in this way it could not puff—

E

A facsimile of Edison's laboratory instructions to Professor Fessenden who, when a young man, was his assistant. The writing is remarkable because Edison writes longhand almost as rapidly as a typewriter can typewrite.

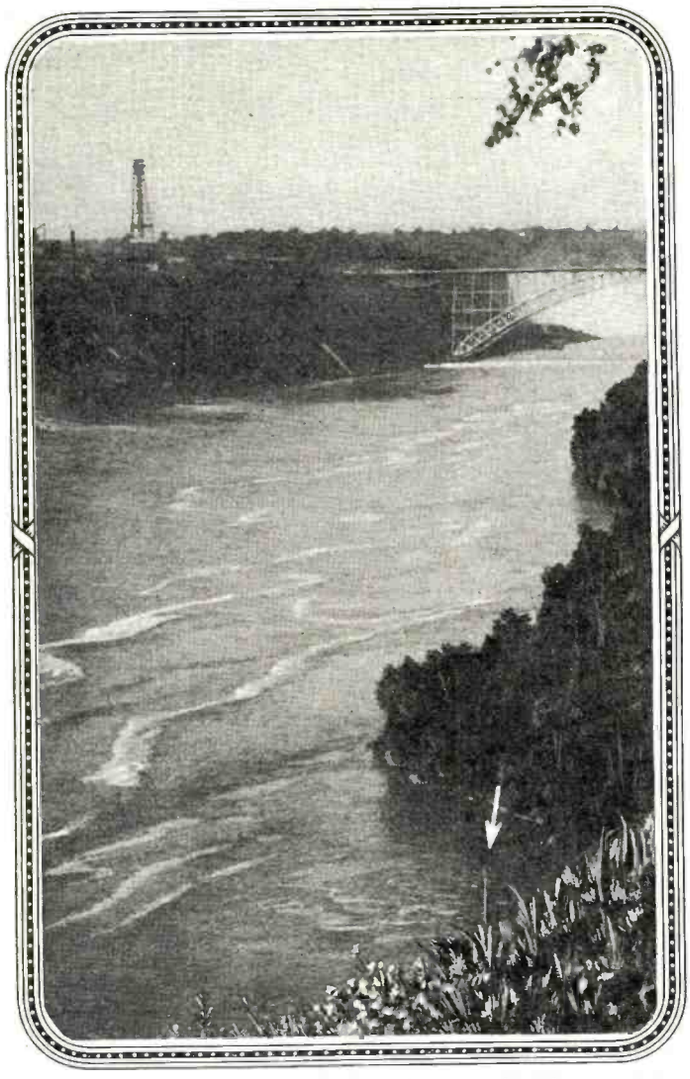
Here a good deal more time was given to sports, mainly cricket and rugby football. Some lawn tennis came in later but faded out. Girls had been seen playing it. The lake was near and gave good swimming, bitterly cold in spring. The long strips of flooded marsh land along the shore were splendid for skating and when well warmed up by this we would often strip and go in the lake, having a time getting back out of the water on to the ice mounds formed by the spray which made the winter shore, and crawling, vermillion hued and in anguish, over the corrugated surface till we reached the smooth surface and raced away for our clothes.

A long hill, starting in front of the school, was for sled and toboggan. In a misguided moment, when the slush had frozen hard, I thought I would go down it a little way, on skates, and then stop. Two years' experience on the gymnasium trapezes got me down to the bottom, erect.

There were long tramps, over the country to the brook for swimming, mainly, though some collected eggs or butterflies. Weekly hare-and-hounds was good for the lungs and legs.

There was little inducement to stay indoors at any time of the year. There were no private studies, and the bedrooms were substantially unheated so that in winter the first thing one did on getting up was to break the ice in one's pitcher with the handle of the hair brush to get the water out. So the only place to read was in one of the "form rooms," furnished with bare oak benches and long oak tables. No doubt things are quite different now, but the old system seems to have had some advantages.

A photograph of the campus of Trinity College School, Port Hope, Ontario, Canada, where Professor Fessenden spent his earlier student years. The school was conducted according to the old English traditional discipline in scholarship and athletics.



The arrow marks the old swimming hole of a group of sturdy youngsters with whom the boy Fessenden spent his school days. The place is between the Niagara Falls and the Whirlpool Rapids and the swimmers had to cope with strong eddy currents.

I cannot remember any boy trying to recite with a sore throat or a cold in the head.

The secular studies were substantially confined to classics and mathematics, taught in the old-fashioned way, which in my experience is exactly the wrong way. Why should it take six years to teach a boy Greek or Latin so that he can read it with difficulty and cannot speak it at all, when a ten-year-old boy learns to speak French fluently in a year? Would it not be better to teach the boys to speak Greek and Latin fairly well the first year, and then apply one or two years more to teaching them the grammatical rules, etc? They would learn so much faster and be so much more interested.

EDISON'S SYSTEM OF WRITING

Our impositions were the writing of so many hundreds of lines, generally from Virgil. We used to hate them, of course, but they had one good effect—they formed the handwriting. In any art or game the best form is always the easiest form. Perhaps the best way to learn a new game is to go out and tire oneself at it till one can hardly move the racquet or club or whatever it is. Then keep on playing, and you may be pretty sure your muscles will unconsciously take the motions which give the best form.

Edison was one of the two men I have met who could write well and plainly almost as fast as a typewriter could typewrite, or a man talking easily. He learned the art as a telegraph operator, taking down high speed messages. Some way or other he has developed a surprisingly rapid and clear system. I give here a few words of laboratory instructions, such as he used to hand me in the morning when I first went with him, and before I had learned his methods and could carry out his work along the lines he wished without his having to tell me everything. There is no question but that his system should be adopted for all the public schools. It is so clear and he writes it so marvelously fast. Some of the educational authorities should persuade him to permit slow motion pictures to be taken, showing him writing, so the method could be studied.

The other man was Mortaza Khan, the Persian minister in Washington about 1904. He explained that he always, in his audiences with the Shah, held a tablet and reed pen in his hands and took down every word that was said to him. But Persian is a much easier language to write than English.

HOLIDAYS ON NIAGARA RIVER

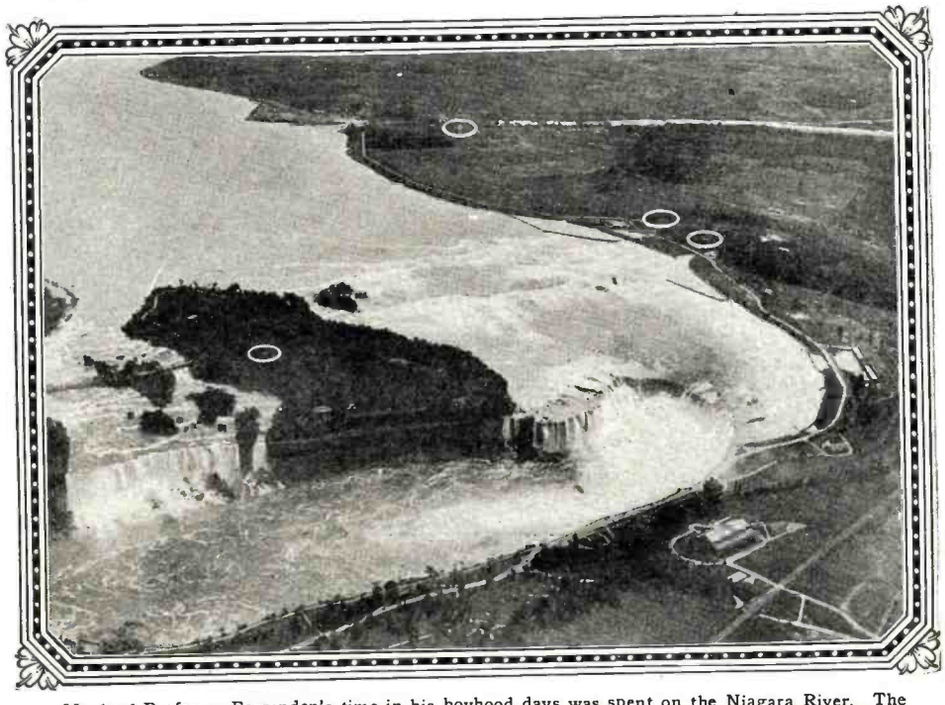
Holidays at Suspension Bridge were times for scrambling about the cliffs of the gorge between the Falls and the Whirlpool, or at the Whirlpool. There was an old mill race, abandoned, just above the Whirlpool Rapids, where we went in swimming; perfectly safe, but a very swift current, so we were all strong swimmers. The edge of the Whirlpool was not so safe and several of the boys were drowned; one, Preston, son of our next door neighbor. So we left that and went up river, towards the Falls. There, too, we could fish for eels, and a cave where real smugglers and criminals hid when trying to get across the border. No one got drowned here, but there were every now and then strong eddies which had twisted their way along from above, and which would suck one down. Some of the older boys had learned a trick which they showed us. If, when an eddy caught you, you kept swimming a breast stroke, it would suck you down. But if you turned over on your back and floated, it would whirl you round a few times and then throw you out at its edge. Some, occasionally used to go still further up the river and swim all the way across, starting a little above the new Suspension Bridge on the U. S. side and landing about half way between the Falls and the Whirlpool Rapids on the Canadian side.

CAPTAIN WEBB'S DEATH

A number of people went through the Whirlpool Rapids in barrels, but I think no one swam it. Captain Webb tried it. Crowds watched him from the bridge and the cliffs. He had men row him into the middle of the river to make sure that he got into the central current. The boat barely got back. It was terrible to see him sucked faster and faster toward the rapids. Once in the rapids the great jets of spray hid him most of the time. Then he was seen on top of a great surge opposite a jutting out ledge of rocks, but not again.

CHIPPEWA

Then we moved to Chippewa where there was a delightful old rectory with a splendid garden, all kinds of fruits and vegetables and a good horse which we uesd to ride all over the neighborhood bare back. There were ever so many rooms in it and during the many years we lived there my father and mother kept a rather delightful fashion of open house. People would drop in and stay for days or even weeks. One couple drove up to spend the night and remained for more than a year. The expense was practically nothing. The rooms were there. The cow gave plenty of milk and enough over for butter. We raised our own corn for the cow. There were no servants. When din-



Much of Professor Fessenden's time in his boyhood days was spent on the Niagara River. The circle in the background marks his father's rectory at Chippewa, Ontario, while the circles in front mark the islands over which Professor Fessenden used to roam during holidays.

Professor Fessenden's graduating class at Bishops College, Lenoxville, Quebec. Here Professor Fessenden while still quite young taught mathematics, Greek and French to classes some of whose members were older than himself. Professor Fessenden is the second from the right in the row at the back, standing.

ner time came my mother would say to one of the visitors, "Katie, you pick this bowl full of strawberries. You will find them down at the right-hand end of the garden. And Mrs. Gordon, the peas and the asparagus are just right now. Professor, I am going to make a big omelette, and we will need about a dozen eggs. The hens lay mostly in the stalls." And so, everybody helping, the dinner would assemble itself. The only expense was the meat, and good steak could be bought for ten cents a pound.

There were always people in the house, and I cannot remember an unpleasant visit. For one thing, unpleasant people would not have wished to come, or if they had, would not have been asked. And many of the visitors were very interesting. Martin Tupper, Dean Stanley, the Duff-Gordons, are some I remember. I am glad in one way, but sorry in another, that I could not think much of Tupper's poetry. He asked me, then about eleven, which poem of his I liked best. After some silent consideration I picked out the one which seemed to me least objectionable. It happened to be one of which he was especially proud so he presented me with a set of his works. It is not generally known that when at Oxford he beat Gladstone in Divinity.

The Rectory was about a quarter of a mile from the Niagara River, about two miles above the Falls and little current, so the swimming was pleasant and safe. Every morning during the summer months a procession started from the glebe, one boy on the horse, one leading the cow, three very tame ducks, the other two boys, my father, and the men visiting us. The ducks had a game of their own. After they had finished their breakfast from what they got in the shallows, they swam up to us and bit us in play, often to hurt, and were very indignant when held head under too long. Then we dressed and came back, but the ducks did not come waddling back till noon. It was further up the river, above the Chippewa, that I had to bring in a boy who had been carried out by a rather fast current which came from behind a point. It was not so interesting as anticipated. He did what he was told and was prosaically towed to safety in ample time and without any risk on my part. But another time, years after, in Pamlico Sound, it happened to be a very excitable individual who was being carried out and who kept wasting his breath in shouting for help. So that time I picked up a big piece of wood which was on the shore and pushed it ahead of me and kept him at the other end of it. This method is recommended as being not only safe, but comfortable, as one does not have to hurry so getting back.

DRUMMONDVILLE HIGH SCHOOL AND THE IMPERIAL BANK

Then, after an illness and an operation on my eyes, I was supposed to attend the high school at Drummondville. But except in winter I played hookey entirely, in the Clark Hill and other islands about the Falls, and in the woods. With a couple of good stories, Marryat or Cooper or Melville White, to read, a little fire a few inches square, of twigs, to cook my lunch, I would lie along the grass next the edge of the running water. Or I would tramp around or fish.

Then as they would not admit to college until 16, came a year in the Imperial Bank at Woodstock, where owing to illness of officials, rapid extension of the bank in a growing town, and mainly the kindness of the president, I filled some months in every position in the bank except cashier. It looked as if I would remain with the bank, but I learned just in time that there was a fixed policy as to age at promotion to the positions which really counted. Then came a couple of terms' work at Trinity School to prepare for the honor examinations and the examinations themselves where I came out only second or third.

BISHOPS COLLEGE SCHOOL AND BISHOPS COLLEGE

During the summer holidays after the examinations came an offer from Bishops College and Bishops College School, of a mathematical mastership in the school with the privilege of being credited with the year's college work without attendance, provided I passed the college examinations in the subjects. This was too good a chance to lose, especially as my father had to look after the education of my brothers.

The college is at Lennoxville, Province of Quebec, on the river St. Francis, and was where my father took his divinity degree. School and college buildings were around the one quadrangle or near it. The school was very much like Trinity College School, but not so large or with quite such a tradition. Though I was called senior mathematical master in the school catalog, the work was quite easy. Later on I even added one of the junior classes in Greek and one in elementary French. But at that I never had more than two or at most three hours per day. Of course, the other masters were much harder worked; possibly it was felt not wise to put much responsibility on a master who was younger than some of his pupils.

But the college was a delight. And it was there that I made my first invention.

Lessons in Esperanto

(Prepared especially for RADIO NEWS *by James Denson Sayers, Esperanto writer and Editor, President of New York Esperanto Harmonio Club.)*

LESSON 7

USING THE ESPERANTO AFFIXES

I HAVE received a large number of requests since these lessons began in RADIO NEWS, asking that information be given here about addresses of Esperanto publications, book publishers, how to place ads for correspondents in other countries, etc. It is obvious that I can't turn this into an advertisement column, but as it is of great importance to the students of these lessons that they have this information, I will gladly furnish such to all who send me a self-addressed envelope to Box 223, City Hall Station, New York City.

It is not necessary to extensively illustrate the manner of using all the Esperanto affixes, but for some of them it is.

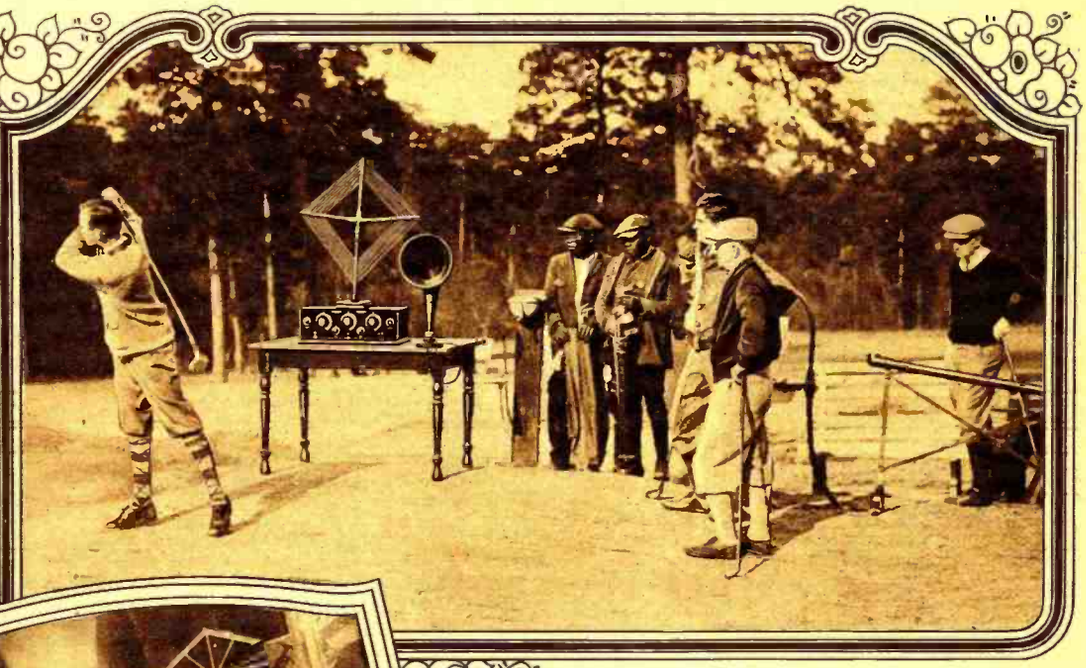
-Aĉ-, a suffix. An indication of contempt. Indicates that the thing, animal or person to which it is attached is in some way of poor, or slovenly character. **Viro**, man; **viraĉo**, a bum, a slothful, idling fellow. **La viraĉo rajdis ĉevalaĉon kaj portis sur lia kapo ĉapelaĉon.** The bum rode an old stack-of-bones nag and wore a shabby hat on his head.

-Ad-. This suffix indicates that an action is being continued or is habitual. It marks an action that is of some duration, not just for a moment. Thus: **La ridado estis laŭta kaj senĉesa dum la vespero.** The laughing was loud and unceasing during the evening. **Dancado**, dancing; **desegnado**, designing; **kantado**, singing; **skulptado** (the art of) sculpture; **skribado**, writing. These words do not signify momentary acts, but habitual actions; in fact, they are arts or practices, as the art of painting, singing, etc. **Kanto**, a song. **Ŝia kanto plaĉas al mi**, Her song pleases me. **Ŝia kantado carmas min**, Her singing charms me. **Movi**, to move; **movado**, a movement; **La Esperanto movado.**

-Aĵ- denotes that the idea contained in the root word it is used with has a certain quality, or is something made up of

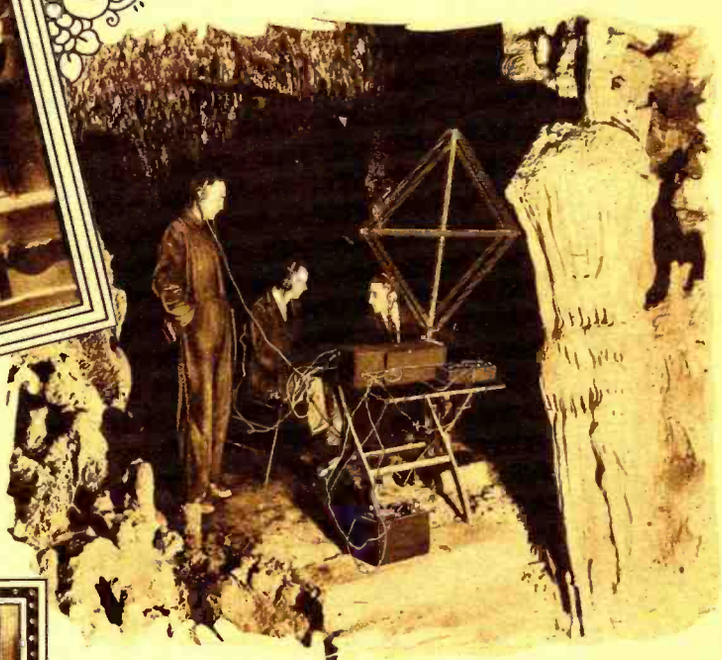
(*Continued on page* 2146)

Latest Radio Developments



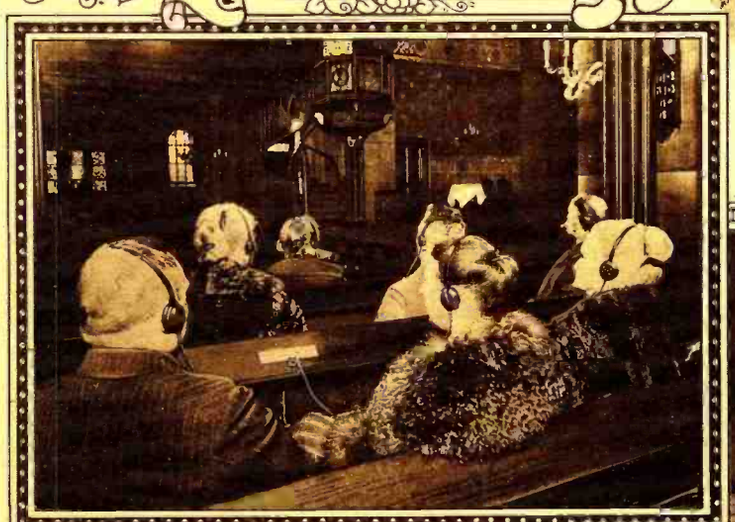
HOW TO KEEP BOGEY FIGHTERS PATIENT AT THE FIRST TEE. At the Augusta Country Club in Georgia, instead of the usual scowls, mutterings and cusswords, there are smiles from the golfers awaiting their turns to drive off. It is even reported that some of the players pass up their turns to listen to the radio. © Underwood & Underwood.

BROADCAST REVUE TO SYNCHRONIZE WITH MOVIES. Below: scenes from Charlot's Revue being filmed. An experiment has been tried showing the film at a moving picture theatre at the same time that Station 2LO in London broadcast the music that was sung when the film was taken. Loud speakers in the theatre supplied the music picked up from 2LO. © P. & A. Photos.



RADIO RECEPTION PERFECT IN ENDLESS CAVERNS. Right: in the famous caverns at Newmarket, Va., Benjamin King, a radio engineer of Washington, D. C., picked up with his four-tube receiver many eastern stations. © International News Reel.

NIGHT WATCHMAN HEARS ELECTION RETURNS. In Aberdeen, Scotland, this man had to stay up all night, anyway, so he beat the newspapers to it by getting the latest returns. © Underwood & Underwood.



LOUDSPEAKER EARPHONE CHURCH IN GERMANY. Above. For persons who are ordinarily too deaf to hear church services, a microphone in the chancel and another in the pulpit pick up the minister's voice, which is then amplified and connected to earphones in the pews. © P. & A. Photos.

The Radio Inauguration

Radio again changes history. For the first time the inauguration ceremony could be heard by all.

FOR the first time in history, the entire nation was able to enjoy the inauguration of a President of the United States. Through the instrumentality of radio, the audience, instead of being composed of a few thousand, as in the time of George Washington and Abraham Lincoln, reached nearly 30 million in number. It was estimated that more than two million people listened to the ceremonies in Greater New York alone.

Twenty-one radio stations using a power of more than 12 kilowatts broadcast the inaugural exercises. This remarkable feat was the outcome of weeks of planning and then weeks of overcoming difficulties in arranging for land wires, programs and all the multitude of details necessary for such a huge undertaking. Not only was the radio audience to be cared for, but there was also the throng that attended the exercises—and it was estimated that there were about 70,000 people gathered at the Capitol in Washington. Here was installed a pub-

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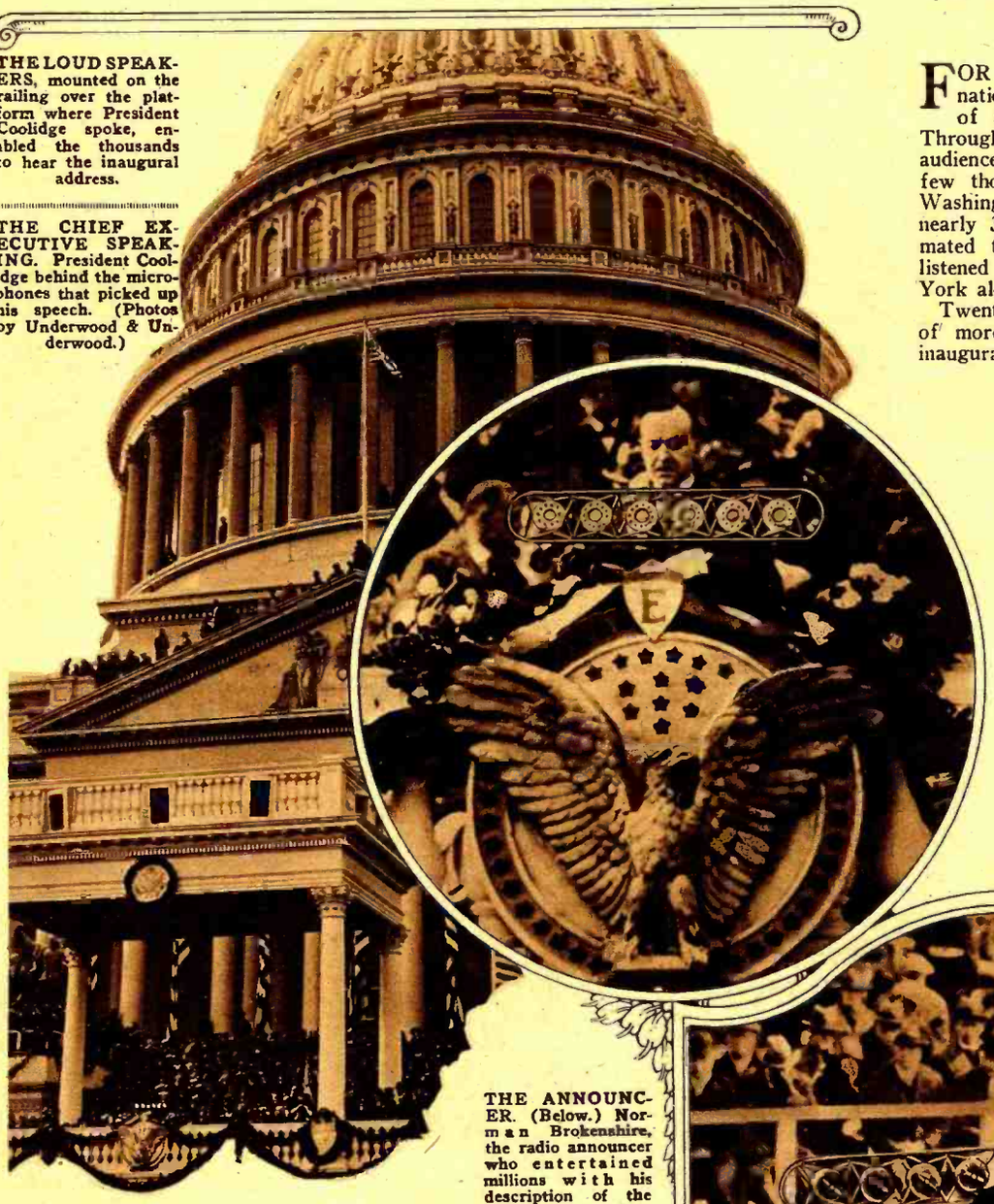
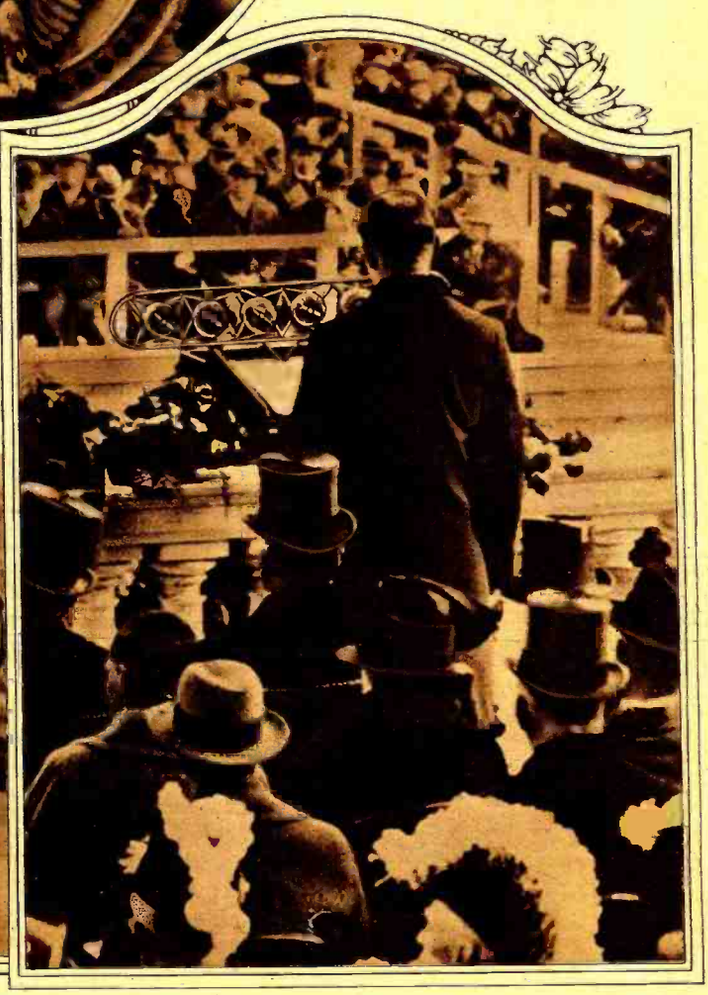


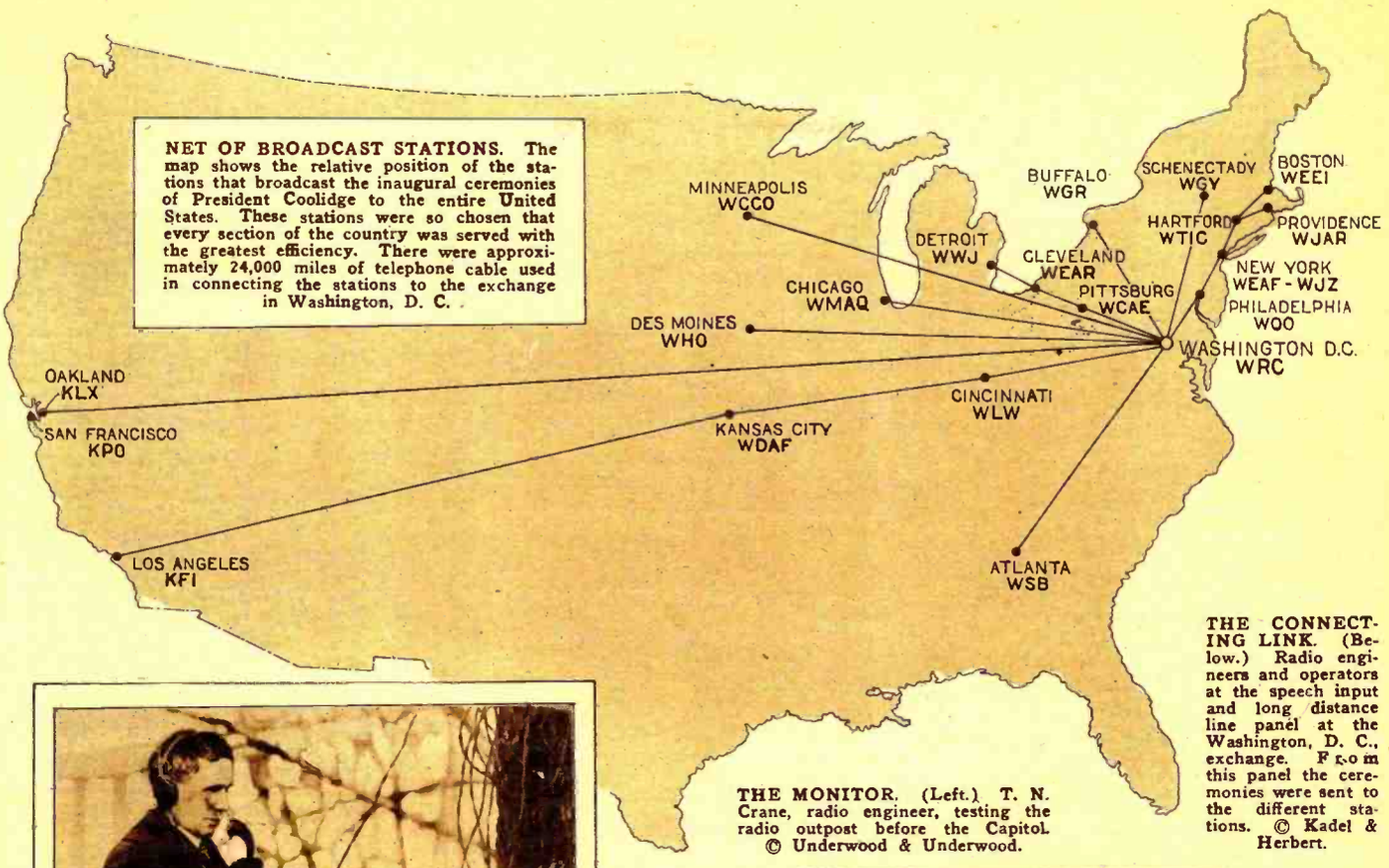
THE LOUD SPEAKERS, mounted on the railing over the platform where President Coolidge spoke, enabled the thousands to hear the inaugural address.

THE CHIEF EXECUTIVE SPEAKING. President Coolidge behind the microphones that picked up his speech. (Photos by Underwood & Underwood.)

THE PRESIDENT BEFORE THE "MIKE." (Below.) This photograph and the one in the circle were copied from negatives that were sent by wire simultaneously from Washington to New York, Chicago and San Francisco in less than 10 minutes. ©Underwood & Underwood.



THE ANNOUNCER. (Below.) Norman Brokenshire, the radio announcer who entertained millions with his description of the inaugural exercises. © Underwood & Underwood.



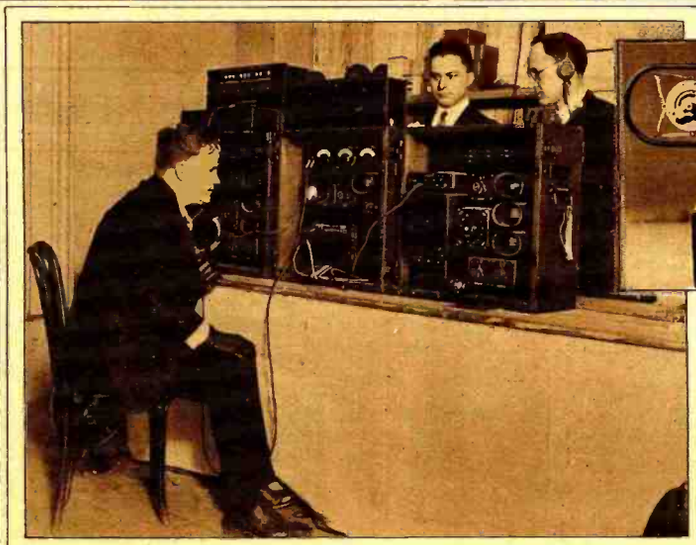
NET OF BROADCAST STATIONS. The map shows the relative position of the stations that broadcast the inaugural ceremonies of President Coolidge to the entire United States. These stations were so chosen that every section of the country was served with the greatest efficiency. There were approximately 24,000 miles of telephone cable used in connecting the stations to the exchange in Washington, D. C.

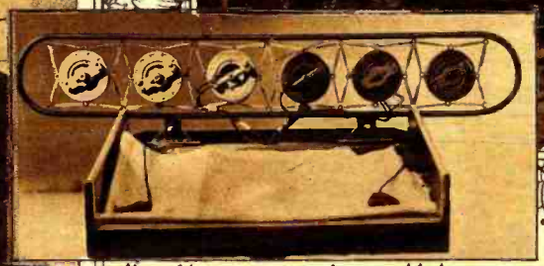
THE MONITOR. (Left.) T. N. Crane, radio engineer, testing the radio outpost before the Capitol. © Underwood & Underwood.

THE CONNECTING LINK. (Below.) Radio engineers and operators at the speech input and long distance line panel at the Washington, D. C., exchange. From this panel the ceremonies were sent to the different stations. © Kadel & Herbert.

THE CONTROL ROOM. (Below, left.) These amplifiers under the steps of the Capitol, strengthened the speech and music before they reached the telephone exchange. © Kadel & Herbert.

THE MICROPHONES were placed over the reading stand. © Underwood & Underwood.





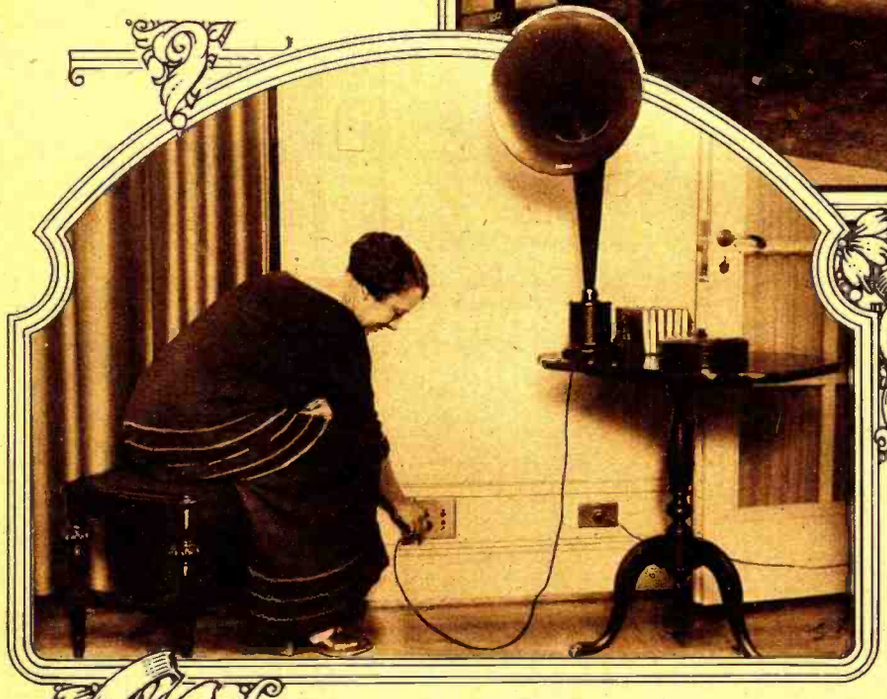
lic address system that enabled every person to hear plainly every word uttered on the platform.

There have been programs broadcast heretofore from several stations simultaneously that attracted boundless interest, but it is safe to say that the ceremonies broadcast on March 4, 1925, attracted many, many more people to their sets than anything ever broadcast before. It was an easy matter to find a store that sold radio apparatus on that date by the crowd in front listening-in to the loud speaker. Many of the business houses installed receivers and loud speakers to permit their employees to hear President Coolidge's inaugural message. When a section of a country neglects its luncheon, it is

(*Continued on page* 2171)

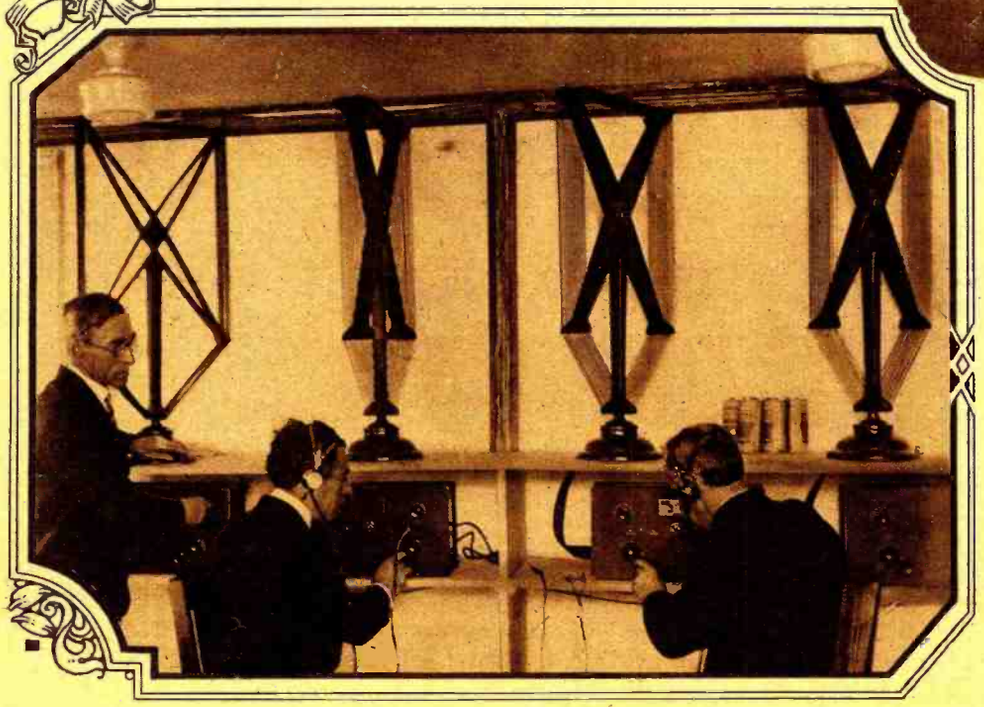
The Month's Advances in Radio

WAITING CHAUFFEURS ENTERTAINED BY RADIO. During rush hours, a New York store provides a garage for patrons' cars and entertainment for chauffeurs. © Underwood & Underwood.

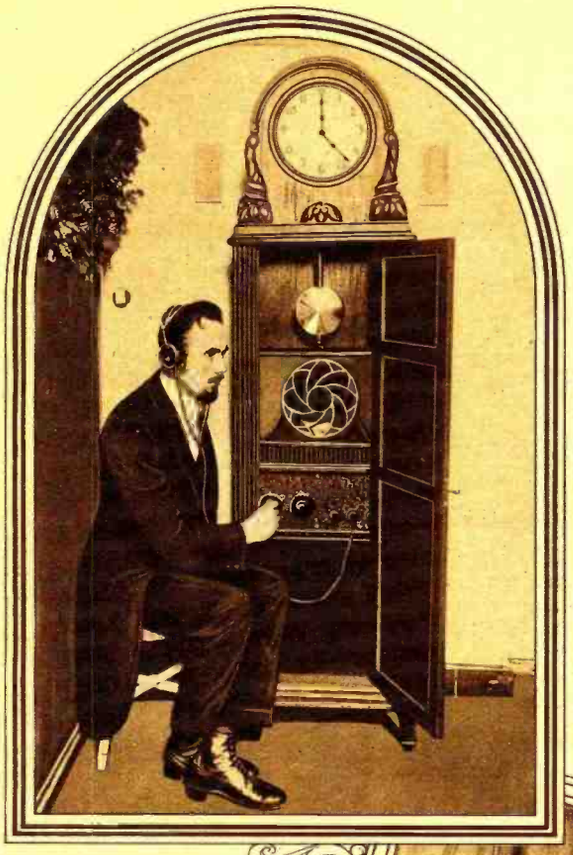


MUSIC FROM WALL SOCKET. In one of New York's newest apartment houses all that is necessary to have loud speaker reception is to plug in on one of the four outlets in the wall. (By United)

Above. **RECEIVER IN FORM OF A HOUSE.** Each room contains a miniature radio set in this unique "Radio House," and by opening any of the windows signals from 15 stations may be heard. © Underwood & Underwood.



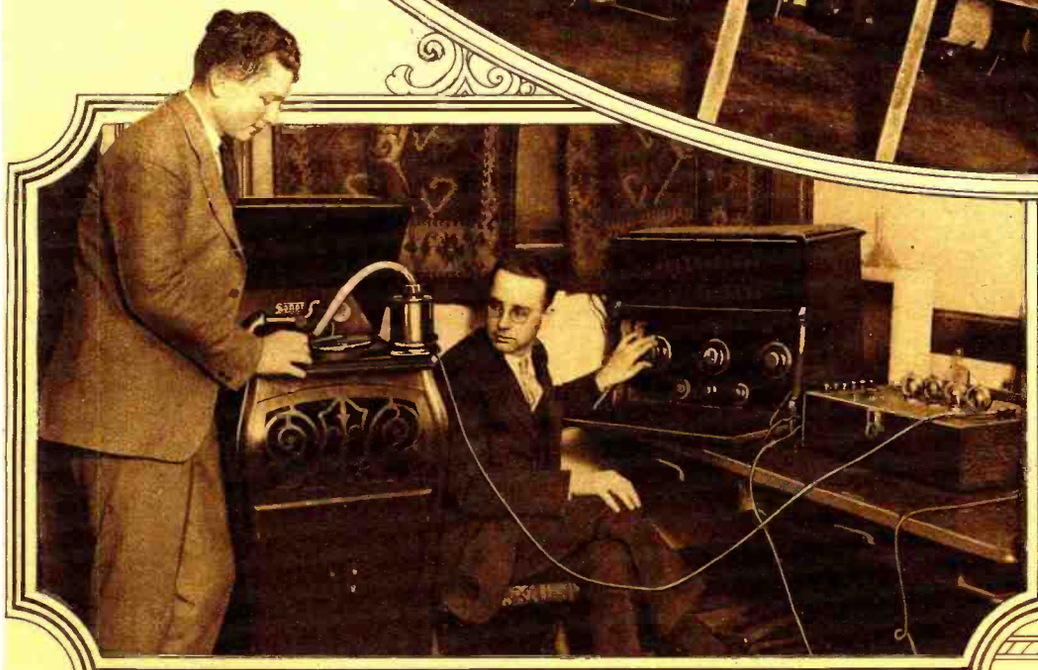
Left. **APARTMENT HOUSE CENTRAL STATION.** Four receivers on the top floor of the building mentioned above supply tenants with four different types of entertainment. (By United)



KING ALFONSO BROADCASTS. Right. His Majesty, King Alfonso, of Spain, made his début before the microphone recently at a Spanish broadcast station. The microphone is covered with a cone-like arrangement which condenses the voice or tones before putting them on the air. © International Newsreel.

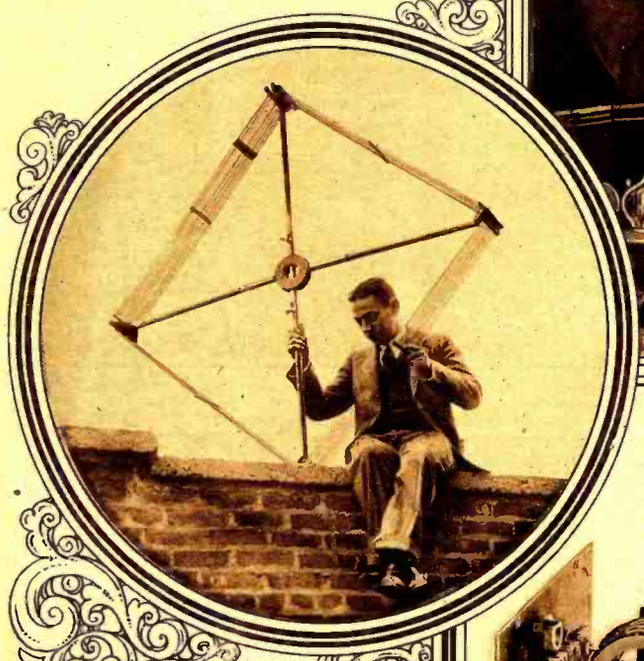
GERMAN RADIO CLOCK. Left. The clock not only has the usual works that make the hands move but also a radio set that causes the loud speaker to operate. This invention was recently announced in Germany.

IDEA TO IMPROVE THEIR BROADCAST MUSIC. Right. An unusual, but effective method of improving their music is employed by this orchestra who listen in to their own selections as they are played. © Kadel & Herbert.



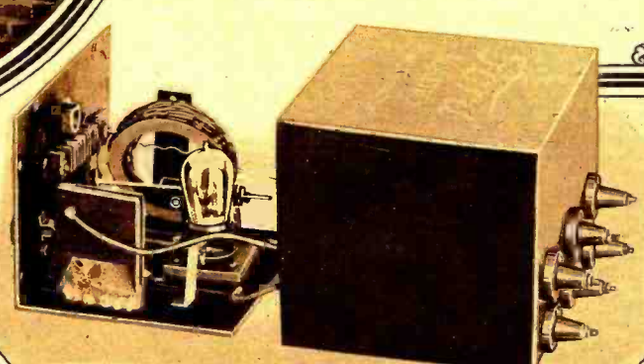
DEVICE FOR RECORDING RADIO SIGNALS. Left. In the research laboratory of New York University, Messrs. Borden and Busee have recorded local broadcast concerts on phonograph records with the aid of their device. A special type amplifier is shown carrying the music to the loud speaker unit on the phonograph. © Kadel & Herbert

USES LOOP ANTENNA ON ROOF. Below: Sidney Schwartz of the Bronx, New York, claims great distance for this German loop antenna that is mounted on his roof. He gets as much DX as he did when using a long single wire antenna and is now perfecting a device to turn the loop from his apartment downstairs. © Kadel & Herbert.



SEARCHING FOR PERFECT RADIO ANNOUNCER. Messrs. Busse and Borden of New York University explaining their new device by means of which they are seeking to set a standard for the "perfect announcer." © Underwood & Underwood.

PAPER LOUD SPEAKER. The paper loud speaker shown in the photograph below is fast becoming popular with radio fans because of the faithfulness of its reproduction. These loud speakers are not difficult to construct and do not have to be pleated, but may be made of stiff drawing paper. © Kadel & Herbert.

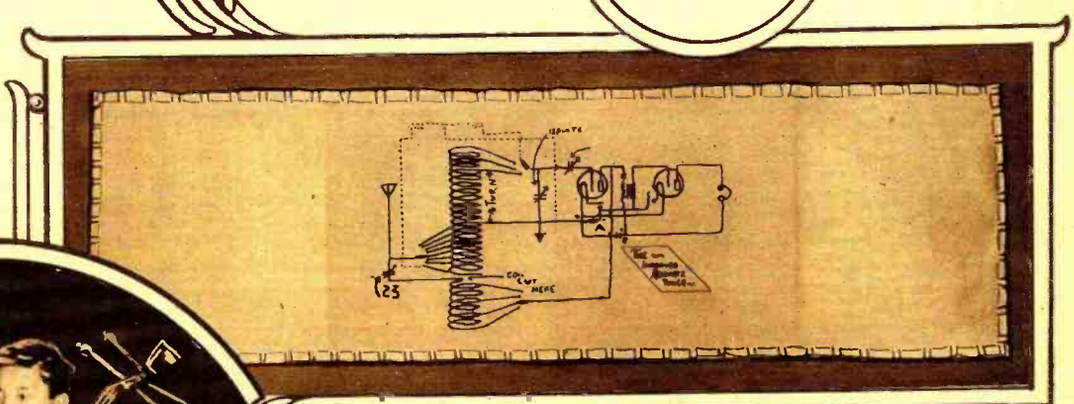


RECEIVER MADE ENTIRELY OF FORD PARTS. Mr. Haitz, of Sioux City, Iowa, must have rebuilt his Ford, for here is a set made from parts of the world-famous car. The only part not of the flivver is the vacuum tube.

AN AIR POLICEMAN. Below: M. S. Strock of the Bureau of Standards in Washington measuring the frequencies of code transmitting stations for use as standards. The Government checks up on the broadcast stations to see that they are using the wave-lengths assigned to them. © World Wide Photos.

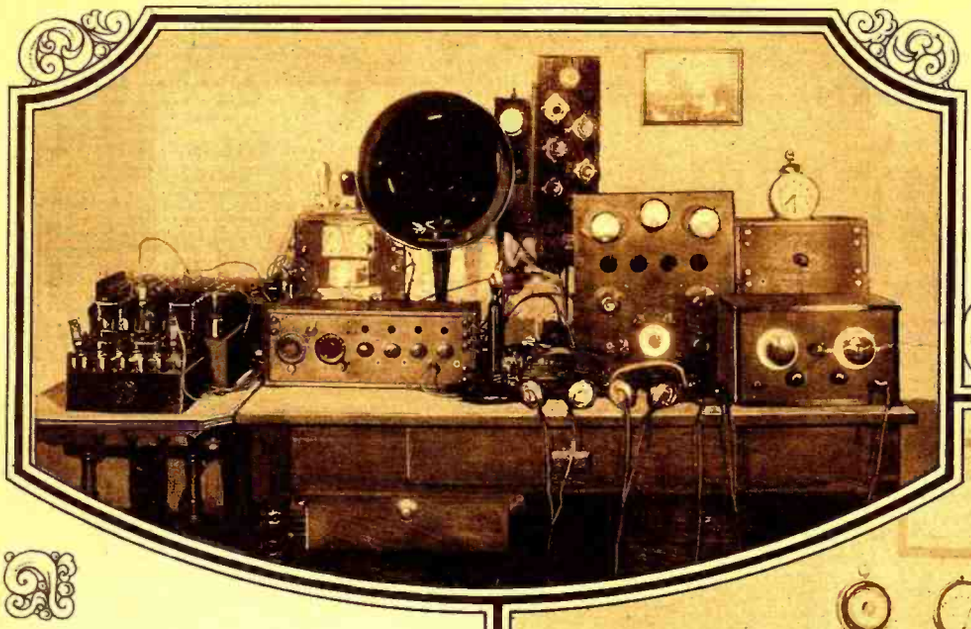
SET AT TOKYO RADIO FAIR. This equipment was one that attracted great interest at the Japanese radio fair. This fair was one of the steps forward that Japan has made, as it gave an estimate of the numbers of people who are interested in radio. © Keystone View Co.

NINE BELOW ZERO. We would like to bet that the man in this photograph did not pose any longer than was necessary.

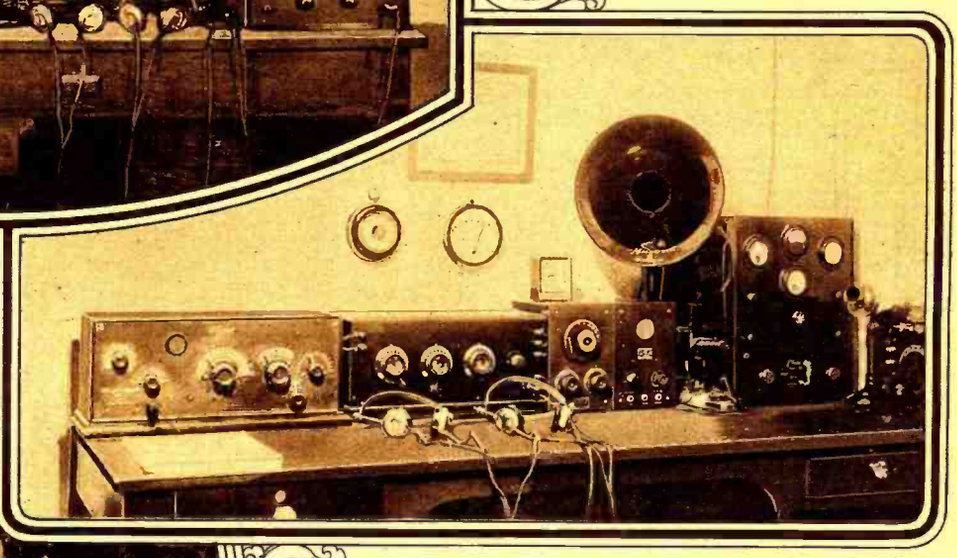


HAND-EMBROIDERED RADIO HOOK-UP TABLE COVER. Louis E. Fischer, of St. Louis, is the proud owner of this unique embroidered table cover. It has its good points besides its looks, too. Instead of having to look all over the house for his circuit diagram, it is always on the table.

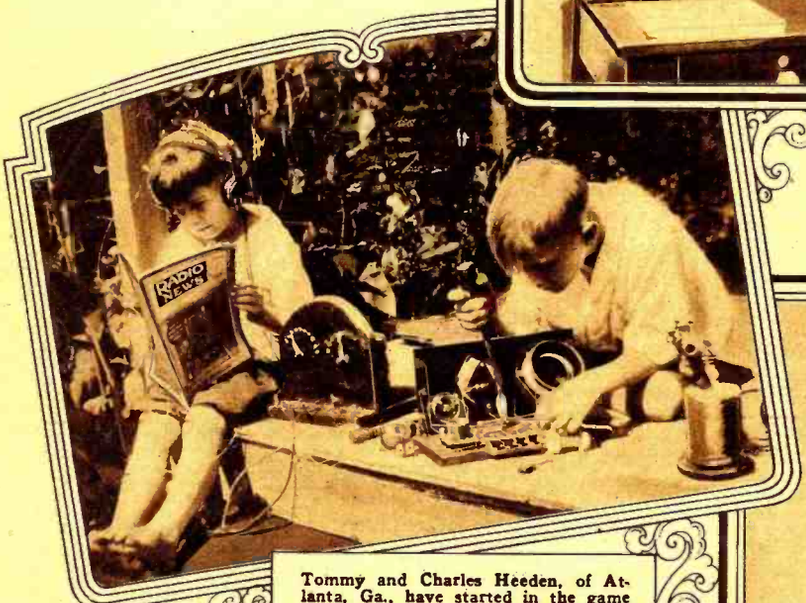
JAPANESE RADIO ARTISTS. Above is shown the founder of Takamine Biwa music, Chikufu Takamine, rendering "Ogi-No-Mato." What this is in English we don't know. On the right is a trio, Mr. and Mrs. Yoshida and Miss Makise. Mr. Yoshida is playing a Shakuhachi. These artists are popular with the Japanese radio fans.



Left. Amateur station 8BEI owned by Dr. W. H. Johnston, of Collins, Ohio, who chats daily with his son in Cleveland, 70 miles distant, at station 8DGS. Power is furnished by a 32-volt D.C. Delco outfit, which in turn runs the 500-volt motor-generator set.

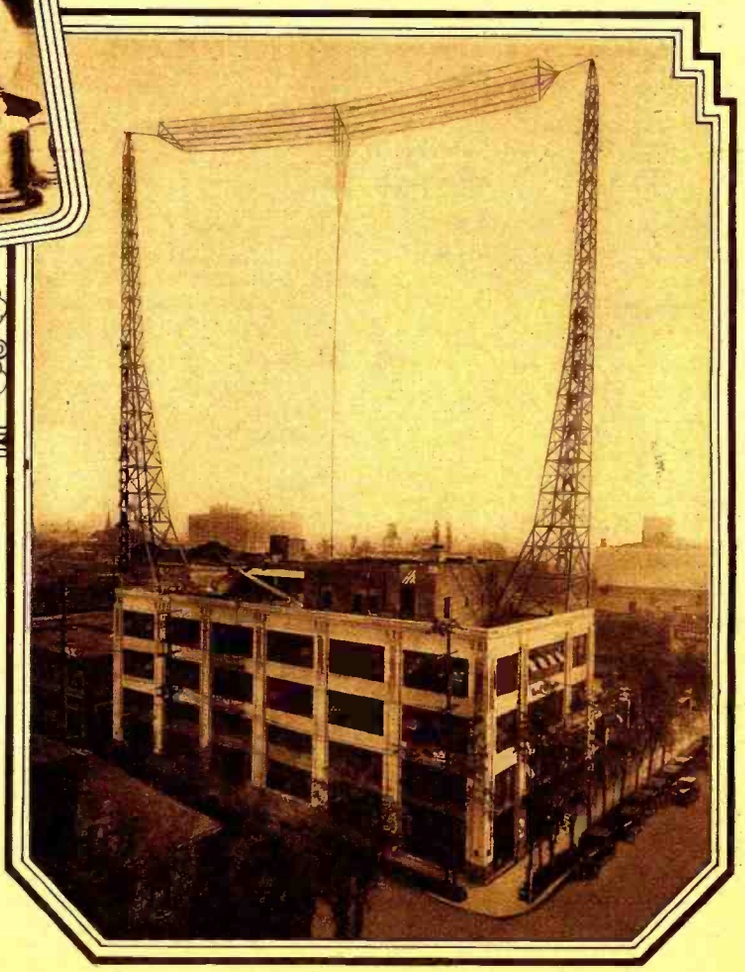


Right. Station 8DGS operated by Don H. Johnston, of Cleveland, Ohio. Both the stations owned by the Johnstons have been heard in every district east of the Rocky Mountains.



Tommy and Charles Heeden, of Atlanta, Ga., have started in the game with vim. Tommy is consulting engineer digging out the latest "dope" with ears and eyes.

Below. Station KFI in Los Angeles, Calif., which is being prepared to broadcast on 5 k.w. The entire station is situated on the roof, which is used for entertaining visitors and artists.



KFI SUPER-POWER STATION OF THE WEST

THE installation of the new 5,000-watt transmission set on the roof of the Packard Motor Car Building gives to California the first of the super-stations. This is the first station of its type to go on the air, and with the present KGO in Oakland, gives the State the two most powerful broadcast stations in the country.

The new station is licensed under the present law to operate at 1,000 watts. In addition to this, the new station has a special license permitting it to go on the air at 1,500 watts. From this point up to the full 5,000, the amount of power to be used will depend on the local existing conditions, as it is not the desire of KFI to unduly interfere with any future or at present existing broadcast station.

To compensate for the increased power of the new transmission set, the towers have been raised an additional 75 feet, giving a total height of 225 feet above the street level, making them the highest structures in Los Angeles. The roof is ready for the installation of the mechanical equipment, for which

(*Continued on page* 2130)

—The Month In Radio—

Being a digest of the odd, interesting, more human side of America's greatest indoor sport. A treatise on the fads and foibles and general effect of Radio on civilization.

Conducted by W. B. A.

RADIO SHOP CLERKS EDUCATED

A School for Radio Clerks! This is the latest in educating the public to the great advantages and advancement of radio. One of the big Eastern radio corporations has decided that its salesmen behind the counter must know a little more about the apparatus they have for sale than the price of it. There is to be much intensive training dealing with the underlying principles of the art, as well as an educational campaign of selling talk for the apparatus of the particular brand. Therefore, the next time you go into a radio store and ask for a left-handed rheostat, the clerk probably will not have to hold lengthy consultation with the manager in order to learn that all rheostats are left—or right—handed. The millenium draweth nigh.

The second batch of Metropolitan Opera stars made their radio debut and the theatrical and musical interests are still a long way from the bankruptcy court—an astonishing condition, according to some of the savants in that field. As a matter of fact, quite the contrary. From all reports, the stars who did the singing, Toti Dal Monti and Guiseppe de Luca, are quite satisfied with their efforts, at least after receiving the monthly royalty check from the phonograph record which sponsored their appearance before the microphone.

Again the amateurs come to the fore—and, as usual, in an entirely new field. John L. Reinartz, probably the world's most famous radio amateur, was heard by F. A. Meyer, of Wickford, England, in broad open daylight. (It was daylight at both stations and the waves traveled in the sun all the way across the Atlantic.) The surprising thing about the report is that the transmission was carried on a wave-length of 21 meters. Reinartz's signals were quite QSA, as the hams' parlance goes, which is to say they were heard very clearly.

May the good Lord help the listeners in the Big Village, known in the headlines as Gotham, Manhattan, or Little Old N. Y. A few Sundays ago, the evening found another 500 watts splitting the already crowded ether around the Woolworth building and Brooklyn bridge. Station WMCA came on with a smash—but that is only the beginning. After the grand opening, with the usual garnishment of celebrities and program *hors d'oeuvres*, it disappeared, seemingly, as quickly as it appeared. But as soon as it passed out, another station began in its place with the call 2XH, giving programs and announcing voluminously that they were testing! WMCA is now on 285 meters. The new station was dividing time with WSB in Atlanta, Ga., and it is rumored that the whole situation will result in another job for Secretary Hoover.

SOMETHING NEW IN STATION DESIGN

Radio fans soon will be listening in to a new broadcast station to be established in Buffalo. Its antenna will be 400 feet above the street level, for it will be swung from masts rising from the tallest skyscraper in Northern New York State, the building of the Liberty Bank, recently completed.

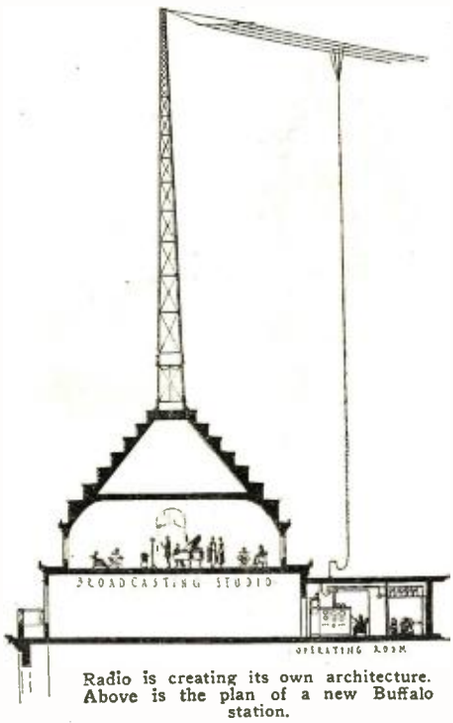
The original intention of the officers of the bank was to have on each of the towers a statue of Liberty bearing a torch, but in compliance with the popular demand, they requested the architect to make plans for a broadcast station instead.

The bank's new home is, as far as is known to the architect, the first skyscraper especially designed to carry a broadcast station. The steel masts of the station are so riveted and bolted to the framework of the building, several floors below the summits of the towers they will withstand the velocity of the highest winds which sweep from Lake Erie and the North. The latticed masts which resemble those of a battleship, and are unique in design, will be illuminated at night from flood lights on the roof.

The towers of the Liberty suggest the Ur-American period, for their outline was studied from that of a pyramid in Guatemala many thousands of years old, on which was a temple from which the ancient priests, archaeologosists say, trumpeted messages to faithful worshippers. The new station will send its call, however, through the ether to unseen audiences hundreds and thousands of miles distant.

This bank is 24 stories in height, exclusive of the towers, and the masts rise 60 feet above their pyramidal pedestals. The studio is to be in one of the towers and operators will work in a pent house on the roof.

And talking about Secretary Hoover: Recently, columns of newspaper copy were turned out on the fight in Cincinnati. It was like this: The directors of WLW



Radio is creating its own architecture. Above is the plan of a new Buffalo station.

read the Constitution of the United States one night before going to bed and became filled with an idea of their own greatness as citizens. They learned that they had a perfect right to broadcast when they pleased.

Now there is another station in Cincinnati, the directors of which also know the Constitution and by the same token were advised of their right to do the same. The result was inevitable. Worse than that, in fact, since both stations were practically on the same wave. For about two nights the listeners were treated to a rare dish—hash! Both stations transmitted constantly and with the best artists available.

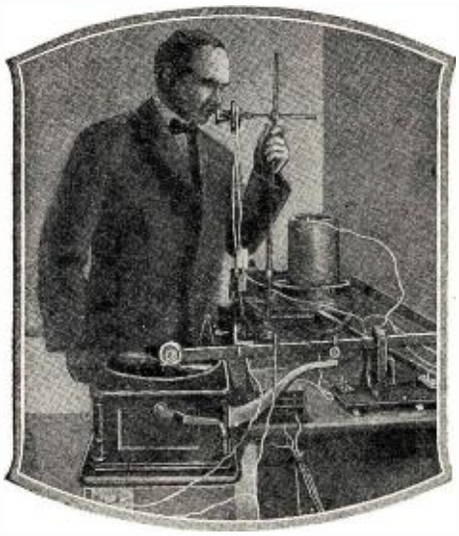
Enter Secretary Hoover. A representative of his department was presented with a ticket to Cincinnati and told to fix things up. A few words and the two stations began to laugh at the situation they had instituted. After a good dinner and many words—friendly—the department agent succeeded in working out an amicable arrangement whereby the stations should divide time on the air—and did.

Those who like the choral work of the Zion City choir as transmitted through the Voliva station at the city of the same name, will be delighted that the power input is to be, not 500, but 5,000 watts in the very near future. All arrangements have been completed and the super power will be available to the antenna.

Which calls to mind the recent super power broadcast vote which was held recently by RADIO NEWS. Before the year is over this question is going to be one of the greatest importance and will probably affect the whole future trend of broadcasting. "The Month" asks for comment.

(*Continued on page* 2173)

The Life and Work of Lee DeForest



DeForest at his early radiophone. Note the talking machine.

PART VIII

"AND you actually carried on intelligible communication between the moving train and your fixed stations in St. Louis and South Chicago?" asked the reporter for the Associated Press, as he was interviewing Dr. Lee DeForest in his room at a hotel in the former city.

"Yes," said DeForest. "There is the operator's log." And he tossed a closely packed envelope on the table by which the journalistic worthy was sitting.

As reporters always do, he opened the package and looked seriously at all the pages. They were Western Union telegraph blanks, bits of Chicago & Alton Railroad stationery and all sorts of waste paper, including used envelopes and the backs of letters. Not a very imposing bunch of original records, but the tale of the first communication by radio between a fixed station and a moving train was written on them.

On DeForest's return from the installation of the stations he had been erecting in the Tropics for the Navy, he learned that the Chicago & Alton Railroad was interested in the work he had done with wireless and had asked many questions about it. Immediately he started for the office of the road's president at Chicago. There he succeeded in making the necessary arrangements for a test to be carried out on the fast mail trains that ran between St. Louis and the Illinois metropolis.

THE STATIONS

So, shortly the arrangements were completed. There already were stations handling traffic from St. Louis and Chicago, so the only other installation which remained to be made was the one on the train.

The standard company apparatus was used in constructing the set. It consisted of a rectifying detector, a two-slide tuner with headphones and a local battery. The antenna was a lamp cord strung along the length of the train from the observation car where the set was located, forward to the first mail car. The instruments were grounded to the wheels of the car where the set was located.

The train left St. Louis at 11:10 a.m. on the first day of the test. It was more than useless to attempt reception of the signals while the train was in the station shed or making its way through the downtown section. There was so much steel and so many towering structures that the signals were effectively shielded; especially was this the case with the small power being used at the transmitter and the nature of the receiving apparatus antenna employed.

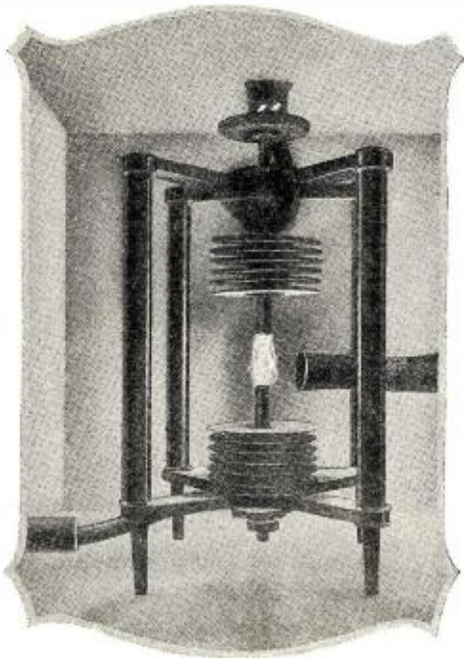
However, as soon as the train cleared the tunnel, just before it reached the river bank of the Mississippi, the dots and dashes began to come in. At first they were faint, then constantly grew louder, reaching a maximum when the train was moving up the west side of the river. Then reception remained good until it started into the Merchant's bridge which lies about three miles above the station —some four miles from the transmitter.

As soon as the train cleared the span and started up parallel with the river on the opposite side, the signals again came in with great clarity and remained easily readable until the course took another slant diagonally from the river. Here the signals again became faint and almost inaudible. The operators thought the test completed, not expecting to hear the home station again on the trip. This was not the case, however.

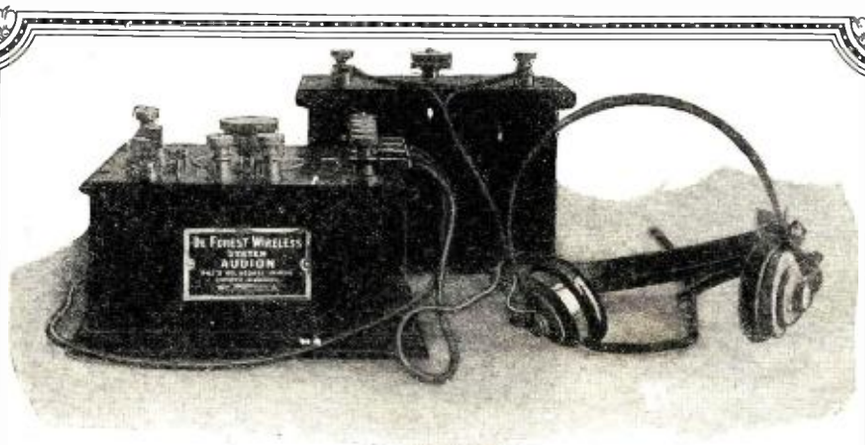
At Granite City, some 25 miles from St. Louis, the signals again became audible. And the notable point was that the track had again come back parallel and near the river. They remained in communication for several miles more.

Two factors made themselves apparent to DeForest when he examined the reports of the operators in charge of the train installation. First, that the Mississippi was acting as a wave chute and carrying along the impulses on its bosom. Second, that the steel bridge structure, which was of course grounded, acted as an especially effective shield, stopping any reception of the waves through it. He also found that the reception was in proportion to the bonding of the rails, so proving again that an effective ground was absolutely essential for the best reception.

The same experiments were carried out from the Chicago station with practically the same results. The signals disappeared both ways where the rails were insulated for the block system which the railroad employed. This condition reduced the available ground to the two lengths of rail upon which the wheels of the car happened to be resting. And observations tell that usually the railroad is laid in gravel and ballasted with rock. Not an exceptional ground connection.



Shades of old time interference! The old DeForest spark gap at the Manhattan Beach station.



An early complete audion receiving unit. The bulb was enclosed for the sake of secrecy.

ONLY TWO ELECTRODE VALVES

It might be well to note here a little incident in connection with the two electrode valve. It was about this time that the DeForest Company sold the first and only two dual electrode tubes for wireless reception in this country. They were installed in the Brooklyn Navy Yard at that station and gave excellent results. However, the three electrode audion was well on its way to perfection and so no other of the two electrode type was either made or installed.

In the early part of the year, the company decided that it would be a good point for the advancement of the art in general if they could establish and check the transmission of a few trans-Atlantic messages. As soon as the decision was made, DeForest was immediately plunged into the work of making

Biography recorded by W. B. Arvin of RADIO NEWS, *under the personal direction of Dr. DeForest.*

the necessary arrangements. The famous old station DF at Manhattan Beach was working regularly, and it was given the task of caring for the American end of the work. DeForest began planning for the station in Europe which was to be placed on the west coast of Ireland. Since the affair was to be only a test, it was decided that the erection of a permanent installation would be more costly than the benefit received would warrant. Consequently, DeForest set about to find another method of transmitting and receiving the test than through the usual system of triangular towers and antenna.

It happened that about this time Dr. Alexander Graham Bell was performing some work in aeronautics. He had devised a sort of tetrahedral kite which had exceptional strength and lifting power. It resembled more than anything else a great piece of honeycomb, the cells of which were three instead of six-sided. DeForest came to a working agreement with Dr. Bell and the kites were made. So DeForest shipped for Ireland with his kites and the necessary receiving apparatus.

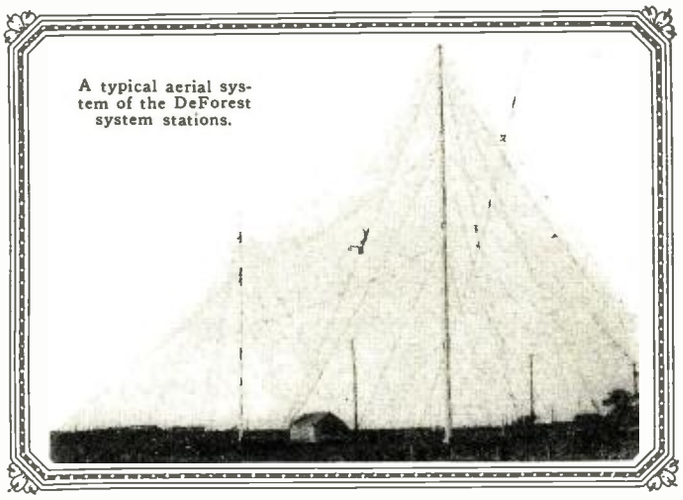
It was in February that he and his assistants arrived and began the actual work of erecting the station. The antenna was built with flexible wire.

The custom was for the men to go out in the afternoon and fly the kites, then return to the hotel and take a few hours' rest before the time appointed for communication. The difference in time between the two stations forced them to carry out this part of their work well after midnight. And many times they would arise in the cold gray night, go over to the station only to find that since the afternoon the wind had died down and the antenna, instead of riding high, was stretched out over the various hedges, fences and barns of the countryside. This happened night after night, but they kept after their goal and finally received the first message across the great expanse of the Atlantic ocean, April 11, 1906.

And with it, they removed themselves back to the United States. They gathered up their apparatus, the kites and their hangars —they were so big that they had to be put in hangars—took their notes and returned to other fields of endeavor.

LOW ANTENNA

Upon his return to New York, he found some improvements necessary at the Connecticut station of the company. Without taking so much as a day's rest, he went immediately to the station and made the necessary repairs. And while there, doing some testing, he had occasion to use a long, low antenna. He strung a long antenna on top of some miscellaneous poles which he found in the equipment of the station and attempted reception. The results were astounding. This was not enough. He took the antenna off the posts and using insulated wire, laid it on top of the earth, so that he could more nearly place it in the proper direction. The results almost sent DeForest to write a paper for one of the scientific societies. They were, to say the least, astonishing.



A typical aerial system of the DeForest system stations.

Always before, the main point in the antenna, according to the tenets of the art at that time, had been its height above the ground. And here he had discovered that it was not even necessary to elevate the antenna at all. In fact, at the completion of the insulated wire experiment, in order to check his results and at the same time to make any further discoveries as to the actual nature of the waves, he substituted a bare wire for the insulated one and found the same results so long as the wire was laid on dry, sandy soil.

Before he had completed these investigations, he was called to the Toronto station in Canada. This installation was working in conjunction with another at Hamilton, handling a great deal of traffic and making quite a name for the company and its stations. Some improvements were needed and DeForest was on his way there to see what changes, if any, were needed. The stations, he found, were seemingly fighting a dead spot or some interference, as it was called then, between them. He set out to make some tests in the field. Of course, there was no provision made for his erecting antenna, so he fell back upon the low antenna method he had just discovered. It could not be placed upon the ground, however, on account of the condition of the weather. So he placed his wire on the bottom cross-arm of telephone poles. For a ground he used the rails of the railroad (he was making the tests along the right of way of the main line between the two towns, the most direct route, and, therefore, the one presumably traveled by the wireless waves) or in some cases to the limb of a skinned bush or small tree, when the track did not work so well.

And here is where he made a second discovery—or at least had it under his nose. He found that the wires of the telephone and telegraph, on the poles above his antenna, served as a "wave chute" allowing the most extraordinary reception of the signals. He checked the effect by removing the antenna away from them and still keeping its directional property. No matter how carefully the other antenna was pointed toward the transmitting station, the results could not compare with those when it was placed under the telephone wires for strength of signals.

Wired radio? Possibly this is the first case of it in the history of the art. Though the primary laws of its use were not promulgated as a result of the experiments, it can hardly be denied that the principle was involved. The comparative test showed it plainly and there is no other means which can be used. And as corroborative testimony, there is the entry in DeForest's note book to the effect that the telephone and telegraph wires acted as a "wave chute." (U. S. Pat. 1,101,533.)

But it might be noted here that DeForest took out a patent on both the low antenna, the antenna lying on the surface of the ground and the antenna strung along the telephone poles. The claims cover the directional effects, too.

Then in the early summer, shortly after his return to the home office in New York, came the second great disappointment in his life. The company had, under the financial direction of Mr. Abraham White, its president, gotten itself into serious financial difficulties. He had, in order to make a bit more out of it, fallen into the ways of promotion schemes, it is said. DeForest, when he first learned of it, immediately made plans for withdrawal. Reports were published in the papers of the time that White had obtained control of both the Marconi Company stock in this country and that of the DeForest Company and intended to amalgamate them into one huge corporation. He had not, evidently, gained as much control of the Marconi interests as he thought, for the morning following this statement the same

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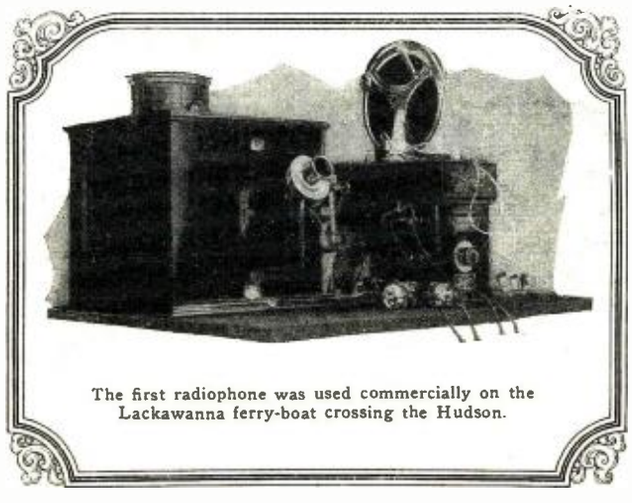
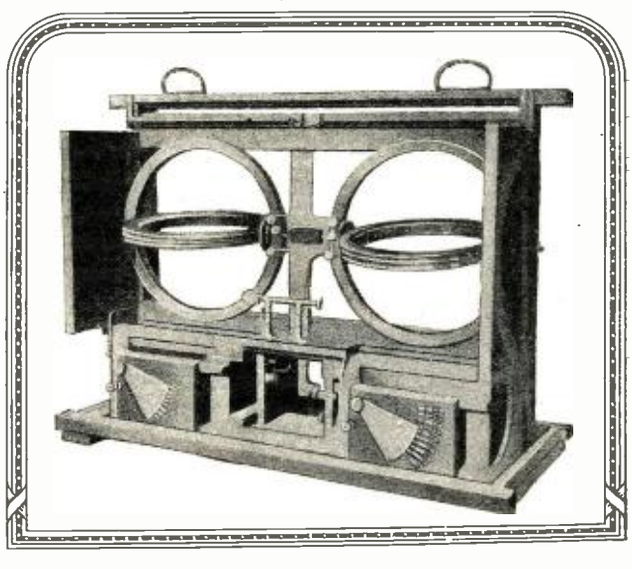


The first radiophone was used commercially on the Lackawanna ferry-boat crossing the Hudson.



At the right is one of the first radio wavemeters ever constructed built for De Forest.

Hotel Furnishes Radio for Its Guests

By C. BROWN HYATT

The Robert Morris Hotel in Philadelphia has started something—it has made radio available to its guests. Others must follow.

THE impossibility of furnishing a radio set for every guest of a hotel, or even one-tenth of them, is obvious under the present development of the art. However, the managers of the Robert Morris Hotel in Philadelphia, having seen the advantages of providing their guests with the wealth of free entertainment which is afloat in the air most of the time, set about, while drawing the plans for their hostelry, to find a way of making it possible for their guests to have radio at hand while staying in the hotel.

Guests staying in the hotel have only to call the telephone operator in order to enjoy the best on the air.

The logical course, they thought, was to call upon one of the large corporations dealing in radio. This they did only to find that there was no plan worked out for such an installation and that it would require the services of several high-priced engineers and a great amount of time to work out the details. The prospect looked so dark that they were almost decided to let the project drop when a young local engineer volunteered his services.

The result of his work on the scheme is shown in the accompanying photographs and the simple methods he employed in the installation are fully described below.

It was decided that a multiplicity of stations was not to be desired, that it would be much more simple of operation and sturdy in practice if the installation were to operate on two or three stations. It was then only a matter of selecting the stations from which it was wished to receive.

The second point considered was to allow the telephone operator to operate the necessary controls. One central radio station was installed on the roof of the hotel and a system of remote controls devised whereby she could be in control of the set. The set itself was arranged to operate on two wave-lengths—four stations available on them—and the control at the switchboard arranged so simply that even a child could operate it. Fig. 2 shows the control for the operator.

Through this system, loud speaker or head-phone service is available in every room of the hotel during all the time the stations are on the air. It is only necessary for the guest to pick up a pair of phones installed permanently in every room.

THE APPARATUS

In order to obtain an efficient station, it was necessary to locate the set on the fourteenth floor and place the controls on the first floor, operated by the telephone operator at her switchboard.

In this manner, by a system of relays, it was possible to construct an apparatus which would not require an experienced operator to tune or maintain.

The difficulty of tuning different wave-lengths was solved by using (in this case two wave-lengths gave four different stations) two single pole double-throw relays, represented by 16 and 17, Fig. 1. These relays are actuated through switch 19, Fig. 1, and an opening and closing switch 2, Fig. 2, located at the telephone switchboard.

The contacts of the relays are connected to the tuning circuits 8, 10, 21 and 23, Fig. 1. Different wave-lengths are thus obtained from the telephone switchboard.

Switch 18, Fig. 1, changes the tuning circuit from the automatic controls to an external manual operated set to be used when special reception is required.

In order to obtain selective tuning, the lateral wound inductance coils were constructed to oscillate at their respective frequencies. Thus only a minor adjustment is required which is accomplished by small capacity condensers 11 and 12, Fig. 1.

The primary and secondary coils of the oscillators are coupled very loosely, due to their oscillation period. In this manner very clear reception can be obtained. With the addition of more sets of relays and oscillators, it is possible to receive any number of desired wave-lengths.

Fig. 1. The receiving set for the hotel installation is panel mounted so that the whole unit is self contained, even to the battery and the plate supply. It also makes for more convenient repairs and allows absolute ease for making the wave-length adjustments for the stations to be received.

Two amplifier panels are used: One for the loud speakers and one for the head-sets in the rooms by connecting the primaries of both first audio transformers in parallel and then the circuits are amplified separately.

BATTERY CIRCUITS

A compound relay 1, Fig. 1, incorporates the features of turning on and off the set and charging the "A" and "B" batteries in such a manner that they are fully charged at all times. This relay is actuated by switch 3, Fig. 2, of the remote control panel operated at the telephone switchboard by pressing the white button which energizes the closing solenoid, thus closing the relay.

When this relay closes, the "A" battery circuit to the filaments is closed, and the "A" battery charging circuit is turned on.

The "A" battery is now charged at the same rate as its discharge plus a 3 per cent. overcharge to compensate for the battery

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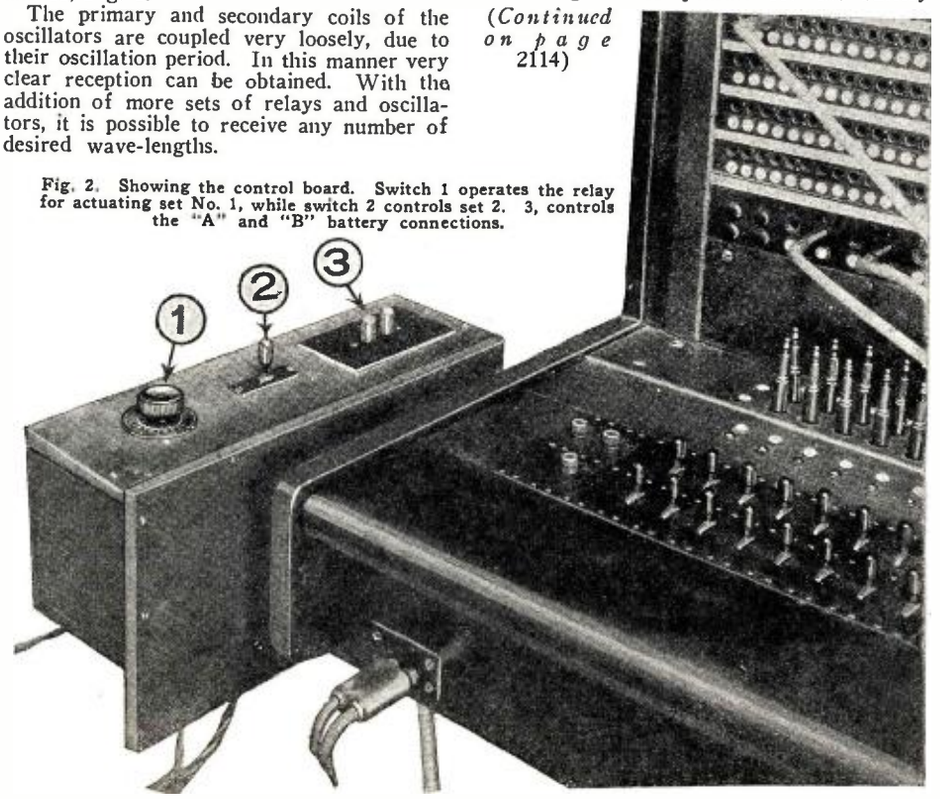


Fig. 2. Showing the control board. Switch 1 operates the relay for actuating set No. 1, while switch 2 controls set 2. 3, controls the "A" and "B" battery connections.

ANNOUNCEMENT

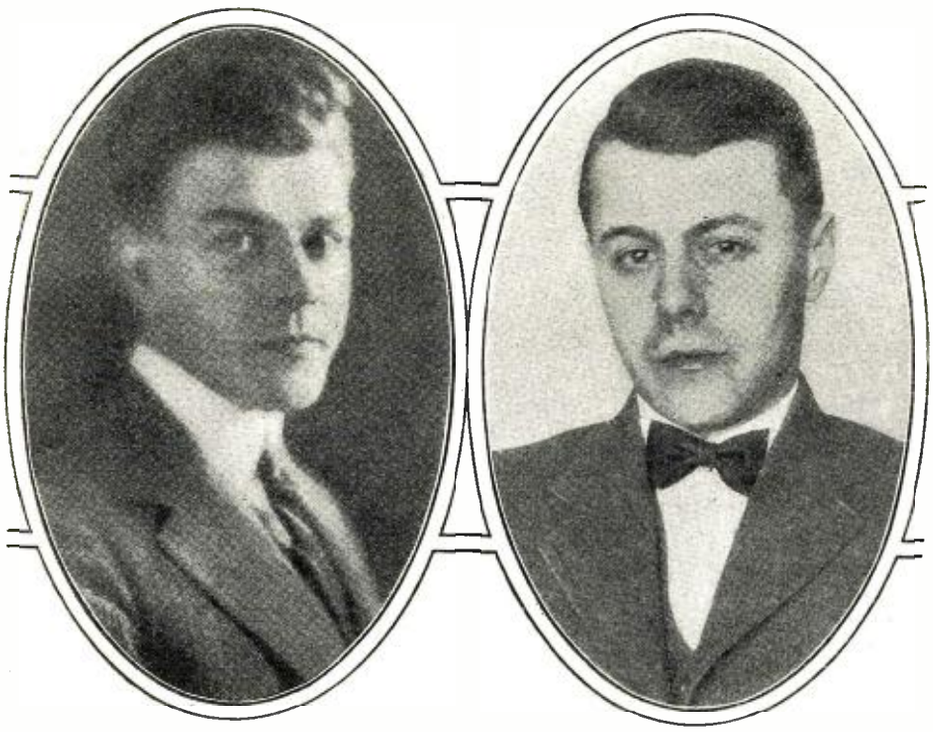
MR. ROBERT E. LACAULT, who for the past four years has been Associate Editor of RADIO NEWS, has resigned from the editorial staff for other endeavors. Mr. Lacault has been for some time engaged in radio research work, and recently decided to devote all his energies to it. Mr. Lacault has contributed not a little towards the editorial success of RADIO NEWS, and it is with regret that we see Mr. Lacault leave.

The duties of the Associate Editor have been taken over by Mr. Sylvan Harris, B.S. in E.E., A.M. I.R.E., A.I.E.E. Mr. Harris, an accomplished radio engineer, needs no introduction to readers of RADIO NEWS. He has contributed a number of excellent papers to this magazine, as well as to other magazines throughout the country. He was formerly technical editor of *Radiofax* of Philadelphia. Mr. Harris is a graduate of the University of Pennsylvania. He is an expert on modern radio, having done a great deal of valuable research work in his former positions.

His recent scientific papers on "Analysis of Condenser Resistance," several of which have appeared in RADIO NEWS, have been widely commented upon in radio circles.

Mr. Harris is also the co-author of a new method to determine condenser losses.

Several new radio circuits developed by Mr. Harris will be published shortly in RADIO NEWS.



ROBERT E. LACAULT SYLVAN HARRIS

$500 Home-made Set Contest

IN order to encourage experimenting and the construction of home-made sets, RADIO NEWS is offering prizes amounting to FIVE HUNDRED DOLLARS for the best home-made sets submitted according to the rules below. There are, of course, hundreds of experimenters all over the country who are working day and night on the construction of sets, but there are doubtless as many more who would do some valuable experimenting if offered any encouragement.

Therefore, in order to strengthen the desire for knowledge and experimenting for both the old-timer and the beginner, RADIO NEWS has offered the announced cash prizes.

In order to judge fairly, the judges will consider the merits of each set in the following manner and rating.

NOVELTY. 10 per cent.

DESIGN. 20 per cent.

WORKMANSHIP. 20 per cent.

RESULTS AND EFFICIENCY. 50 per cent.

The definitions of these terms follow:

NOVELTY. Special design of parts, or novel features, switches, jacks, etc., that will add to the general efficiency of the set.

DESIGN. Style of circuit used, general layout of apparatus on panel and baseboard and simplicity of construction.

WORKMANSHIP. This will include the general appearance of the set, the neatness and electrical efficiency of the wiring, and the smoothness of operation of moving parts, as rotors, condensers, etc.

RESULTS AND EFFICIENCY. This will include the general operating efficiency of the set.

The sets will be tested in the Laboratories of RADIO NEWS either on a loop or outside antenna, as the builder may specify. The judges will be the staff of RADIO NEWS and the staff of RADIO NEWS Laboratories; the chairman will be Mr. Hugo Gernsback, the editor of RADIO NEWS. Each judge will vote upon the relative merits of each set on the basis outlined above and the sets that receive the highest percentage in each class will be awarded the prizes. These decisions will be final.

Any sort of a set may be entered in the Contest—from a crystal set to a Super-Heterodyne—and each set will have an equal chance. The question of range will be taken into consideration and performance of each set will be considered, not on freak range, but on consistent results and quality of signals received. Standard tubes will be used in testing the sets in the Laboratories, unless the builder specifies otherwise. Also, two different makes of standard loud speakers will be used on every set to test the quality of reproduction.

All sets will be judged in their own class depending upon whether they use crystals, one tube, two tubes, etc.

In the manuscript accompanying each set there should be specified what plate voltage should be used and any other useful information that will enable the judges to see the receiver working under its best conditions.

Prizes for the $500 Home-made Set Contest

First Prize	$200.00
Second Prize	100.00
Third Prize	75.00
Fourth Prize	50.00
Fifth Prize	35.00
Sixth Prize	25.00
Seventh Prize	15.00

RULES OF THE CONTEST

1. A manuscript of not over 1,000 words, describing the set, must accompany every set entered in the Contest.

2. Contestants may enter more than one set in the Contest.

3. All manuscripts should be typewritten or clearly written in ink and all diagrams should be clear enough to show all details. No penciled matter is allowed. The type of circuit should be mentioned in the manuscript and a complete description with sketches of any special home-made parts or unusual features embodied in the set. All manuscripts must be mailed flat. No rolled manuscripts permitted.

4. All prizes will be paid upon publication.

5. Should two contestants submit identical sets, thus tying a prize, the same prize will be awarded to both.

6. Excluded from the Contest are radio manufacturers and the publisher's employees and members of their families.

7. Each set should be accompanied by a photograph of its builder, and should be of at least postcard size.

8. Sets should be very carefully packed and tubes, batteries or similar accessories should NOT be sent.

IMPORTANT
GENERAL INFORMATION

9. Before sending in your set, be sure that the binding posts are correctly marked or labeled.

Put your name and address on a tag and tie the tag with a string to a binding post or other projection on the outfit.

Packing is most important. Too many times sets have come to us smashed up. For that reason, all sets must be shipped to us packed in wooden boxes. First wrap up the set in a good grade of packing paper, then place excelsior all around the set. Make sure that no excelsior gets into the instruments. This alone will not help, though, if heavy instruments, such as audio frequency transformers, etc., are not screwed down with strong, stout screws to the baseboard. If a transformer is ripped off in transit, it is liable to smash other instruments, making it impossible for us to test the set.

Sets which have little chance of winning prizes are the following:

Sets crudely assembled, using poor instruments, wooden panels instead of bakelite or radion panels, slipshod work, loose coils, etc.

10. Any non-prize-winning manuscripts published will be paid for at the regular space rates. Rejected manuscripts will be returned after the close of the contest.

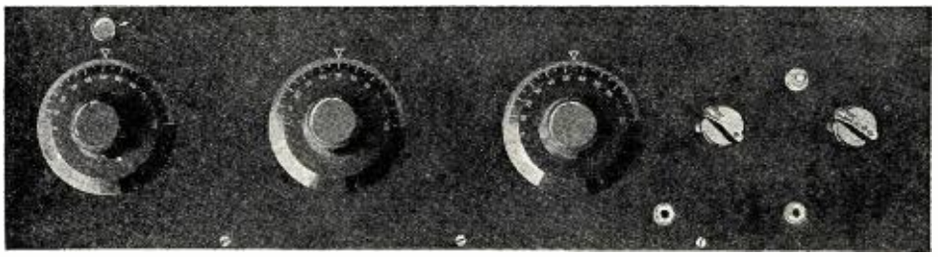
11. This Contest closes in New York on May 20, 1925, by which time all entries must be in New York.

Address all communications and boxes to *Editor, Home-Made Set Contest, c/o* RADIO NEWS, 53 Park Place, New York City.

The Monophase Circuit

By FRANK H. DALET

Radio News is happy to present a new set incorporating a novel method of controlling oscillation in radio frequency amplifiers.



Showing the front panel view of the new monophase receiver. Note the small adjusting knob over the first dial.

IN radio reception, improvements invariably come through the attempt to force each piece of apparatus forming the whole to work at greater efficiency. The best set, that is, the one which will bring in the most DX and at the same time give the clearest and most pure reproduction of sounds, is the one in which every component is functioning at its best.

This line of investigation—constantly working toward deleting the losses from each piece of apparatus—has been responsible for all the recent advances in the field of radio frequency amplification design. From the old transformer coupled stages we have progressed to the tuned steps, and then to the neutralized type. Each of these advances in design served to eliminate some particular loss in the set. The transformers were inefficient in their transfer of energy from one stage to the next. Consequently, some designer conceived the idea of substituting the tuned method of transfer for the old transformer method.

CONTROL

Here another difficulty arose. Something had to be done to control the oscillating characteristics of the tube, since the small inter-element capacity often forced it into oscillation on account of the proximity of wave-length values between the grid and plate circuit of the tube. A losser in the form of a potentiometer was inserted in the circuit to damp out these unwanted oscillations.

Then along came the Neutrodyne with its neutrodons which served the same purpose, *i. e.*, to stop the deleterious effect of the capacity of the tube. This method was infinitely more effective from the standpoint of operation than the old potentiometer method of controlling the tube.

Then, independently and about the same time, the superdyne principle was brought out. This method is nothing more nor less than reversing the tickler so that its power is turned back into the grid circuit in the *reverse* direction. This serves to damp out the signals rather than build them up, as is the case in the ordinary regenerative set. But, in order to make the radio frequency tube operate at its greatest possible efficiency, its plate circuit is tuned so that some regeneration is obtained and the tickler is used to control the oscillation characteristics of the tube.

THE MONOPHASE set described in this article was constructed in the RADIO NEWS *laboratory and was subjected to a very thorough test. The operation was very satisfactory, and we recommend it to our readers as an interesting and promising circuit for experiment.*

It is exceedingly selective and does not radiate when properly adjusted. Considerable care should be exercised in adjusting it, however, for if the adjustment is not made properly it becomes a powerful squealer.

The set can be logged very accurately, and will bring in all the DX that one could desire. In fact, it compares very favorably with any set we have heretofore tried. The selectivity was such that it was an easy matter to tune in WEBH (Chicago) through WHN (New York), a difference of 10 meters in wave-length, and a difference of only two divisions on the dial.

Many distant stations were logged in the RADIO NEWS *laboratory, which happens to be located in a very unfavorable spot for such testing, on account of the shielding effects of the large steel buildings in downtown New York.—EDITOR.*

This circuit is one of the best, tube for tube, that has ever been brought out. The great difficulty with it and the reason it has never gained a wide popularity was the trouble encountered in operating it. A great deal of practice and patience is necessary, and the ordinary broadcast listener, when he has a family that wishes to enjoy the product of the radio set, is loath to install an instrument so fraught with difficulties.

Now comes an improvement on the superdyne principle which circumvents the difficulties encountered in the original and at the same time retains the greater part of its efficiency.

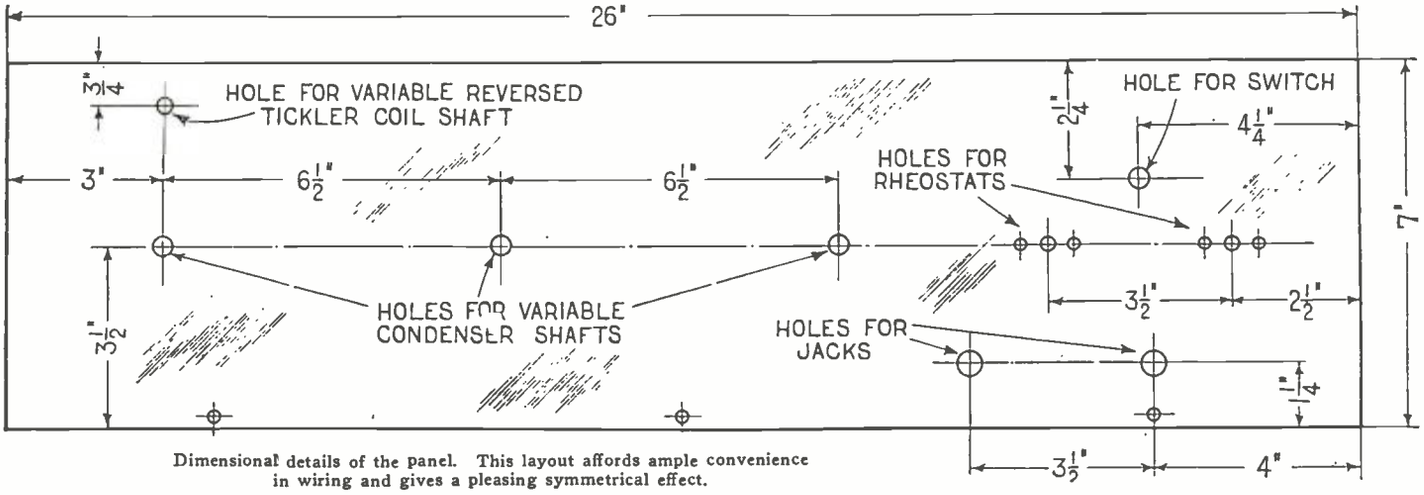
This is the Monophase described in this article.

First will be discussed the theory upon which the circuit operates, in the second place the construction of the set and then its operation.

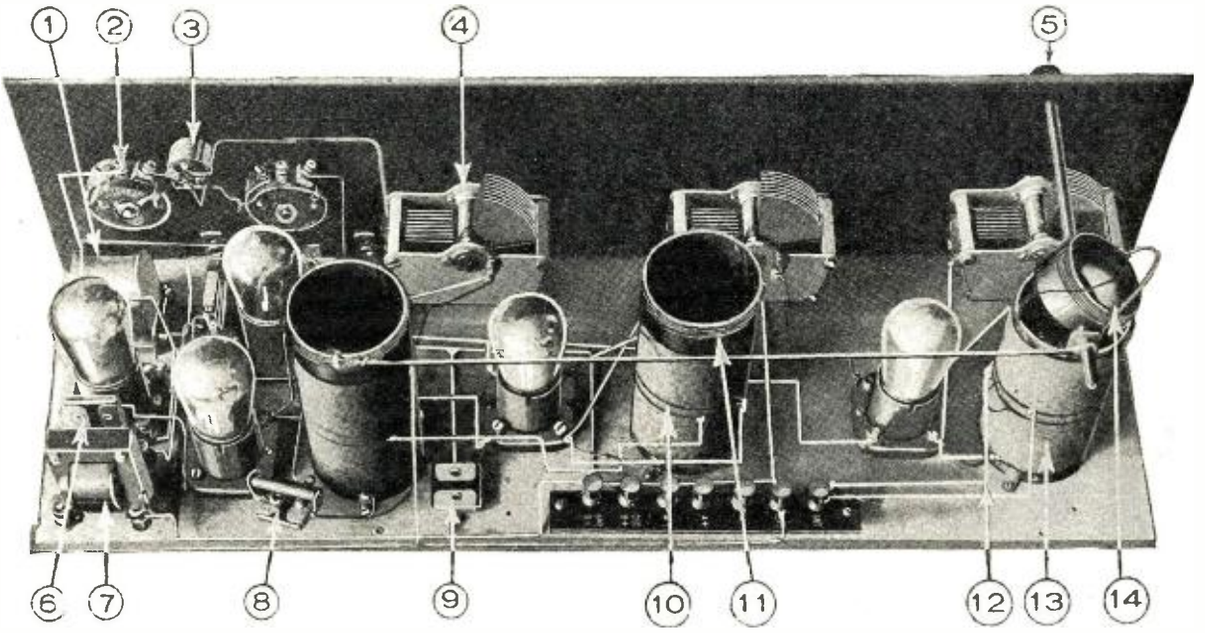
It is well known that when several stages of radio frequency amplification are employed in radio receivers there is a tendency for self-oscillation to occur in the circuits. This is due to the feeding back of radio frequency energy from the plate circuit of a tube to the grid circuit of any other tube, or to its own grid circuit. The incoming signal voltages, therefore, act as a trigger, releasing a large amount of energy stored up in the "B" batteries, which tends to drown out the signals and at the same time radiate energy from the antenna connected to the receiving station. This radiated energy causes considerable annoyance to neighbors, as well as preventing them from receiving the signals they desire.

FEED-BACK

The feed-back of energy referred to in the paragraph above was accomplished either through the capacity existing in the tubes or through magnetic coupling between coils in proximity to one another. There are, in general, three ways of preventing this feed-back: *viz.*, the introduction of resistance into the oscillatory circuits, neutralization of the tube capacity or magnetic coupling, introduction into the circuits of electro motive forces which have a polarity (or phase) opposed to that of the incoming signals.



Dimensional details of the panel. This layout affords ample convenience in wiring and gives a pleasing symmetrical effect.



The Monophase in full dress. Nos. 1 and 7 are the audio transformers; 2, filament rheostat; 3, switch; 4, variable condenser; 5, coil control; 6 and 9, by-pass condensers; 8, grid leak and condenser; 10, primary winding; 11, bucking coil; 12 and 13, secondary windings, and 14, the variable coupling bucking coil.

The last method is that employed in the superdyne receiver and is also the method which has been employed in this receiver. There is a difference, however, in the way in which the circuit stability is accomplished, for in the superdyne this so-called "negative feed-back" is accomplished by coupling a coil in the plate circuit of a stage to a coil in the grid circuit, whereas, in the Monophase system the coupling is between a coil in the filament circuit and the one in the grid circuit.

The fundamental circuit diagram is shown in Fig. 1. Here the common terminal (the negative filament connection) is broken and the feed-back coil connected across the break. The polarity of the feed-back coil is to be made such that it will prevent self-oscillation; that is, when the set is put in use, the amplification should decrease as the coupling is increased. When the coupling is loosened the amplification will gradually increase up to the critical point, at which oscillations will occur.

It has been generally noticed that in regenerative receivers, more especially of the three-circuit tuner type, changes in the tickler coupling will change the setting of the tuning condenser. In this arrangement, however, the coupling between the feed-back coil and the coil in the grid circuit is made very loose, so that the reaction between the two circuits is very small. This loose coupling prevents the tuning circuit from being appreciably affected by the setting of the feed-back coil, so that the tuning of the set will always remain nearly constant.

Fig. 2 shows the complete wiring diagram of the set. Three such feed-back coils are used, one for each stage of radio frequency amplification and one for the detector circuit. One might think that by using so many adjustable parts, the operation of the set would become very complicated. Such is not the case, however, for it will be found that two of the feed-back coils can be left untouched once they are adjusted, so that the number of tuning controls in the set is reduced to the three condenser dials and one dial for adjusting the first feed-back coil or compensator.

The idea is that the second stage of R.F. amplification is adjusted on the long waves, so that, as the feed increases with the short waves, there will be less tendency for oscillations. That is, the set is tuned in on the longest wave it is desired to receive, say 600 meters, and the second and third compensating coils adjusted carefully to the point at which howling just ceases. After this, they can be left alone, for on all wavelengths shorter than this there will be less tendency for self-oscillation to occur, on account of the increased negative feed-back on the shorter wave-lengths.

AMPLIFICATION

The amplification in these stages will always be high, however; in fact, it will be very close to the amplification obtainable at the critical point, for exceedingly small adjustment of the compensators is necessary to start or stop oscillations. After the second and third compensators are properly adjusted they are to be left alone and the circuits can be brought up to the critical point by manipulating the first compensator alone.

The photographs show the arrangement of the apparatus in the set. There is nothing unusual in the general layout, except that the spacing between the several coils is rather generous and the rest of the apparatus must be of good design. The audio frequency end of the circuit is the same as usual.

There is an interesting point in connection with the placing of the feed-back coils which deals with their position with respect to the secondaries of the tuning units. It will be noted in this circuit that the compensator is placed at that end of the secondary coil which is connected to the filament. There is a very good reason for this, it being that the controlling is done at the low potential end of the coil, and the adjustment of the compensators will not be so critical.

This is contrary to the general practice of placing ticklers at the grid end of the coil, but this latter is done in cases where it is desired to increase the regeneration by tightening the coupling. Again, it must be remembered that the third winding is not similar to the reversed tickler in the superdyne, but it does create a bucking E.M.F. which acts against the oscillating circuit and produces a tendency toward damping. It will be remembered, too, that the coupling must be loosened in this circuit to increase the regeneration. It is at once evident that we are not trying to increase regeneration. The only regeneration that will exist in the receiver is that which it inherently possesses due to the natural tendencies of radio frequency amplifiers.

We are thus merely taking the radio frequency amplifier as it is and reducing the seriousness of its great important fault by making this fault controllable. The potentiometer does this, and so do many other devices that are in use, but in this case the efficiency of reception is not reduced, since we are not introducing a resistance loss in the circuits, but an electro-motive force in opposition to the self-generated oscillations.

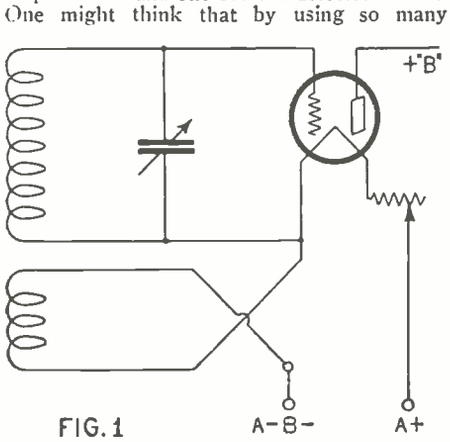
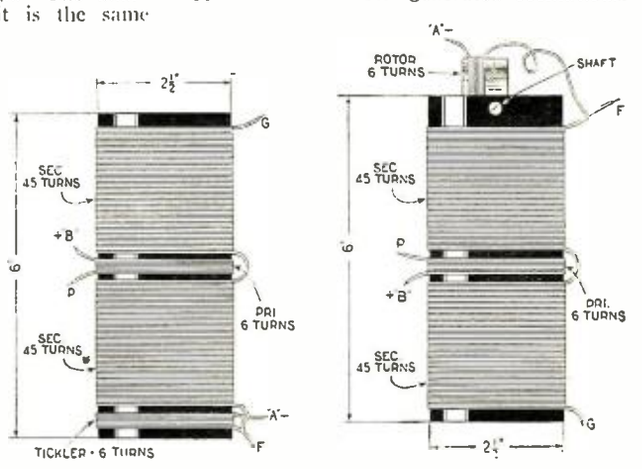
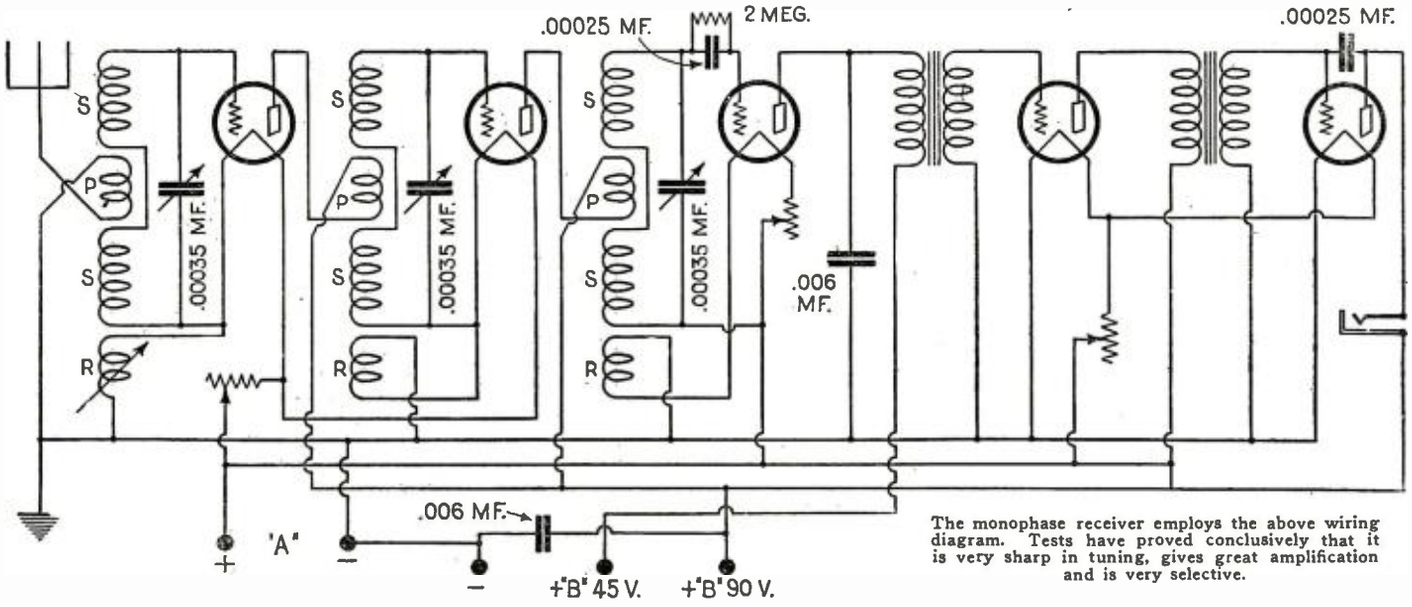


FIG. 1

Left: Circuit diagram which is the principle of the monophase. As can be noted, a reversed feed-back coil is incorporated in the filament circuit.

Right: Details of the radio frequency coupling transformers. Two of the first type and one of the second are needed.





The monophase receiver employs the above wiring diagram. Tests have proved conclusively that it is very sharp in tuning, gives great amplification and is very selective.

The construction of the coils to be used in this receiver is a very important one. The general construction can be readily learned by following the text of this article with one eye and the sketch shown in Fig. 3 with the other.

CONSTRUCTIONAL

The first step in assembling this receiver is to procure the best of the necessary materials. A 7 x 26-inch panel and a 7 x 24-inch baseboard are fastened together in the customary manner, after the panel is drilled with the necessary holes, as shown in the diagram.

The construction of the radio frequency transformers is not a difficult one. Three bakelite or hard rubber tubes 2½ inches in diameter and 6 inches long are required. There are wound 45 turns of No. 22 D.C.C. wire. A 6-turn winding of the same size wire composes a primary winding ⅛ of an inch from the first winding. The secondary winding is then continued for another 45 turns. The compensating coil is next placed on the tubing and consists of six turns of wire wound in the opposite direction to that of the other windings. Two small brackets are used to fasten the radio frequency transformers to the baseboard.

The above description pertains to two of the transformers, the third being slightly different in that the compensating coil, instead of being wound on the tube itself, is placed on a small rotor at one end of the tube. This rotor is a piece of bakelite tubing two inches in diameter and one inch long, at one end of which is placed the six-turn winding. It is not necessary that the wire be wound in any specific direction, since the coil can be readily turned through 180 degrees and thus change its polarity.

The wiring of the receiver is not very difficult, since there are no set rules, except that careful work brings good results. In case trouble is experienced from the beginning, the connections to the compensating coils should be reversed one at a time until the undesirable oscillations are eliminated. It will be found advisable to place two by-pass condensers across the "B" battery and also to use a .00025 mfd. condenser between the grid and plate terminals of the last audio frequency amplifier tube.

It was found that 20-ohm rheostats, of which three are required, gave the necessary critical adjustment and added remarkably to the sensitivity of the set.

As regards the selectivity of the set, it is safe to say that it surpasses the majority of those on the market today. In sensitivity, too, due to the exacting values of the apparatus used and the correct engineering principles involved, the receiver stands as a big step in the development of tuned radio frequency sets.

As will be noted, the coils are fully 6½ inches apart, reducing to a minimum the tendency towards inter-stage coupling with resultant oscillations. Two stages of audio frequency amplification will be found to give more than sufficient volume, it being necessary to incorporate a by-pass condenser across the grid and plate terminals of the last tube.

Radio As A Life Work

DISCOURSING on radio as a vocation, Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards, recently said: "The idea that radio offers a short cut to wealth with little work can be dismissed at once. There need be no 'forty-niners' rush to the 'gold fields'," he continued, explaining some of the mistakes which prospective engineers, salesmen and inventors may make, unless they pause before they leap into this world wide industry.

"Radio in its various phases has become a large and expanding industry. At the present moment there may be a slightly greater return for those engaged in constructing, engineering, selling and otherwise creating radio goods, than in other fields. But it by no means follows that the same skill or initiative or brains or personality or work put into radio will yield more money than in anything else during the next 10 years. It has been said that the opportunities in radio are a thousandfold greater today than 10 years ago. Yes, but if there are a thousand times as many people in it, the opportunity for each one is now exactly what it was then. The laws of supply and demand work rather fast. I am somewhat inclined to think that at the present moment people are going over into radio a little faster than the total number of existing opportunities warrants. This opinion may be wrong; a similar opinion might have been held of the automobile industry five to 10 years ago, and yet the automobile industry is by no means today strewn with the wrecks of blighted careers.

"Considered as an opportunity to do satisfying work and to give service, radio has great attractions. Bear in mind that radio as a vocation is very different from radio as an avocation. As an avocation or diversion radio has its greatest hold at the present time. Indeed, one disadvantage of radio as a vocation is that you are thus denied it as an avocation. I know some people won't agree with me on this. They think they can work at radio all day and get their diversion from it in the small hours of the night too. But, of course, a person's interests and thought are bound to become one-sided when he denies himself the relief that a true avocation supplies.

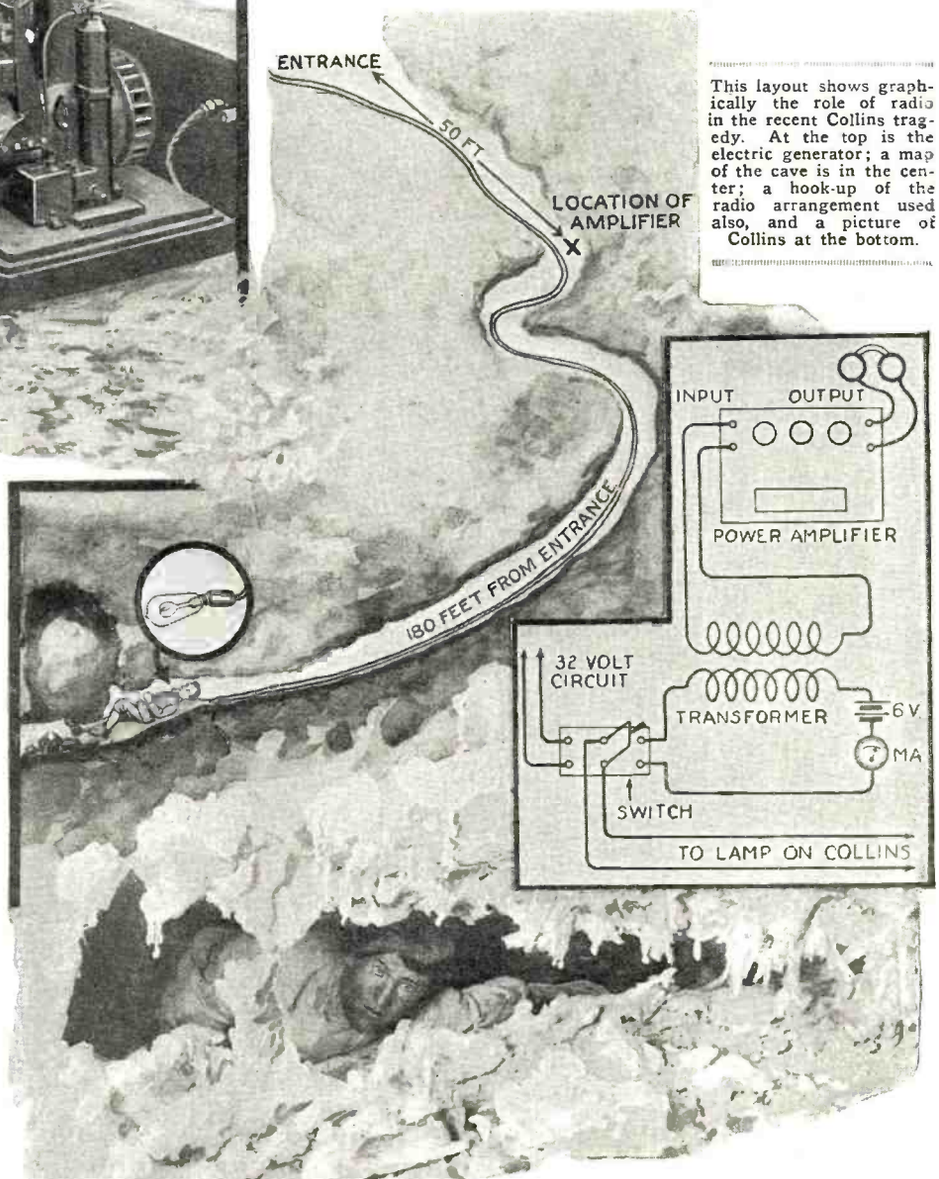
"Probably the chief satisfaction that the worker in radio derives is the certainty that he is in a growing, a valuable and an appreciated service. Only a few years now until world-wide telephony will be a reality. By a combination of wire and radio, people will converse across the oceans, and regular means will be provided to broadcast important speeches that will be heard simultaneously in every country on the globe. What further achievements there will be, only the imagination can suggest. Whether a worker be engaged in radio science, engineering, selling, publishing, operating or programming, he can feel that his contribution to these conquests is an essential one. Another fine thing about work in radio is that it leads inevitably to a widening of the horizon and a viewpoint not limited by national or any other boundaries. As the radio waves themselves spread out into all lands, so must the thoughts and plans of the worker in any of the branches of radio.

"It is only when we consider the several branches of radio that we come really to think definitely about radio as a vocation. You can't very well just go into *radio*. It must be radio operating, research, engineering, broadcasting, manufacturing, selling or publishing. The interest in radio is so great that an unlimited amount of information has become available, in magazines, in books, in schools, to all who wish to become learners. What a person can learn in any of the fields of radio work, first from these sources, and second from his actual experience in the job, is limited solely by his capacity for absorbing information.

"Formal training is a great help to the worker in any of the fields mentioned. Not that the college or school course of itself makes the man or brings greater rewards. It simply gives a greater knowledge of the subject and a broader grip on the implications of the subject and its place in the whole scheme of life, so that the trained man can more readily profit by new developments and perform services of real value in unforeseen circumstances and thus take advantage of opportunities. The particular branch of radio that one should enter depends on his natural bent

Radio In the Cave Disaster

By C. W. WILLIAMS, RADIO,9CSO



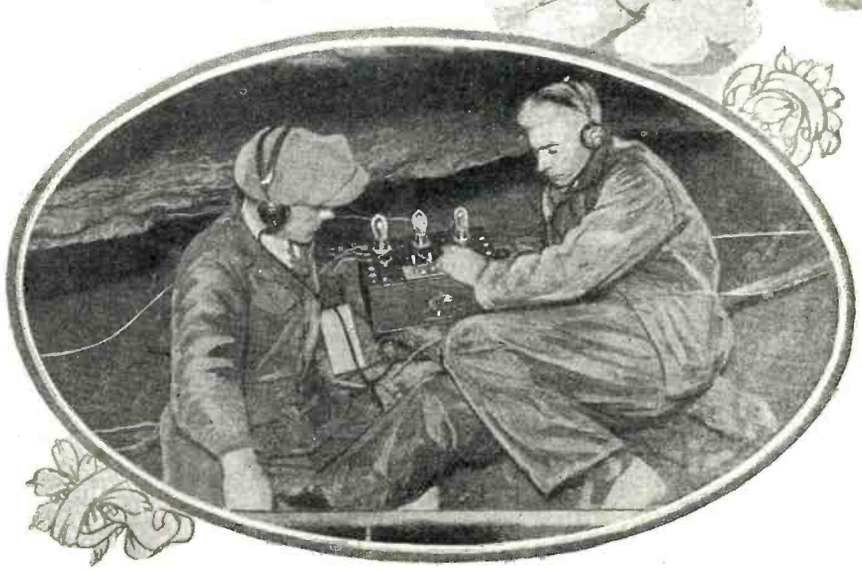
This layout shows graphically the role of radio in the recent Collins tragedy. At the top is the electric generator; a map of the cave is in the center; a hook-up of the radio arrangement used also, and a picture of Collins at the bottom.

RADIO NEWS is privileged to present here exclusively the log of Mr. C. W. Williams, Radio 9CSO, who was in charge of the radio installation at Cave City, Ky., in connection with the recent Collins disaster. He gives full details of the work that was done and the methods used.

WHEN there is dire danger, radio usually finds a place in the scheme of rescue. So it was simply more than logical that the newspapers carried accounts of the radio installation which kept the anxious watchers who held vigil outside the cave-prison of Floyd Collins, hopeful and working.

But none of the daily press carried a description of how the installation was made or operated. Below I present a full radio log of the days preceding Collins' death and how radio played so important a part, keeping the rescuers hopeful, and advising the doctors constantly of Collins' condition.

Mr. Lane, who has charge of the Delco lighting system at Sand Cave, called me over the telephone and asked if I could use any radio apparatus or amplifiers on the lighting circuit running back to Collins, so as to determine whether or not he was moving or living. He advised that a 25-watt lamp in a weather-proof socket had been placed on Collins' chest with blankets over and underneath the lamp, and that the circuit had only this one lamp in it inside the cave. He also stated that the connections where the weather-proof socket was connected to the No. 10 insulated copper wire from the lighting circuit were very loosely made up, and this is the point I worked from.



CONNECTIONS

I took the following apparatus back in the cave far enough to be away from any outside noise, cut the lighting wires and connected up the apparatus as shown in the accompanying diagram. The apparatus used was a three-stage power amplifier, using 201-A tubes with 90 volts on the plate and 6 volts for filament from storage battery. The wires going to the lamp on Collins' chest were connected in series with the primary of a G-E audio frequency transformer and four dry cells, 6 volts and a milliameter as per diagram. The secondary of the transformer was then connected to the input of the power amplifier and headsets connected to the output of the amplifier.

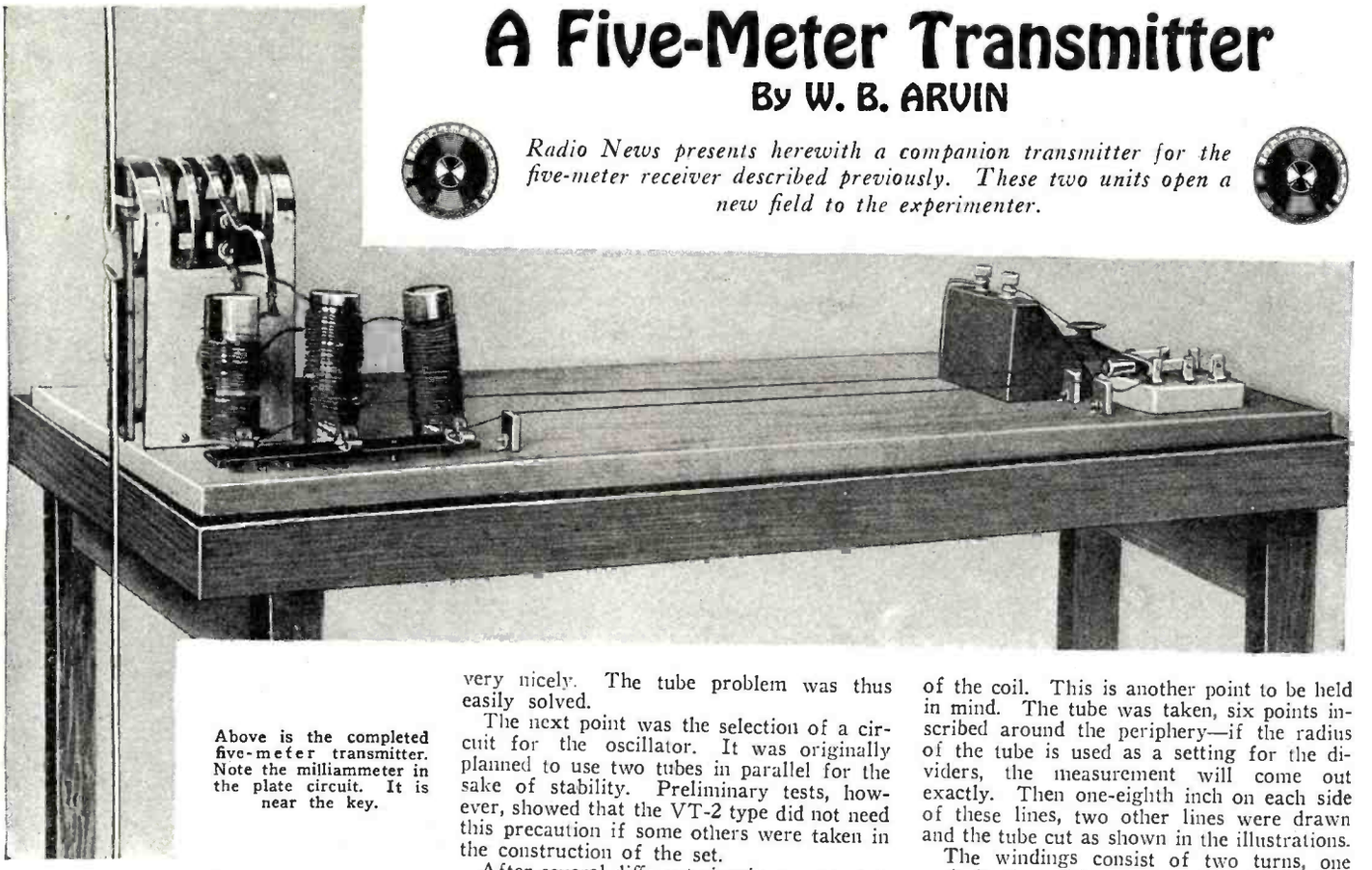
After determining that all connections were good at the end where we were testing, and that there was not a connection or

(*Continued on page* 2171)

A Five-Meter Transmitter

By W. B. ARVIN

Radio News presents herewith a companion transmitter for the five-meter receiver described previously. These two units open a new field to the experimenter.



Above is the completed five-meter transmitter. Note the milliammeter in the plate circuit. It is near the key.

EVER since the first amateur work was done on the ultra-short wave-lengths, there has been a constant stream of articles dealing with the construction of apparatus for the purpose of transmitting and receiving signals on these bands.

Many of them were, of course, excellent, but were experimental in the extreme. Following the building of the receiver shown in the March issue of RADIO NEWS, the laboratory staff started work on an efficient and easily made transmitter to work at the same wave-length. The results are shown in the accompanying photographs.

Before any actual work was done, there were several questions which had to be answered. It was necessary that all these points be noted down and all the available information on the subject gathered together and digested.

TUBES

The first point, of course, was the selection of a tube which would have sufficient capacity to allow of a respectable radiation, since the set was built primarily to work over a few miles and in spite of the great amount of steel and other metals in the path of any station which attempts work in New York. A VT-2 was first used, but on account of the excessive plate voltage which it was wished to apply—in order to radiate the greatest possible amount of energy—a brush discharge occurred at the press in the tube where the plate and filament leads entered the glass.

Of course, it is hardly necessary to mention in connection with short wave work that the first step in preparing any tube for work is the removal of the base. The VT-2 worked admirably when the plate voltage was kept below 500. Through the courtesy of the DeForest company, the laboratory obtained two tubes with separate plate and grid leads brought out the side of the tube. A thousand volts was put on the plate and the milliammeter jumped to 126 mils plate current. Of course, the radiation increased very nicely. The tube problem was thus easily solved.

The next point was the selection of a circuit for the oscillator. It was originally planned to use two tubes in parallel for the sake of stability. Preliminary tests, however, showed that the VT-2 type did not need this precaution if some others were taken in the construction of the set.

After several different circuits were tested, the one shown (a coupled Hartley) in the accompanying diagram was hit upon and proved to be the most satisfactory from every point of view. Aside from its electrical characteristics, it has the very distinct advantage—from the short wave point of view—of lending itself admirably to the mechanical design.

And here is a point that is extremely important in this work. Panels, dials and everything possible that is not directly necessary to the correct functioning of the set should be deleted once and for all. The least of every substance but air and ether in the immediate neighborhood of the transmitting and receiving apparatus is a condition of affairs much to be desired. Therefore, the precaution noted here. Cut out everything! It is never a good point to sacrifice neatness and symmetry, but in the present case neatness, and particularly symmetry, do not fit into the electrical scheme of things.

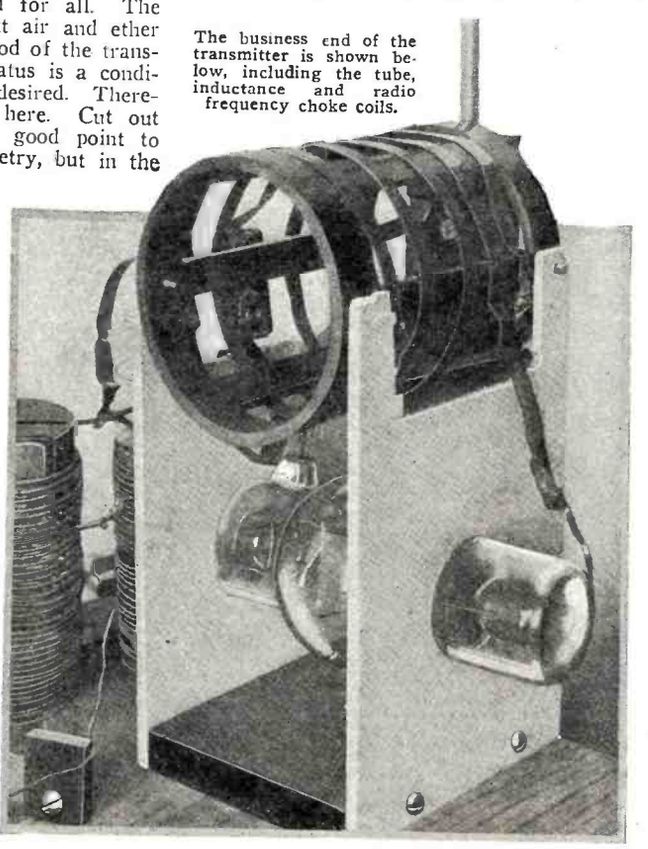
INSULATION

Then there was the necessity of insulation — not necessarily, except that the tuning and oscillatory inductances must be wound on some sort of support. Bakelite must at once be dismissed. It was found that this usually excellent stuff becomes almost a conductor at the ultra frequencies employed. Glass was found to be good, but at once obvious difficulties arise in the matter of working it. Hard rubber was finally selected and proved to be good. The coils were wound on three-inch tubes which had been cut out as shown in the photographs. It is necessary, also, to have the least possible amount of insulation in the oscillatory field of the coil. This is another point to be held in mind. The tube was taken, six points inscribed around the periphery—if the radius of the tube is used as a setting for the dividers, the measurement will come out exactly. Then one-eighth inch on each side of these lines, two other lines were drawn and the tube cut as shown in the illustrations.

The windings consist of two turns, one each in the grid and plate circuits. These are placed near the outside end of the tube and one-half turn is placed in the center between them for the transfer of energy to the antenna circuit. The windings were made with No. 24 gauge sheet copper cut into ribbons, three-eighths inch wide. Ribbon is possibly the best to use in this position and it should be very wide in preference to being very thick.

The support of the tube is, of course, a question. The special tube used in this case, having two protruding ends, was suspended

The business end of the transmitter is shown below, including the tube, inductance and radio frequency choke coils.



between two asbestos boards drilled to take the ends of the glass. Asbestos must be used in order to withstand the heat generated when the set is in full operation.

The leads from the tubes are taken directly—as directly as possible—up to the terminals of the coil. As before, the main point in the construction of apparatus to work at such wave-lengths is extreme compactness and the absence of everything not absolutely essential to the set.

By the use of a small insulating strip placed in front of the coil support, a standard for the antenna and counterpoise is permitted. In the present instance, it was fitted with two bushings into which the ends of the rods forming these two units of the radiating system could be screwed. This is a point included only to make the set a bit more handy when it is to be moved.

AERIAL SYSTEM

The rods should be in the neighborhood of 40 inches long. The actual radiated wave may be controlled by increasing or decreasing their length. No tuning device was employed in the grid or plate circuit since it was found unnecessary. The condenser across from the plate to the filament may be of small value, its absolute capacity is a matter of cut and try and is discovered by the good old method of substituting different condensers until the proper capacity is found, that is, until one is used which gives the best actual results. No grid leak was used since the grid return was made to the negative end of the filament. Many old experimenters will at once look askance at this point. The only refutation of their arguments as to its necessity is the fact that the set worked, and worked beautifully, without it. Its addition would only add to the complication of the construction and lengthen the leads. Furthermore, it is more than likely that the leakage which occurs at these very high frequencies may offer all the leak that is necessary.

In case a standard VT-2 is used as the tube, it may be mounted against a section of asbestos board similar to that used in the present case, and the support changed and put into the position of the insulating strip in the present case. Then the antenna and counterpoise may be fastened to the back of the asbestos board with the interposition of a bit of insulating material. The coils for the oscillating circuit may be wound in the same way and the tube held, bottom up, by a couple of insulating pieces. By supporting it in this fashion, the shortest possible leads are available.

The old designer may question the length of the baseboard and the size of the choke coils. The use of the latter is obvious. Unless they be inserted in the circuit, the radio frequency current generated by the oscillator will be flowing all over the set—if the tube is good enough to oscillate without them. They are simple in the extreme, being nothing more than 50 turns of No. 24 single cotton-covered magnet wire. The rolls of mica in them, shown in the photographs, are simply to keep them upright and reduce vibration to a minimum.

The baseboard is used in the present form simply for the sake of having the set compact and complete in one unit. It is necessary on account of the capacity of the person of the operator to remove the key some distance from the business end of the arrangement, therefore, the length of the board.

OPERATION

After the set was erected and put into operation with the aforementioned 1,000 volts on the plate, the set was started up. Some difficulty was at first experienced in forcing the tube to oscillate, but once started it continued and was very dependable.

As is noticed, the key is inserted in the grid return. In this position it works very well and there is no noticeable key click. It was tried in other locations and the present one was found to be the best after tests. A resistance and condenser may be used across it if necessary, though the chances are, such an arrangement will be found of no particular use as far as results are concerned.

In conjunction with the receiver described in these columns a few months ago, the set was tested in the downtown district of New York. The transmitter was set up in one office building and the receiver in another, a short distance away. Communication was immediately established.

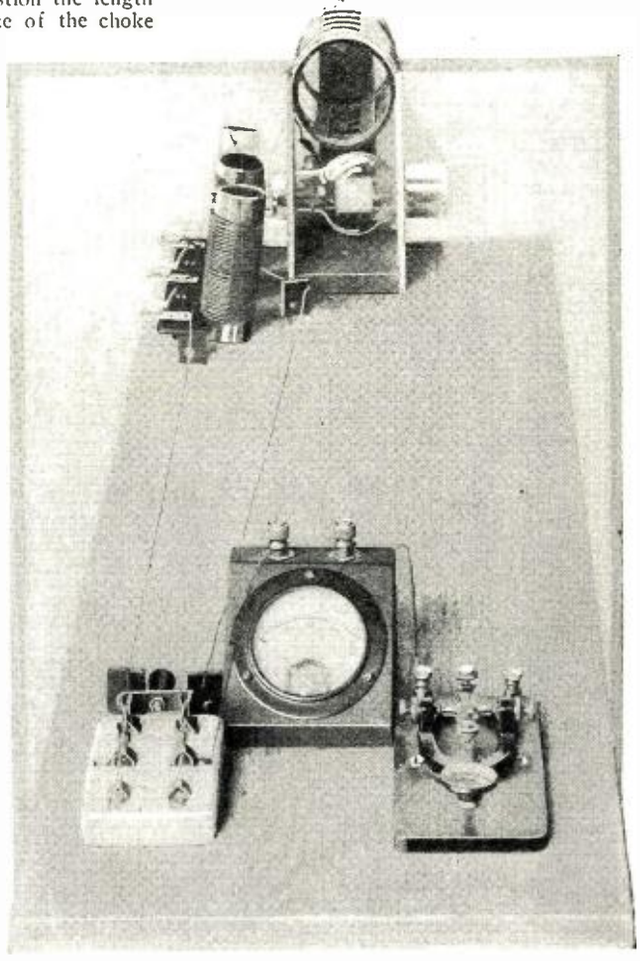
This was considered a good report for the first operation, since both buildings had extensive steel frames and there was an elevated railway structure directly in the path of propagation.

After the set was properly operating, there was the question of computing the exact wave-length at which it was operating. The only method available which would permit of any degree of accuracy was the old Leisher parallel wire method, *i. e.*, stretch two parallel wires together, place an absorption loop on one end, couple it to the source of oscillation, and with a Neon lamp, or miniature electric light, find the voltage node by sliding the lighting device along the length of the wires until the glow is found. Following this, when the point of lighting has been well established, the distance may be measured between the two points and multiplied by four, giving the approximate wave-length.

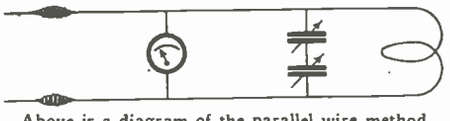
A great deal of trouble may be experienced here unless the wires are several times longer than the wave-length. The glow will occur at several points, due to the reflection of the waves from the ends of the wire. This point is discussed to some extent by Mr. W. A. Bruno in his recent article in RADIO NEWS on short wave work.

The preliminaries having been performed, the experimental work of actual transmission over distances will be continued and the readers of RADIO NEWS will be advised of it as the results are obtained.

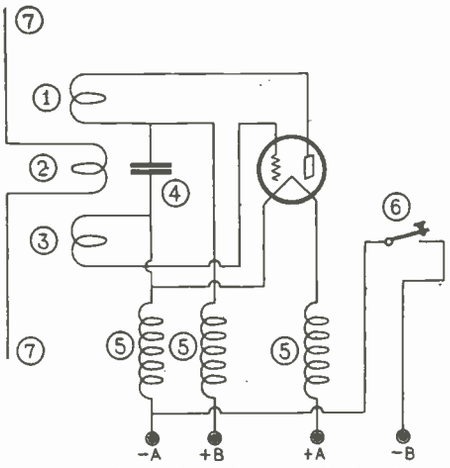
NOTE: It must be remembered that the set described here, with the antenna and counterpoise in place, may not be operated without a license from the Bureau of Navigation, United States Department of Commerce.



A view of the transmitter from the key looking toward the tube, inductance and aerial. Note the placement of the antenna and binding posts.



Above is a diagram of the parallel wire method of measuring wave-lengths of the five-meter transmitter. The series condensers give the necessary small capacity.



The complete wiring diagram of the short wave transmitter is given above. 1 is the plate inductance, 2 is the antenna coupling coil, 3 the grid coil, 4 the insulating condenser, 5 shows the radio frequency choke coils, 6 is the key in the grid return and 7 is the antenna and counterpoise system.

RADIO TO HELP AMNESIA VICTIMS

Victims of amnesia will be benefited by radio, if plans of wellfare workers are carried out. Persons who lose their memories and are held in various hospital wards, due to inability of authorities to establish their identification, will be presented to the general public before radio broadcast stations in the hope that their voices will be recognized by friends or relatives. A young woman in Kansas City, Mo., recently had forgotten her name and her past life. She was taken in charge by welfare authorities, and at length gave a short talk before the microphone and she was identified by persons who listened in.

The Most Novel Super-Heterodyne

By D. C. WILKERSON

Mr. Wilkerson presents an almost revolutionary principle in the Super-Heterodyne scheme detailed in the article below. Every experimenter, as well as layman, will be extremely interested in the possibilities it admits.

IT is the ambition of every scientist and experimenter to produce the *ultra* in his line of work. That is natural, and it is the thing that makes experimentation and study in scientific work so fascinating.

Ever since Major Armstrong announced his Super-Heterodyne circuit, there has been a strong and continuous interest in it, and many novel variations of it have appeared before the public in these and other columns. One very notable variation of the principle is the circuit devised by R. E. Lacault, former associate editor of RADIO NEWS—the Ultradyne.

There have been others. Many different styles of oscillators and detectors, and varied types of radio frequency transformer cascades have been tried out. Some have been built for antennae and others have been made solely for loop aerial work.

THE STANDARD TYPE

The customary style of Super-Heterodyne common among those who build their own, has eight tubes in straight amplification work. There is a first detector and oscillator, a three-tube cascade of radio frequency, a second detector and two audio frequency amplifiers. This requires first of all a large panel and a long one, and a considerable amount of accessory instruments.

IN publishing Mr. Wilkerson's article, we must make it plain that this is as yet a theoretical circuit. Although Mr. Wilkerson has done quite a good deal of experimental work on the circuit, much remains to be done.

Another article, giving more data on results, will be published in a forthcoming issue of RADIO NEWS, *this article also being written by Mr. Wilkerson.*

We are publishing the article chiefly on account of its novelty. It embodies some good ideas and the readers are given much food for thought, particularly those readers who care to leave the beaten path. We are all apt to follow along somewhat the same lines, and it is most refreshing to stray afield once in a while.

Coming into vogue today is the application of the reflex principle, and we are discovering that many ingenious designers are getting double work out of their tubes by clever handling of reflex ideas. The application of reflex to the Super-Heterodyne, however, is simply carrying out the old adage, "Every little bit added to what you've got," and the true meaning of reflex-plus-super is only to reduce the number of tubes required to run the set.

There are so many and varied adjuncts to the art of radio that one is always at a loss to know what principles or instruments to use when a certain result is desired.

This writer is one of the many who decry the "blooper" and believe that legislation should be enforced to drive the radiating set out of existence for good and all. Carrying out these ideals practically, the writer must perforce own and operate a radio set which will not annoy the neighbors, and which will not radiate disturbing impulses of a radio character.

Like many others, also, this writer desires to own a most efficient radio set, one which will reach out to the nethermost parts of the world and drag in the distant stations. One, under these conditions, naturally turns to the Super-Heterodyne.

This writer is one of those, also, who desires to build his own set instead of getting a "boughten" receiver.

Summing up the requirements for a Super-Heterodyne which shall not radiate, which shall not be factory made and which shall incorporate something new in the way of contribution to the art, we are confronted with these things:

1. We will not fool with reflex. Practically everyone else has, and we would not, therefore be traversing virgin ground.
2. We must consider deeply some way to avoid oscillation in the first detector. Here is where radiation can start.
3. We must prevent spilling over from the oscillator circuit which heterodynes into the master circuit.
4. We must stop all oscillating tendencies arising from faulty radio frequency construction, feed-back from second detector circuits and throw-overs from the audio end.

CRYSTAL DETECTOR

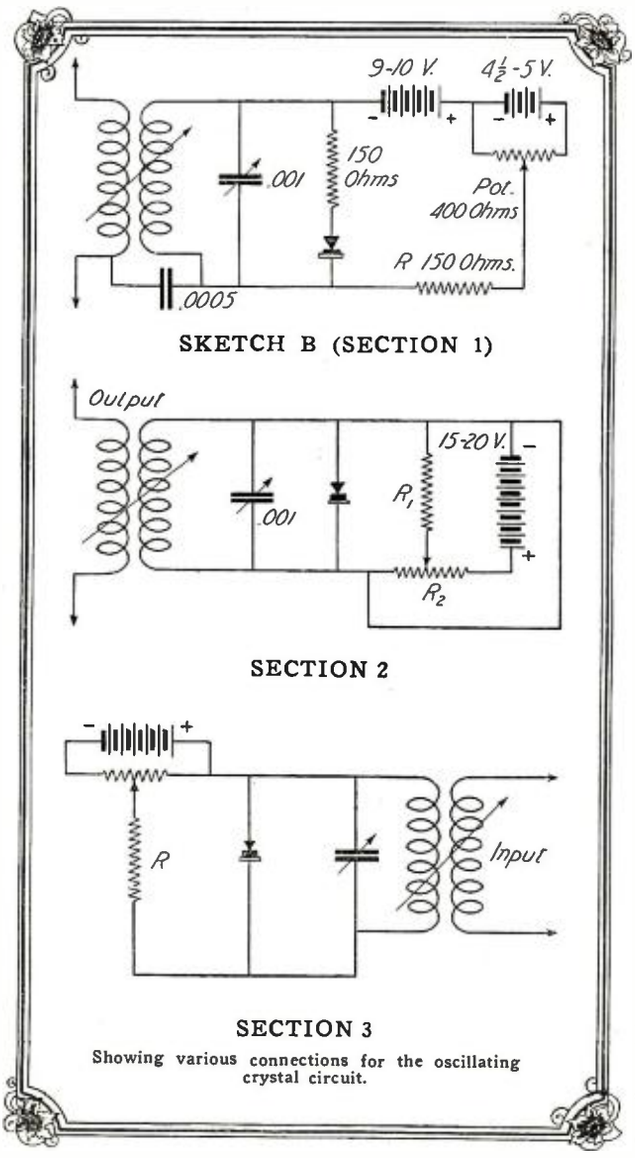
The first consideration then is to eliminate oscillation from the first detector. A bold stroke here would be to substitute for the customary tube at this point, a crystal, or else some other detector which would not and could not oscillate.

Right here and now, this writer is going to "start something." He is going to try out the much despised and little used electrolytic detector. Don't laugh at this. Just remember that the first real and reliable distance transmission and reception records in wireless were due to the success of this type of detector.

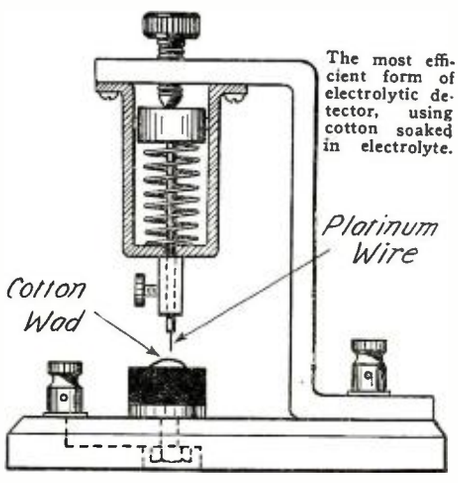
This writer remembers, many years ago, in 1910 and 1911, when the present editor of this magazine, Mr. Hugo Gernsback, was piloting his first radio publication, MODERN ELECTRICS, and how the introduction on the market of the old E. I. electrolytic detector made great distance records for the amateurs. This device had a small Wollaston wire (a very small diameter platinum wire) with adjusting means, to dip into a carbon cup filled with weak muriatic acid solution.

ELECTROLYTIC DETECTOR

The wide prevalence of lead-sulphite ore, the purer parts which could be used as detector crystals (galena) drove the unsteady electrolytic detector to an early and unjustified grave. This writer believes that the radio art would have been much farther advanced in the progress of the study of ion and electron movements if the electrolytic detector had been kept alive in the art at the time of its popularity.



Showing various connections for the oscillating crystal circuit.



The most efficient form of electrolytic detector, using cotton soaked in electrolyte.

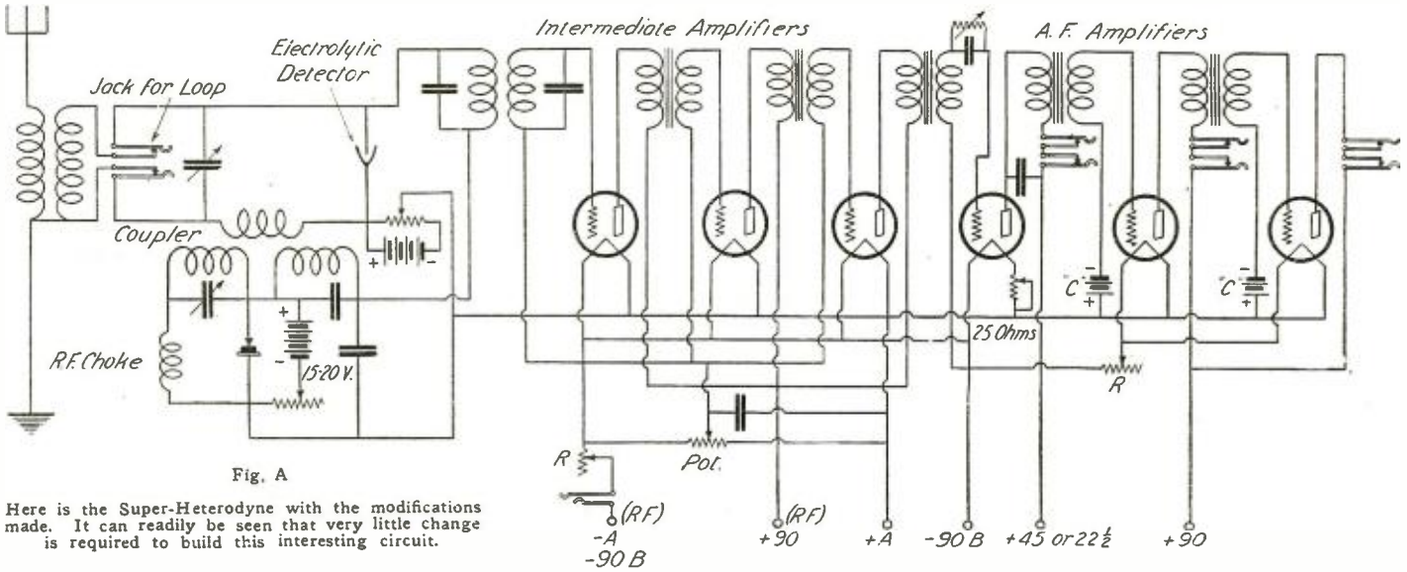


Fig. A

Here is the Super-Heterodyne with the modifications made. It can readily be seen that very little change is required to build this interesting circuit.

Another reason for the early demise of the electrolytic detector was that it had to have a steady table, undisturbed by jolts, swings or jars, such as encountered at sea, to perform its best. Upon what tiny things does the fate of ideas rest! If these early electrolytic pioneers had only done what this writer had done, put a small ball of absorbent cotton soaked in the electrolyte in the carbon cup. No matter how much the ship rolled, we always had contact, and the old Wollaston wire brought in the message. The tiny fibres of cotton clung to the platinum wire and seemed to improve the character of reception.

Then, we are going to try out electrolytic means in a first detector. So far so good. How about the oscillator?

Surely we will have to eliminate for good and all any chance of undesirable oscillation from this source so we will also dispense with the oscillator tube. There's nothing like being original, anyway. What can we get to do oscillation work with? How about one of those fixed crystal quartz oscillators? This would give us a nice continuous frequency without variations. How would we vary this frequency, though? We'd have to devise some means of tuning which would bring the resultant oscillations within the super-audible frequency peak of the intermediate stages of radio frequency amplification.

A quartz crystal is not the only means by which we may obtain oscillations to heterodyne the incoming signal down to the proper frequency range.

There are many kinds of odd oscillating mediums, but few are adaptable to the reception of modulated signals. Let's look around. How about another relic of radio's forgotten graveyard? How about trying out the old piece of zincite and a steel needle contact? Lossev, the celebrated Russian scientist, has accomplished some remarkable results with different crystals, having produced amplification and many other radio phenomena, as told in the pages of RADIO NEWS from time to time.

We will not try to devise any further means for detecting and oscillating at this point. Just now we have enough new material to work with.

HETERODYNE THEORY

Let's review our theory a bit. The ordinary Super-Heterodyne works on the principle that the incoming signal is used to create a flux field in a circuit, which generates a current of feeble intensity in that circuit. This current is placed in phase or in resonance with a connected circuit, where it is led to a vacuum tube grid, the impulses being there detected, heterodyned through a separate coupled oscillator circuit and then fed into a cascade of super-audible frequency stages and amplified. The output end of this latter amplifier bank is led to the input side of a second detector where the impulses are chopped down again, but this time to audible frequency, to pass on through into audio frequency stages to the final output—phones and loud speaker.

Our immediate problem is to substitute for the first detector the electrolytic detector. How this is done is shown in Fig. A. So far so good.

Thus far no complications have arisen. Now we are confronted with the problem of substituting an oscillating medium for the first and only oscillator tube. The general scarcity of oscillating quartz crystals, and the rather easy access to zincite crystal supplies in most parts of the United States, leads us to try out this latter means in order to lay down a plan that most any radio experimenter can follow.

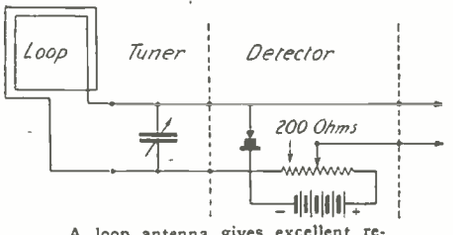
The zincite-steel combination is known as the *Crystodyne* detector, and it has been afforded considerable space and discussion in the columns of RADIO NEWS under the names of the editor and I. Podliasky, E. E. On page 294 of the September issue and on page 470, October issue, a good, clear understanding of the Crystodyne idea is given. It can be used for straight detection, for spark and arc detection, for regenerative action, for oscillation and for audio frequency amplification, as well as radio frequency amplification.

We are more interested here in the means for obtaining oscillation, and the impressing of it on the detector circuit, so that the incoming signals may be heterodyned into the intermediate radio frequency amplifier. The customary coupler is used, inductively connecting the oscillator into the detector circuit.

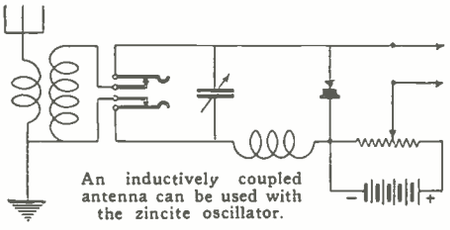
Fig. A shows a trial hook-up of the Super-Heterdoyne equipped with a first detector of the electrolytic class, and an oscillator of the Crystodyne type. This hook-up will not be the ultimate one, as there has not been time before this publication goes to press to work out the different association values and the circuit constants best fitted to provide oscillations.

Several different methods of producing oscillations and the way to impress them on the electrolytic detector circuit are shown in Fig. B. Naturally, the coupler and tuning condenser values will depend upon the frequency at which it is desired to operate the radio frequency stages. The writer is equipped with 45,000- and 35,000-cycle R.F. transformers, and the variable condenser value of the tuner of .001 mfd. is the one to be used under these conditions.

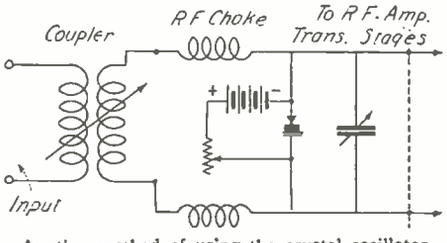
Section 2 of Fig. B shows a variation allowing finer adjustment of the battery voltages across the crystal, which will be found to be very critical at best.



A loop antenna gives excellent results with this super.



An inductively coupled antenna can be used with the zincite oscillator.



Another method of using the crystal oscillator as an autodyne, dispensing with a separate oscillator. The variable condenser readily governs the frequency.

ADJUSTMENTS

It has been found, thus far, that a sharp click will be noted if head-phones are bridged across the output of the oscillator when it is on the job as such. When it is not oscillating, the click will not be noticed.

The potentiometer adjustment allows considerable leeway in changing the oscillation frequency of the zincite-steel combination. A Victrola needle pressed tightly against a zincite crystal gave the best preliminary results.

Filing off the crystal or digging out a small pit in which to seat the steel point gets better and more positive results.

The theoretical considerations involved in the operation of this type of oscillator are too broad to be gone into in a short article such as this. The solution of the practical

(*Continued on page* 2132)

The Most Selective Set

By ALFRED R. MARCY

With the reassignment of wave-lengths recently made, the more selective a set is the better. The receiver described should be of great interest.

An inductance and variable condenser comprise a unit which can be used as wavemeter or wave-trap.

WITH the constant increase in the number of broadcast stations in every populous city, the question of receiving anything but the most powerful local station becomes of the utmost importance. In fact, with a majority of the sets now on the market, it is almost impossible to get an out-of-town station operating on a wave-length anywhere in the immediate neighborhood of the locals.

The set described in this article is undoubtedly the most selective one possible, incorporating at the same time no new device and very simple tuning.

Let us see first how the idea incorporated in the design is arrived at from well-known principles and adaptations. Examine Fig. 1 carefully. It will be seen immediately that it is the well-known tuned impedance coupled receiver consisting of one stage of radio frequency amplification and detector. The antenna circuit is of the shock excited type which is finding more and more favor with everyone because of its advantage in helping to reduce the number of controls. It might also be worth while to mention that the antenna circuit is known as an aperiodic one; that is, one which is not tuned to any particular wave-length.

Besides the fact that the primary inductance contains but a few turns of wire, it is variable in coupling to the secondary or grid circuit. This feature enhances the possibility for the elimination of undesirable interference.

It will at once become apparent that maximum transference of energy from the antenna circuit to the grid circuit of the first tube will not occur, due to, first, the small number of turns, and second, to the loose coupling. However, this condition does not appreciably affect the DX ability of the set.

In the case where considerable trouble is experienced from nearby stations, the antenna system can further be altered by the insertion of a wave trap such as that depicted in step 1, Fig. 1. This trap circuit made up, preferably of a coil and variable condenser the constants of which the range of wave-lengths to be received should cover from 200 to 600 meters approximately for the broadcast waves. Having adjusted C_1 and C_2 for the desired station and still experiencing interference, C_3 is slowly turned until the undesired station's signals completely disappear.

Again, some will not approve of this method because it introduces more resistance into an already high resistant circuit—the antenna. True, it must be admitted that such is the case, but if reference is made to step No. 2, practically the same results will be obtained, there being manifest a very small increase in strength of all incoming signals over the case of step 1, Fig. 1. The degree of coupling can be varied until all the interference is entirely done away with, without materially affecting the strength of the desired signal.

Let us now refer to the secondary, or grid circuit. Here, the very best arrangement has been found to consist of an inductance and suitable variable capacity with which to cover the desired range of wave-lengths. Again, it is sharply drawn to one's mind that the coupling between antenna and grid circuits bears a great significance in overcoming interference. If the coupling is close, there is a slight tendency towards tuning the antenna circuit inductively by means of C_1. This is highly desirable, since a maximum transference of energy will take place, but we are very limited in this respect. Absorption takes place and especially when the circuit is a regenerative one, as in this case, due to the tuned plate circuit, radiation takes place from the antenna circuit to a large degree. This is again highly undesirable because it interferes with our neighbors' reception. Rather than change the grid circuit then, let us now turn to the plate circuit.

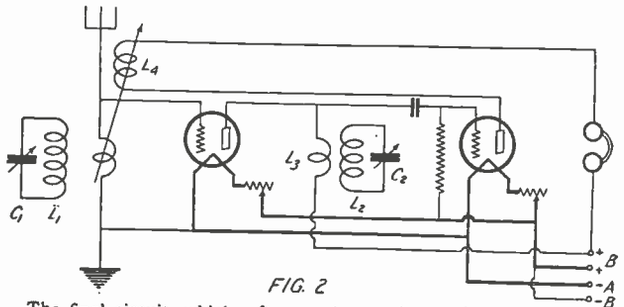


FIG. 2

The final circuit, which, after much experimentation, has proved to be the most selective one ever constructed.

It has been found that tuned impedance coupling is far superior to untuned or choke coil coupling. Whereas the latter method (which can be consummated by removing the variable capacity C_2 from across L_2) will readily cover a wide range of wave-lengths, it is strictly aperiodic in nature and best results will be obtained from it only at resonant frequency. In tuned impedance coupling, we have the advantage of being able to tune to resonance and thus get maximum signal strength. But again, we run into the difficulty of eliminating undesirable oscillations. Having both a tuned grid and a tuned plate circuit, ideal conditions for self-oscillation in a tube exists and are normally hard to overcome.

Why not then apply what we have learned concerning the antenna circuit and incorporate it into the plate circuit? Refer now to step 3, Fig. 1. Here, a relatively few turns of wire L_6 constitute the plate inductance, connected in the usual manner similar to a larger coil, as an untuned choke coil. With a variable coupling augmenting it, a similar wave trap to the one in the antenna circuit is placed in inductive relation to it.

From previous experience, everyone knows that an inductively coupled circuit is by far more selective than one conductively coupled. We have applied what we found to be true in the antenna to the plate circuit and are bound to secure better results.

Step 4 shows that we can add regeneration very nicely and reaps its benefits both in increased selectivity and signal strength.

We, therefore, come to Fig. 2, where is depicted the complete circuit, somewhat revised in that the antenna inductance is directly connected to the grid circuit of the first tube. This is done because it was found that the combination of both traps—more correctly, the closed oscillatory circuit coupled to the antenna is a wave trap while that coupled to the plate circuit is more properly termed an inductively coupled variable reactance, whose function is to increase the effective plate inductance, L_3, as L_2 C_2 is brought into resonance with the incoming frequency, thus again allowing increased selectivity and sensitivity of the system so greatly that it is only optional to incorporate an inductively coupled input circuit which means an extra control.

To tune the circuit, the antenna wave trap is tuned to the incoming interfering wave so that it can be completely absorbed. All frequencies other than this will readily pass through the antenna circuit and onto the grid of the first tube. Of course, it is desirable to tune in but one station. L_2 C_2 is then adjusted to resonance with the incoming desired wave and its coupling varied in relation to L_3 for the purpose of controlling the conditions for self-oscillation. Having received a maximum signal, L_4, the tickler feed-back coil is coupled to the antenna coil until again best results are obtained.

As many as three stages of radio fre-

(Continued on page 2182)

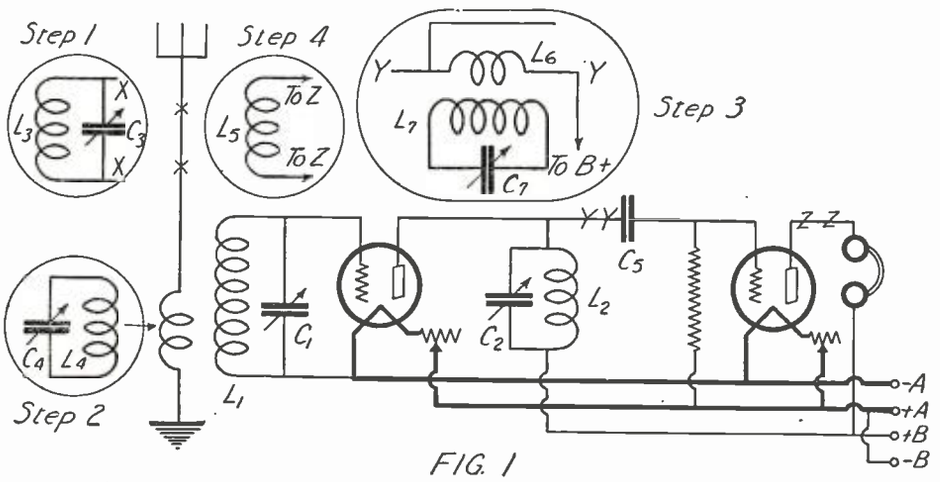


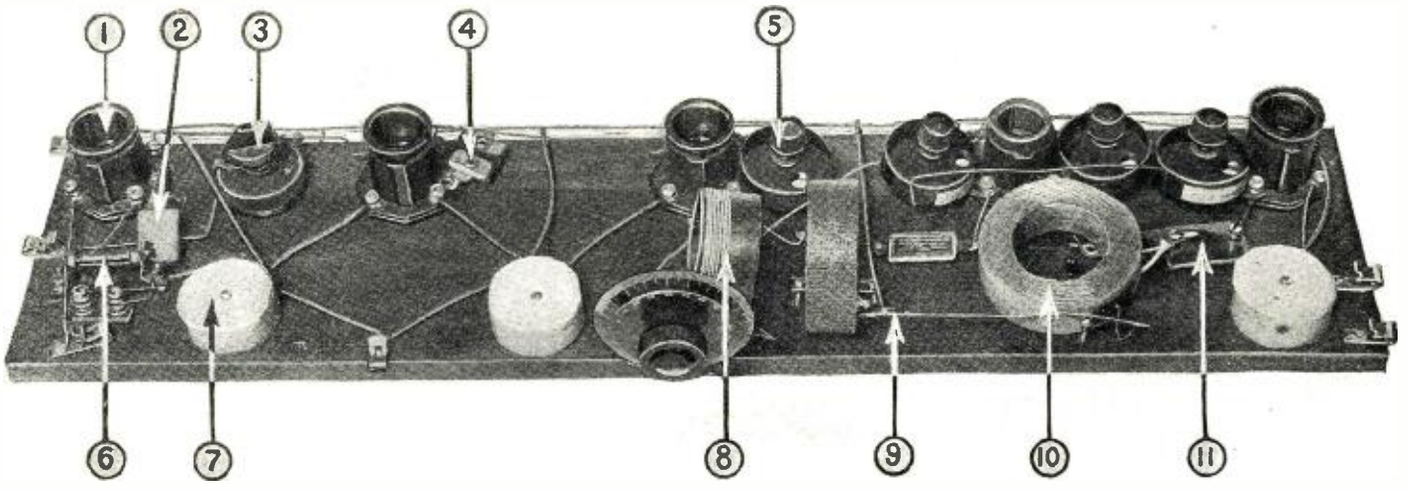
FIG. 1

A circuit using one stage of radio frequency amplification coupled to a non-regenerative detector by the tuned impedance method. Note various ways of improving the selectivity of the receiver.

A Noiseless Intermediate Amplifier

By G. C. B. ROWE

The present amplifier will be found exceptionally valuable on account of its characteristics which tend to cut out the noise and at the same time increase the selectivity of the complete set.



Layout apparatus on baseboard. Above is a view of the laboratory layout of the new interference eliminating amplifier. 1 is the second detector socket, 2 fixed condenser across the secondary of the last tuned intermediate frequency transformer, 3 rheostat, 4 another intermediate condenser, 5 condenser for tuning the intermediate trap, 6 grid leak, 7 intermediate frequency transformer, 8 tickler, coupling the plate circuit of the second detector to one of the trap coils, 9 resistance, 10 trap coil, 11 grid leak and condenser.

WITH the advent of summer time, the bug-bear of static and atmospheric noises comes to the fore again. The users of the Super-Heterodyne are confronted with this nuisance more than the same listeners with other types of sets, since the intermediate frequency amplifier employed in it tends to pass more miscellaneous noise than straight tuned radio frequency sets or those of the single circuit class on account of the low frequency to which the intermediate stages are tuned.

The principle involved is simple in the extreme, being a combination of resistance coupling amplification with the addition of a sort of trap circuit in the form of a tuned circuit placed across the connections between the separate stages working in conjunction with the resistance coupled amplifier.

With the addition of small value blocking condensers in the grid and plate circuits, two of the tubes function as detectors on the low frequencies, those in the audio range, while giving intermediate frequency amplification to the desired signal. Through this process of elimination, practically every wave-length but the one desired is cut out before the signal reaches the second detector and the audio frequency stages.

By referring to Fig. 1, the action of the circuit may be easily explained. The first detector and oscillator are of the standard type. No deviation from the regular Super-Heterodyne hook-up is noticed until the first tube of the intermediate frequency is reached. A standard transformer is connected between the first detector and the first intermediate frequency tube. The grid circuit of this tube functions in the standard fashion.

In the plate circuit, however, the connections are changed. Instead of the intermediate frequency transformer, there is a resistance, a tuned circuit and a grid leak. The action of this circuit may be easily explained.

The heterodyned signal delivered to the plate circuit of the first detector is passed through the transformer PS to the grid circuit of the first intermediate frequency amplifying tube. Here it is again amplified. It is well to note that everything passing the first detector is also amplified to some extent. This includes static, atmospheric noises, other signals than the one desired on account of the broadness in tuning of the tuned grid circuit of the first tube, and a certain amount of extraneous noise arising from the transformers, the tubes and the oscillator.

All this noise is amplified, but the nature of the coupling between the first amplifier and the second tend to reduce it in the following manner: The condensers C_2 and C_3 are of small capacity, .00025 mfd. or less. Experience will show that the static and tube noises are of audio frequency and are usually loud in ratio to the signal intensity. Therefore, the size of C_2 effectually prohibits their passage onto the grid of the next tube. The only possibility left to them is to take the alternative path through the resistance R_1, which is approximately of 25,000 ohms value. Here they are dissipated in the form of heat, leaving only the higher frequencies to pass on.

Now the desired signal at the intermediate frequency, in this case 6,000 meters, passes through the small condenser with relative ease and travels on its way toward the grid of the next amplifier. And here is where the trap circuit L_1 C_4 comes in. This circuit is tuned exactly to the intermediate frequency by the cut and try method, *i. e.*, using a small variable condenser or else adding or subtracting turns from the inductance. When the signal reaches this point, with the oscillatory circuit tuned exactly to the intermediate frequency, all that part of it which is not in resonance with the trap circuit dissipates itself by following the inductance to the grid return.

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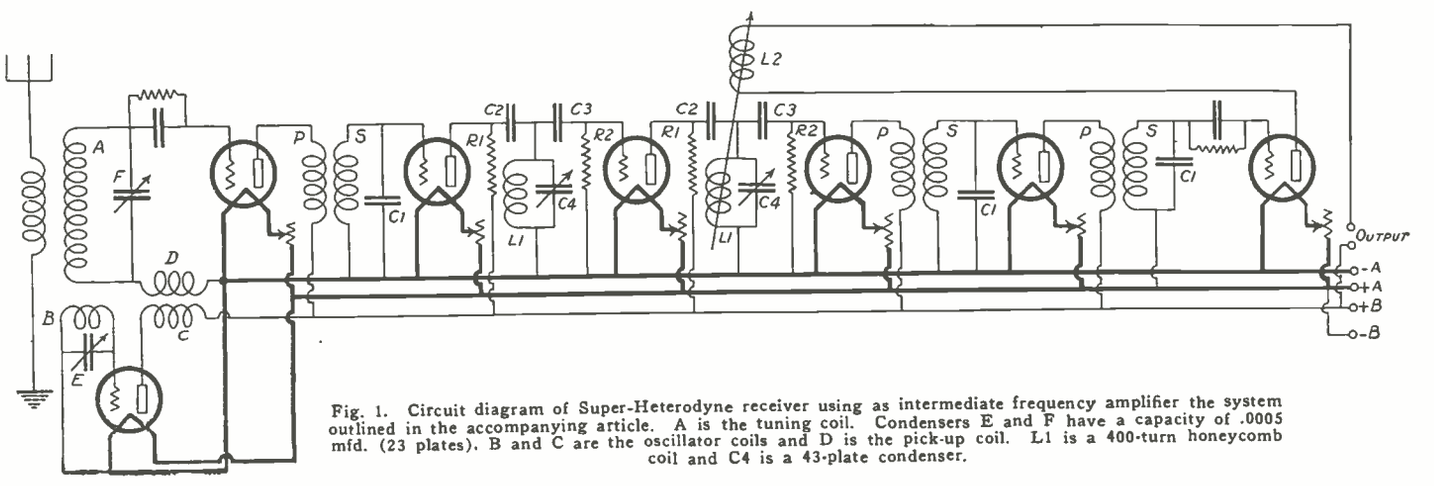


Fig. 1. Circuit diagram of Super-Heterodyne receiver using as intermediate frequency amplifier the system outlined in the accompanying article. A is the tuning coil. Condensers E and F have a capacity of .0005 mfd. (23 plates). B and C are the oscillator coils and D is the pick-up coil. L1 is a 400-turn honeycomb coil and C4 is a 43-plate condenser.

Some Effects of Resistance In Radio Tuning Circuits

By SYLVAN HARRIS

In this article Mr. Harris supplements his previous articles dealing with the losses in coils and condensers.

Showing a few of the instruments used in making some resistance measurements in the laboratory.

NEARLY all radio fans are by this time aware of the disadvantages that may come in operating radio receivers when there is excess resistance in the receiver, but it is doubtful if their attention has been called to the many ways in which resistance can affect the operation of the set.

In considering the losses in circuits which are tuned, as is usual in radio work, the formula $P = RI^2$ always comes to mind, for this equation enables us to calculate the loss of power in the circuit when the current in it and its resistance are known. In other words, suppose a current of 10 amperes is flowing in a circuit which has resistance of half an ohm (0.5 ohm). The power loss in the circuit will then be $P = 0.5 \times 10^2$ or 50 watts.

The amount of power used in radio receivers seldom approaches this value, but is generally expressed in microwatts, or millionths of a watt. Some conception of the magnitude of the watt may be obtained by remembering that 746 watts are equivalent to one horsepower.

In radio receivers, where we are dealing with such minute quantities of power, it is very essential that every bit of this power be utilized, for the loss of a small amount of it may represent a considerable portion of the total power coming into the antenna from the transmitting station.

DESIGN

The proper design of radio apparatus, directed by the ideas of efficiency and economy, requires the reduction of all losses to the least amount possible, and for this reason it is well to obtain an understanding of the various ways in which resistance in a circuit acts, and also as to what factors contribute to the resistance.

In making a study of this, it must be remembered that the values to be used in the formula given above are the high frequency values, which are in existence when the receiver is operated. R is the high frequency resistance, and furthermore, the frequency at which the measurements are made must be specified, for the resistance changes with the frequency. This has been explained more in detail in previous articles by the writer in the January, February and March issues of RADIO NEWS.

It will be found that the actual resistance of a coil added to the circuit depends somewhat on the coil's position in the circuit with respect to other apparatus. This does not refer to coupling effects through magnetic or electrostatic fields, which may result from having the apparatus too close together, but refers to the actual diagram of connections. This will be brought out clearly as we proceed. In many cases the particular piece of apparatus may *act* as if its resistance is higher than it really is, thus giving rise to the expression "apparent" resistance.

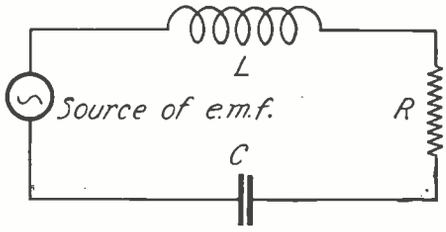


FIG. 1

A simple series circuit consisting of a resistance inductance and capacity in series with a source of e.m.f.

SERIES CIRCUIT

To begin the discussion, let us consider a simple series circuit, as shown in Fig. 1, consisting of a coil and a condenser connected in series with a source of energy. This source of energy may be any generator of high frequency current. Both the coil and condenser have resistance, so, to simplify matters, we have assumed all this resistance to be concentrated into the resistor marked R.

The current in this circuit is obtained by dividing the voltage of the generator by the *impedance* of the circuit. This impedance is given by the formula

$$Z = \sqrt{R^2 + \left(0.00628fL - \frac{159.3}{fc}\right)^2} \quad (1)$$

in which f is the frequency in kilocycles, L is the inductance in microhenries, C is the capacity in microfarads, R is the resistance in ohms, and Z is the impedance in ohms. This formula is not given to mystify the reader, but it is presented because our discussion uses this formula as its basis.

If we have a certain signal coming into the antenna, impressing a certain voltage onto the tuned circuit pictured in Fig. 1, by means of formula No. 1, we may learn how the current changes in the circuit as the condenser setting is changed, or, as the circuit is brought into resonance.

Fig. 2 shows three curves plotted from this formula, assuming the coil to have an inductance of 100 microhenries and the condenser to have a capacity of 0.001 microfarad. This is a combination that will cover the broadcasting range of wave-lengths. One curve is for the theoretical condition of no resistance in the circuit, and the others for the same circuit with resistance added.

As the condenser is turned around from zero setting, the curve continuously drops. This means that the impedance of the circuit is decreasing, and the current consequently will increase. (See Fig. 3.) When the circuit is exactly tuned to the incoming frequency or wave-length, the impedance of the circuit is a minimum and the current a maximum. The curve for the circuit of zero resistance drops all the way to zero impedance. If it were possible to have a circuit of zero resistance, the current existing in the circuit when resonance is attained would be enormous, even with small impressed voltages.

When there is resistance in the circuit, however, the impedance cannot drop any lower than the value of that resistance. This is the lowest point of the upper curves in Fig. 1. Besides this, the curves do not come to as sharp a point as the lowest curve.

These same curves are plotted in Fig. 3, but here, instead of using the impedance for the vertical scale, we have used the *admittance*, which is the reciprocal of the impedance (or admittance = 1 ÷ impedance). This gives a graphical idea of how the current varies in the circuit as the condenser is turned. The current is small for the greater part, but as resonance is approached, it mounts to relatively high values.

The curves for the circuit with resistance do not go nearly as high as that for the circuit with no resistance, which theoretically would have no topmost point. Furthermore,

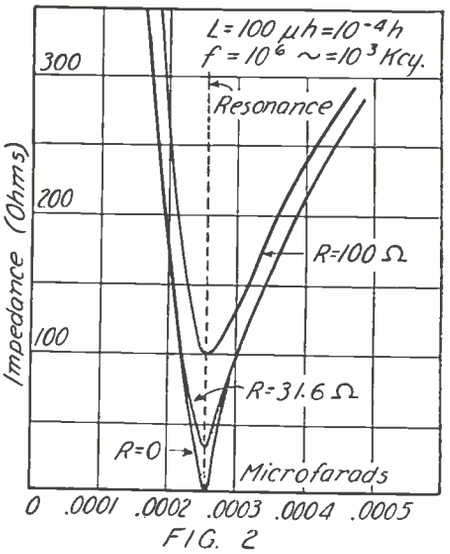


FIG. 2

Showing how the impedance of a simple series circuit changes with the setting of the tuning condenser. This is for a certain incoming wave-length, viz., 300 meters.

the greater the resistance, the flatter will be the curve, so that it will be difficult to tell exactly where the peak of the curve is. This is the reason for broad tuning, and illustrates clearly an important reason why resistance ought to be kept out of tuning circuits.

The series circuit we have been discussing is the same as the antenna circuit consisting of the antenna capacity in series with the inductance of the tuning coil. It is also the same as the secondary circuit (or nearly so), which has likewise a coil and condenser in series. The electromotive force in each case is regarded as in series with the rest of the circuit, although in the secondary it originates in the windings of the coil.

PARALLEL CIRCUITS

The reverse conditions are found in the case of parallel or shunt circuits, such as we

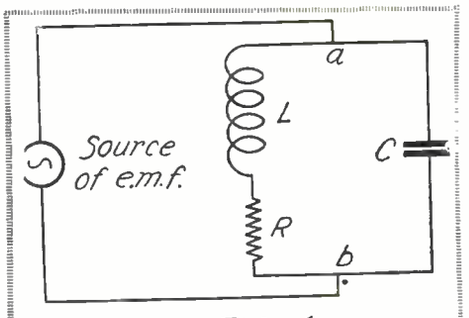


FIG. 4

A simple parallel or shunt tuned circuit connected in series with an e.m.f.

have in wave-traps or filters. Fig. 4 shows such a circuit in which a coil and condenser are connected in parallel and the combination connected in series with the source of energy. The formula for this case is rather complicated and will not be given here, but in Fig. 5 are shown curves plotted from it. The two curves shown are for a circuit like Fig. 4, with and without resistance. These are to be interpreted the same as the curves of Fig. 2. It will be noted, however, that in Fig. 2 for the series connection the *impedance* is zero at resonance, while in Fig. 5 the *admittance* is zero at resonance. This means that when tuned to resonance, the series circuit will permit a *maximum* of current to pass through it, while the parallel

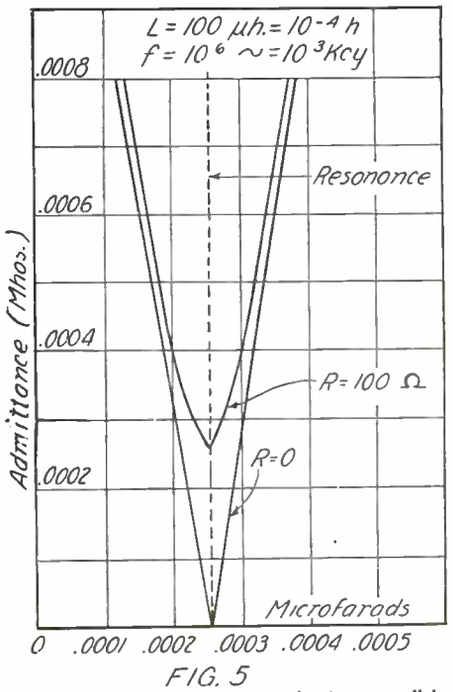


FIG. 5

Showing how the current varies in a parallel tuned circuit. Compare with Fig. 2.

circuit permits a *minimum* of current to pass.

When there is resistance in the circuit, the series circuit does not permit as much current to pass as it should, and the parallel circuit does not cut the current down as much as it should. Moreover, in both cases, it is difficult to find the maximum or minimum points, with the result that the tuning is broad.

RESISTANCE AFFECTS FREQUENCY

There is another effect present in tuned circuits which has considerable resistance that is generally overlooked, and that is, in parallel circuits the presence of the resistance causes the natural frequency or wave-length of the circuit to be different from that which would be calculated from the usual formula:

$$f = \frac{159.3}{\sqrt{LC}} \qquad (2)$$

in which f is the frequency in kilocycles, L is the inductance in microhenries, and C is the capacity in microfarads. The exact formula is

$$f = 159.3 \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}} \qquad (3)$$

in which R is the resistance of the coil, and the other symbols are as above. Thus, if we have a coil of 100 microhenries, and our condenser is set to 0.000253 microfarads, if the circuit had no resistance, it would be tuned to a frequency of 1,000 kilocycles (300 meters) as calculated by equation (2). If, however, our circuit had a resistance of 100

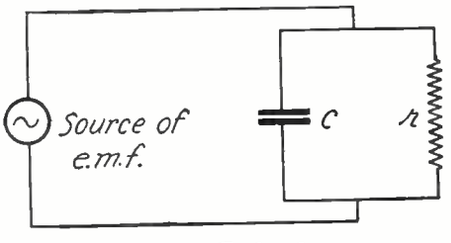


FIG. 6

Circuit diagram equivalent to a leaky condenser, showing the capacity of the condenser in shunt with the resistance of the condenser.

ohms, its frequency, as determined by equation (3), would be 988 kilocycles (304 meters). To tune the circuit to exactly 1,000 kilocycles we would have to use a trifle more of our condenser.

Of course, this change of wave-length is not serious, for we can always make the necessary adjustment by tuning the condenser; in fact, we do it automatically, but it is interesting to know how many things resistance can do in a tuned circuit.

If, in Fig. 4, the capacity C should be relatively small as compared with the inductance L and resistance R of the coil, we have the ordinary conditions for a coil with distributed capacity. The mere fact that there is a small capacity in shunt with the inductance of the coil, causes the coil *to act* as if its resistance is higher than it really is.

The joining of several pieces of apparatus in parallel, as in Fig. 4, causes their resistances and reactances to be in parallel, and if we regard the whole combination to be *one* piece of apparatus, it is obvious that its resistance and reactance as measured between the points a and b will be different from those of the separate pieces of apparatus.

In other words, suppose we have a coil with a certain inductance, resistance and capacity. The resistance of this coil measured between its terminals will be greater than its true resistance, because the resist-

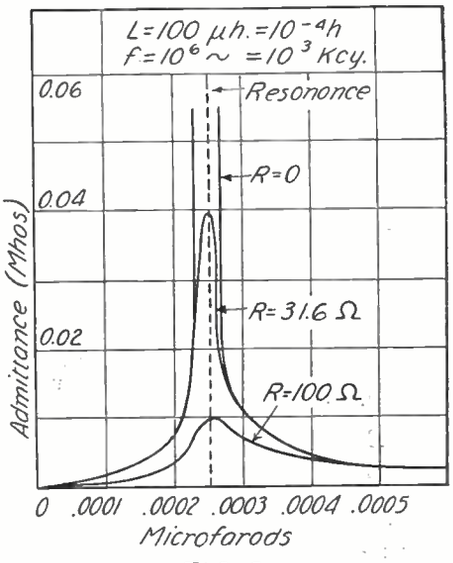


FIG. 3

Showing the variation of current in a single series circuit, as the setting of the condenser is varied. Wave-length remains constant.

ance of the coil is associated with the other things, *viz.*, the coil capacity and inductance. The measured resistance, reactance or inductance of the coil is called the *apparent* resistance, reactance or inductance, as distinguished from the true values which exist when the coil has only one of these three properties.

This point is brought out in Fig. 5a, in which the effect of coil capacity on the resistance of the coil is shown graphically. The horizontal axis gives the capacity of the coil in micromicrofarads, while the vertical axis shows how many times the true high frequency resistance of the coil has been increased by the capacity. In other words, the vertical axis is the ratio of the high frequency resistance of the coil to its high frequency resistance neglecting the coil capacity. This curve was explained in the January issue of RADIO NEWS. It is to be noted, however, that even for such abnormally high coil capacities as 50 micromicrofarads, the ratio of apparent resistance to true high frequency resistance is small compared with corresponding ratios due to skin-effect only. The latter may run as high as 50 or 60, depending

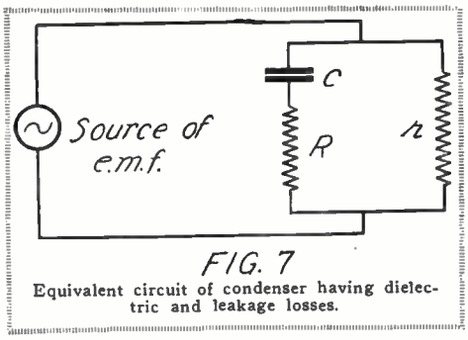


FIG. 7

Equivalent circuit of condenser having dielectric and leakage losses.

on the size of wire and the spacing of the turns of the coil. The curve in Fig. 5a has been calculated for a frequency of 1,000 kilocycles (300 meters).

CONDENSER LOSSES

We will next consider a leaky condenser. This is quite in vogue now, for everybody is talking excitedly about low-loss condensers, and are doing everything in their power to reduce the leakage through the dielectric. They are also trying to reduce the absorption in the dielectric, by reducing the amount of insulating material in the condenser. This was described in detail in the writer's article in the March issue of RADIO NEWS.

(*Continued on page* 2134)

An Efficient Crystal Detector

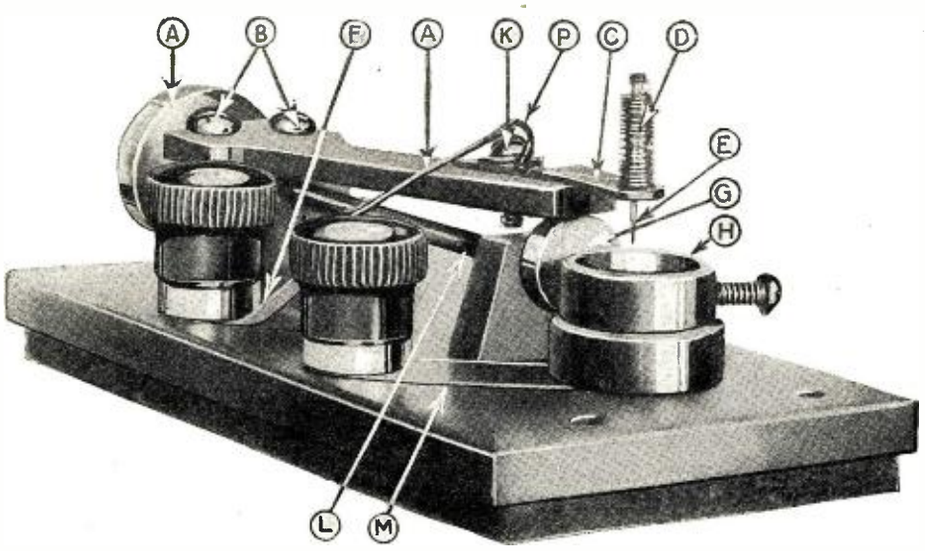
By R. HUTCHISON

This crystal holder is about as good as one could wish for, and can be built for next to nothing.

TUBE sets may come and tube sets may go, but the crystal set goes on forever. And here is a new type crystal detector.

Perhaps of all apparatus that is needed for receiving radio signals, there have been more different forms employed in the detector using a crystal than any other single instrument. There have been detectors using a catwhisker in all its various forms, and there have been detectors using two crystals in contact, such as the perikon type. There are the fixed crystal detectors and the adjustable ones. And here is the floating contact crystal detector.

We say "floating contact detector" because in lieu of the unstable catwhisker there has been employed a phonograph needle held by a spring that makes contact with the crystal. The contact made by the needle is so delicate that even when the cam, operating the vertical motion of the contact point, is rotated completely, the point of the needle does not puncture a piece of thin paper stretched across the crystal holder. There is also sufficient play in the spring to prevent the contact from being thrown out of adjustment by vibration.



This efficient crystal holder can be made of scraps in the workshop. The letters refer to the parts of the detector and are referred to in the directions for construction.

The arm supporting the contact needle we will consider first, as it is a very important part. This arm A is made from a piece of spring brass, 2¾ x ¾ x 1/16 inches. This is filed down so that it will be 1/16 inch wide for a length of 2¼ inches.

Two clearance holes for the 6/32 machine screws B are drilled ¼ inch from the wide end of A and ⅛ inch from the edge, giving ½ inch centers for the holes. At the other end of A, drill and tap a hole ¾ of an inch from the end for the 4/32 machine screw that fastens the flat brass piece C to the arm. In the strip of 1/32 inch brass C, bore and tap for a 6/32 machine screw and at the other end drill a hole for the No. 4 screw that fastens C to A.

The head of a ¾-inch, 6/32 machine screw is then removed and a hole drilled lengthwise through the screw as a needle guide, enough for the phonograph needle to slide through easily. File off all but 4 or 5 threads of the screw. These remaining threads serve the double purpose of holding the needle guide to C and as a support for the phosphor bronze spring, D. This needle guide should be soldered to the brass strip C to keep from becoming loosened.

It is necessary to make a mandril for the spring D from a wire nail to give the correct diameter for the 6/32 screw. After this size has been determined, file down one end of the mandril to the correct size to fit the needle. The small diameter of D must be ⅛ inch long to grip the needle firmly. As may be seen in the photograph, D is a continuous spring of the two diameters mentioned above.

Next are prepared the blocks to support the arm A and the cam G. The arm supporting block F is made from the piece of bakelite or hard rubber ¾ x ½ x ¼ inch or two ¼-inch pieces held together by the bolts. The arm A is clamped to the block F and used as a template for the drilling of the holes for the screws B. The camshaft bearing, is made from the bakelite or hard rubber block ½ x ¾ x ¼ inch. This piece is filed ¾ inch wide at one end and 7/16 inch remaining ½ inch high at the other end. Through the center of these two blocks, F and M, while clamped together, drill a clearance hole for the 3/32 inch brass rod L, ⅛ inch from the top or the 7/16 inch side. Thread one end of the brass rod, L, for 6/32 machine screw and the other end to fit the adjusting knob N. Drill and tap for 6/32 thread the ⅜ inch bakelite washer G so that it will have a throw of ⅛ inch, which means the hole will be drilled 1/16 inch off center. This cam G is screwed to the brass rod L.

The base is then prepared. Using the arm supporting block F as a template one inch from and parallel to one end, mark carefully the locations of the holes for the screws B. The screws B should not come entirely through the base, but should be about 3/32

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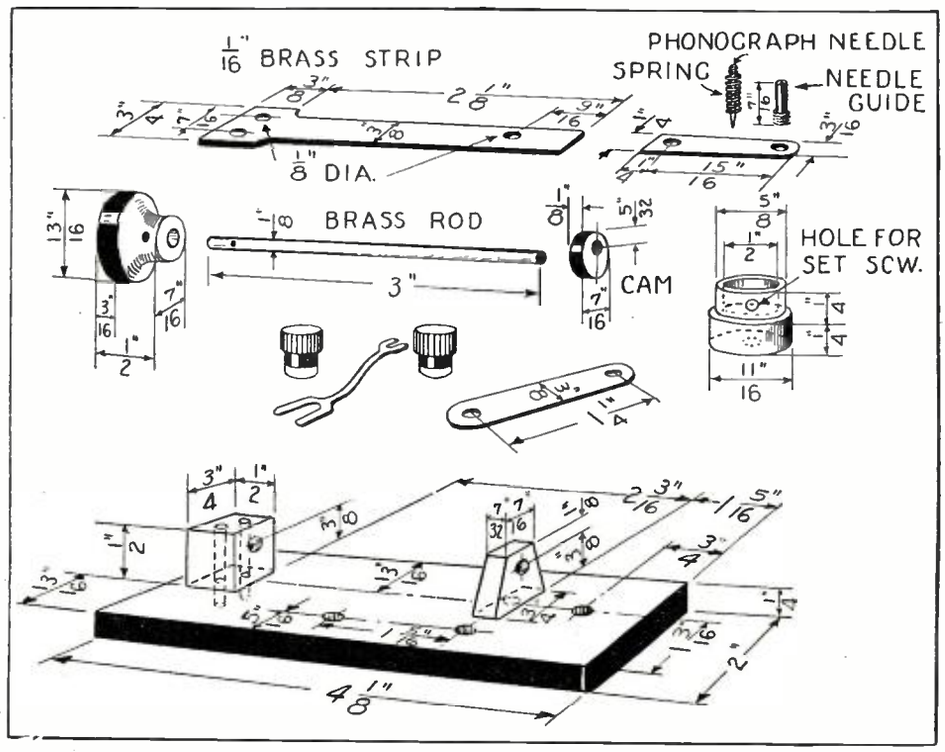
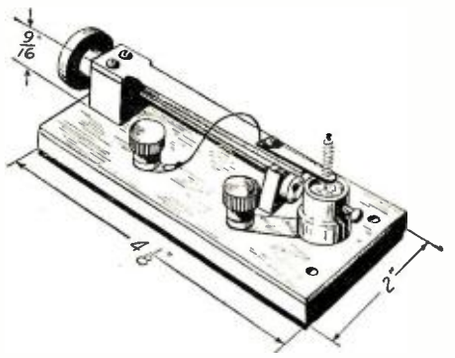




On the left are shown the details of the parts required for the detector. Above is an assembled detector with phonograph needle in position.

Oscillations and How They Are Overcome

By LEON L. ADELMAN

There has been no art, science or industry which has had such a meteoric development as radio. This article deals with some of the advances made in circuit design, especially with regard to stabilizing the operation.

WITH the fulfillment of DeForest's dream of a highly sensitive detector for radio reception, the three element tube stepped in to fill a wide breach theretofore the cause of much concern. We know now that without it such necessities as the long distance telephone radio broadcasting, scientific apparatus and a host of other indispensable items would never have been realized.

Just how the tube functions and how it is used has been fully discussed time and again, so that it will not be necessary to say more than while it has a highly desirable property of being able to generate oscillations over a very considerable range of frequencies, this very same property is responsible for one of the present difficulties in radio reception and design.

The day of the purely regenerative set for broadcast reception is practically over. True, regeneration is highly desirable in all sets, but regeneration without radio frequency amplification has been found to be inferior to the present day radio frequency amplifying receivers.

First came the so-called single circuit non-regenerative set. Then the two circuit receiver to which was added regeneration and now known by the familiar phraseology as the old three circuit tuner. One, two and then an unsuccessful third stage of audio frequency amplification was added. (Old-timers will well remember a receiver comprising regenerative detector and two-step amplifier having a list price of $1,000 and not so long ago either! An audio frequency amplifying transformer could be purchased for no less than $20 or thereabouts.)

The thought of radio frequency amplification brought much skepticism, and for a long time no one ventured to do much along this line. Suitable inter-stage coupling transformers were lacking.

Today there are more than 200 legitimate types of receivers, all of which constitute an adaptation of about five fundamental circuits.

THE FIRST RADIO FREQUENCY

The first radio frequency receiver with its one-stage of untuned radio and non-regenerative detector gave enough trouble. Some signals were good, others terrible. And to add regeneration to the detector was akin to tempting the wrath and ire of a lion.

Someone, applying Pupin's principle, conceived the idea of tuning the radio frequency amplifier, and from then on progress has been made in utilizing tuned radio frequency amplification in receiving sets. But again—just as the signal would be brought to maximum intensity, very objectionable howling and squealing would begin.

Venturing forth again, after having applied the audio frequency amplifier to the circuit, two stages of tuned radio frequency were added, and one can imagine what happened to those persevering pioneers. Their lot was by far much worse than one can believe, for radio engineering was undreamt of and each followed his own line of procedure. But more and more the slide rule and sound electrical engineering principles were applied to solve the great amount of work standing before those ambitious experimenters, and more and more it was found that by following rigidly well-known electrical rules those of radio well-nigh agreed. Men who worked haphazardly found that they could get nowhere, and only by thorough reasoning was the present stage of development reached.

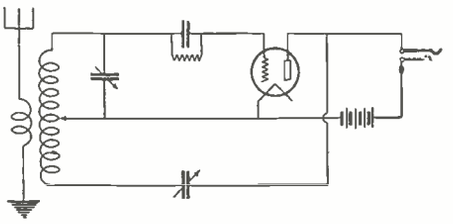


Fig 1. A powerful generator of oscillations over a wide band of frequencies, the Hartley oscillator has found great favor with the transmitting amateur.

Fig. 1 shows the familiar Hartley oscillator used to a large extent in the transmission of continuous wave signals. With a slight modification we can recognize it as the splendid Reinartz circuit, so efficient in the reception of C.W. signals.

An oscillating receiver is not necessary for broadcast reception (except in the special case of the Super-Heterodyne), and thus such a type of set is used only on the short waves from 200 down to 75 meters and less where radiation from it does not interfere with broadcast reception.

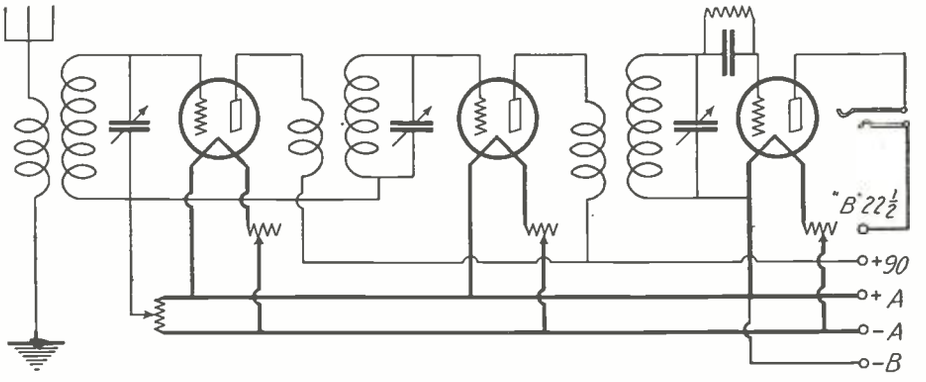


Fig. 2. The familiar potentiometer or "losser" method which is also known as tube characteristic variation, was one of the first steps used by experimenters in controlling oscillations.

OSCILLATION

In broadcast reception, maximum amplification with any tube is reached just below its oscillating point. Obviously, the question immediately arises, why use a circuit which causes the tubes to oscillate? This logical question is readily answered when it is stated that it would be impracticable to build such a set because it would be impossible to obtain sharp and selective tuning. For best results both the grid and plate circuits must be tuned and this leads to a condition where oscillation is bound to occur, unless special arrangements are used.

There are several various methods used to keep the tubes from oscillating. Each affects to some degree the sensitivity of the circuit as a whole, but, generally speaking, results are good. Everyone knows that the introduction of resistance into an oscillating circuit will do two things. It will cause broad tuning and, more important, will result in poor signal strength. Of course, the resistance will prevent undesirable oscillation, but the cost in inferior results is far too great.

In a radio frequency receiver there are precisely two causes for oscillation, one that of inter-tube coupling due to the inherent capacity between elements of the tube, and the other due to inter-stage transformer coupling, both of which are of great concern.

Let us see what has been done to bring about a condition of stability and control, a condition where quiet operation is an outstanding feature not to be overlooked in the performance of a set.

Along with the first attempts at controlling the oscillating point in a receiver, the potentiometer found ready application. It was soon learned that if the grid return was connected to the negative side of the "A" battery for the radio frequency amplifier units, the tube was placed in a much better position as a straight radio frequency ampli-

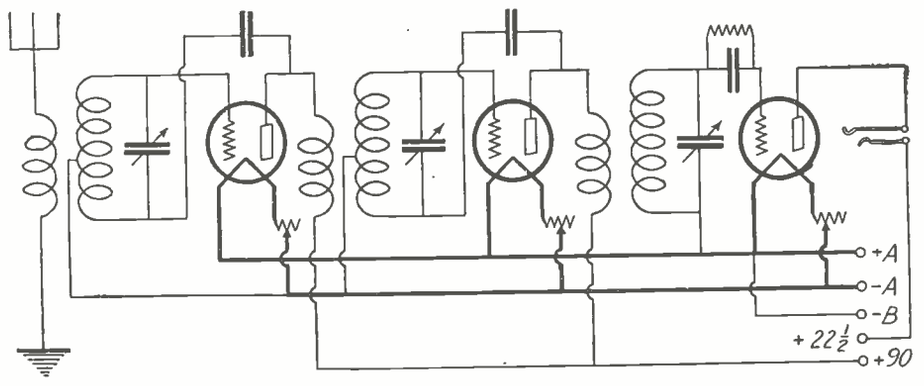


Fig. 3. The method invented by Rice. As can be noted, it is similar to a bridge arrangement, in which the capacity inherent in the tube is counterbalanced by the neutralizing condenser.

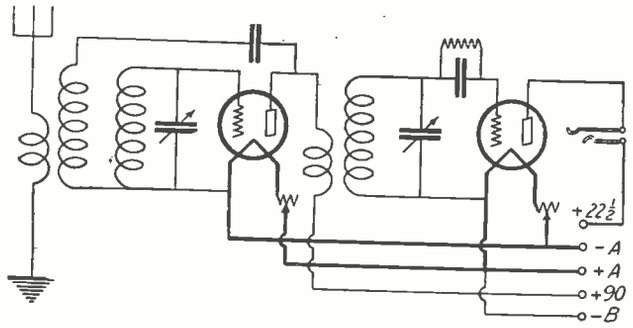


Fig. 6. An adaptation of the Rice method which employs a tertiary coil wound alongside the secondary and whose magnetic field is in opposition to the latter. Although this scheme is applicable to several stages of amplification, it is rather inefficient on account of introducing too much absorption, with consequent loss in signal strength.

fier because of its inherent characteristics. However, strong oscillation was the result of a too negative grid bias, while poor amplification was the result of a too positive grid bias. The potentiometer afforded a ready means of adapting the grids of radio frequency amplifier tubes to the varying circuit conditions incident to wave-length change while tuning. These incident changes are variations in "B" battery potential, differences among tubes and radio frequency transformers and other minor changes in either circuit or apparatus. Although this method of controlling oscillations is a very good one, its main disadvantages are that it constitutes an added control, results in somewhat broad tuning and slightly decreased signal intensity. This is due to the increase in the current taken by the grid when the potentiometer makes it positive. For this reason, it has often been termed a "losser."

Fig. 3 shows the Rice method of neutralization wherein the filament terminal of the tube is connected to a point which divides the inductance of the secondary circuit into two nearly equal parts. This places the mid-point of the coil always at zero potential, the ends alternately being made positive and negative, respectively, by the high frequency potentials impressed on the grid. One end of this coil is connected to the grid of the tube, while the other is connected through a small capacity to the plate of the same tube.

It is readily seen that this forms a Wheatstone Bridge arrangement which neutralizes the effect of the tube capacity. The capacity of this condenser, if the two parts of the coil have equal inductance, should be equal to the inter-electrode capacity of the tube. Using the 201A or 301A tubes, this should be about 10 to 15 mmfs. This prevents the feed-back of energy through the tube capacity, and permits the use of tuned circuits for inter-stage coupling without having self-oscillation occur.

NEUTRALIZATION

It will be noted that in this circuit the neutralization takes place on the grid side of the tube; the Hazeltine circuit, shown in Fig. 4, does the neutralizing on the plate side. The bridge arrangement can be seen to include the grid filament capacity and the primary of the coupling transformer as one side and the neutralizing condenser and secondary of the transformer as the other side. The ratio of the two capacities is the same as the ratio of the two inductances, that is, the inductances of the primary and secondary coils. In some cases only part of the secondary coil is used in neutralizing. This is done for convenience in obtaining neutralization, but is not always necessary.

In the Farrand method, shown in Fig. 5, we have also a bridge arrangement, but this time there are no inductances involved. One side of the bridge is formed by a condenser and resistance in series, while the other side is formed by the internal capacity and resistance between grid and plate of the tube. These are to be regarded as in series. The values are not critical generally and depend upon the characteristics of the tubes.

A very effective method for preventing oscillations is to provide a means for damping them. This is accomplished by placing a closed circuit composed either of inductance alone, or a combination of inductance and capacity, in close proximity to the tuned circuits. These auxiliary circuits act as absorption circuits, tending to absorb energy from the tuned circuits. This has the same effect as if resistance were added to the tuned circuits which prevents oscillating. The tuning, however, is not as broad as would result from the introduction of resistance directly into the tuned circuits. (See Fig. 5A.)

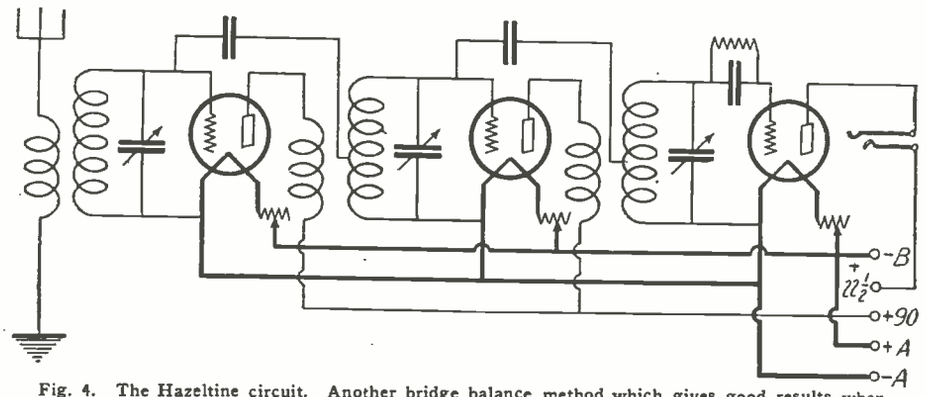


Fig. 4. The Hazeltine circuit. Another bridge balance method which gives good results when the radio frequency transformers are properly disposed.

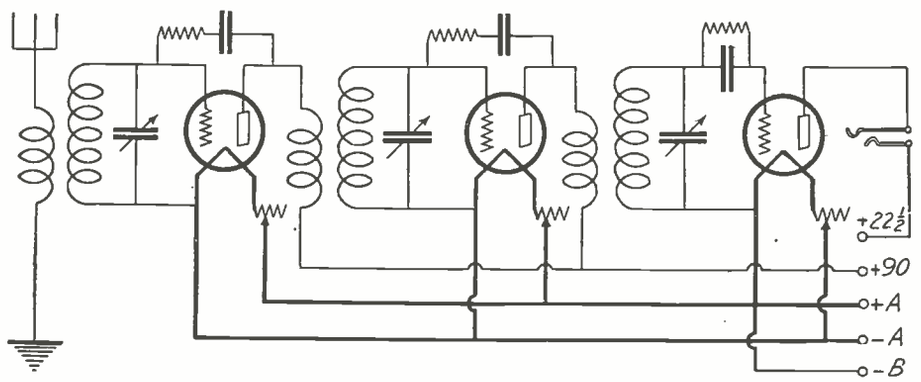


Fig. 5. Farrand, employing still another modification of the bridge balance method, evolved the above. The system can be used for a number of stages and proves quite effective.

Fig. 6 shows an adaptation of the Rice method, in which, instead of tapping a coil near or at the middle, the coil is built in two sections, which are in inductive relation to one another. The coils are so disposed that the magnetic fields are in opposition.

Fig. 7 shows an adaptation of the Hazeltine circuit, excepting that, instead of using the secondary of the transformer secondary for neutralizing, another coil is introduced into the magnetic field of the transformer.

REVERSED FEED-BACK

Fig. 8 shows the Superdyne method, which is also known as the reversed feed-back method. In this circuit an e.m.f. is introduced into the grid circuit by coupling a coil to it which carries the plate current. The polarity of the "tickler" is made such that the e.m.f induced in the grid circuit is in phase opposition to the incoming signal potentials impressed on the grid. At the same time, the coupling transformers are tuned. The amplification decreases as the coupling between the grid and tickler coils is made closer, but as it is loosened the amplification increases up to the conditions permitting self-oscillation. This negative feed-back may be made to occur in any one

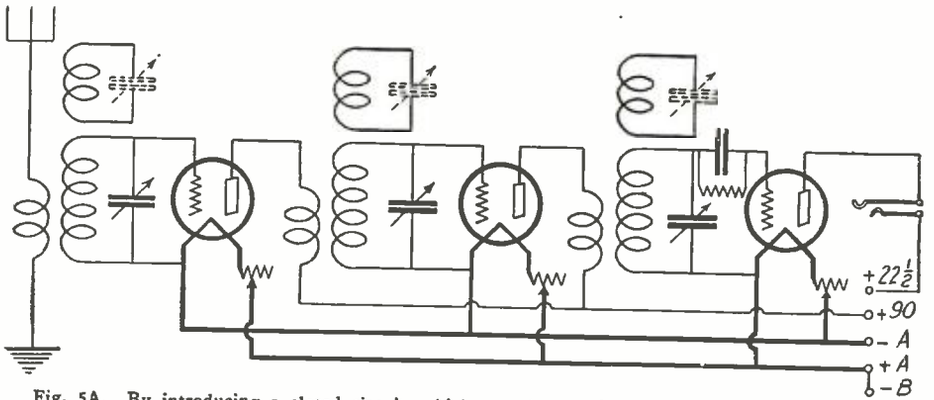


Fig. 5A. By introducing a closed circuit, which may be tuned or untuned, in inductive relation to the radio frequency transformers, its damping effect readily controls any tendency toward oscillation.

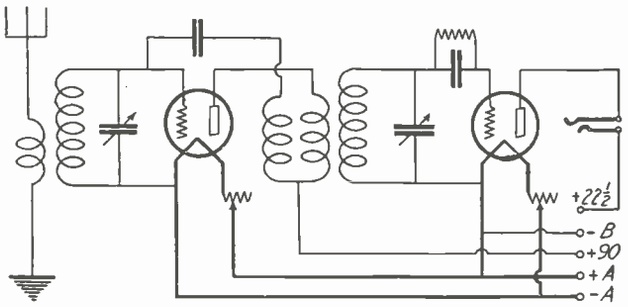


Fig. 7. Left: Showing the use of a bucking coil in the plate circuit, whose magnetic field is in opposition to the plate inductance. This is a variation of the Hazeltine circuit.

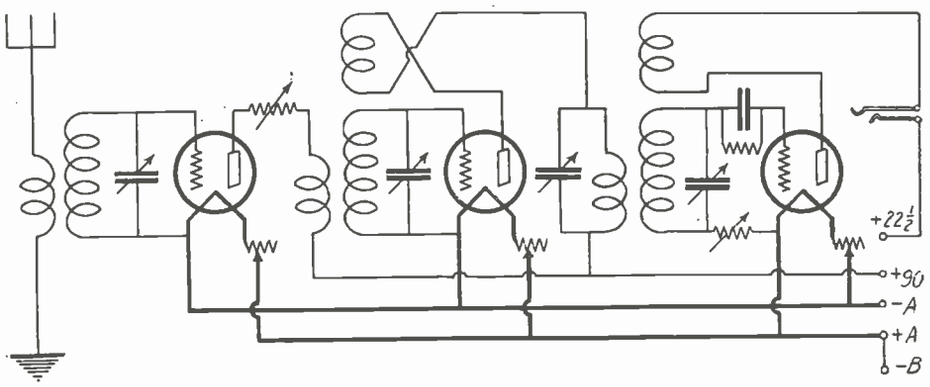
Fig. 8. Below: A combination showing a plate resistance in the first stage, the Superdyne method in the second, and a grid resistance introduced into a regenerative detector circuit, preceded by two stages of tuned radio frequency. This arrangement is but one of the many possible circuits using the known methods of overcoming oscillation.

stage of amplification, or may be accomplished by coupling the plate circuit of the detector tube to the grid circuit of the first R.F. amplifier.

There are other methods by which self-oscillation can be controlled or prevented, but they are all further adaptations of the methods that have been explained above. Furthermore, several of these methods can be incorporated into one receiver, using one method for one stage of amplification and another method for another stage. This gives rise to many circuits known as "plexes" and "dynes," which generally bewilder the radio student, but contribute very little to the radio art.

It might be interesting to note in passing that the tendency in receiver design is the use of a minimum of controls. Whether the successful single control receiver will make its appearance in the near future or whether the nearest approach to it, in the shape of a two control set, will supplant it, is at this time hard to conjecture.

The manufacturer has realized the potential possibilities in the use of the experimental laboratory as an aid, not only to himself, but to the art of radio as well. More and more, extensive research work is being undertaken and the inevitable result is the large succession of so many circuits that put in an appearance. In some of these, there are meritorious points which are commendable from an engineering point of view, while others will stand comment as an exceptionally fine example of quantity production. Of course, it is readily understood that the manufacturer's main consideration is the building of a receiver which, primarily, shall be of advanced design and work well under all conditions. It is his problem to evolve a method of producing large quantities of receivers which shall cost him as little as possible and be able to sell at a reasonable price. The public is not interested in his troubles and are not desirous of knowing the intricacies involved in the manufacture of the set. What they want is something good at a price within their means.



Undoubtedly, those who are carefully watching the market are noticing the falling off of the inferior class of sets. The better grade of receiver holds a dominating position which it is bound to maintain in the future. As Coue might say, "Every day in every way, our radio sets are getting better and better."

American Scientists Strive for Radio Perfection

DEEP dyed-in-the-wool scientists are now taking a serious interest in the many phases of radio transmission and reception, and may evolve standards for methods, frequencies and measurements which will aid broadcasting and benefit the denizens of radioland, here and abroad.

The American Section of the International Union of Scientific Radio Telegraphy at a recent meeting in Washington, reported on many problems on which research is underway. A resumé of the session by Dr. J. H. Dellinger of the Bureau of Standards states in part as follows:

"There is a great increase of interest in radio measurements because so many people, have gone into all phases of radio design and engineering, have found it essential to secure real measurements. The accurate measurement of radio frequencies, has attained international importance and popular as well as scientific interest because the reduction of interference in radio reception depends upon it. The vast increase in the use of radio necessitates the operation of transmitting stations as close together in frequency as possible. A practical limit to such crowding is the accuracy of maintenance of station frequencies. The work of numerous investigators is providing means to give the necessary precision of measurement, constancy of adjustment, and absolute accuracy of frequency basis. International comparisons of frequency standards have shown a very satisfactory agreement. One of the interesting means of making such comparisons is the piezoelectric oscillator, a new device which is contributing greatly to current progress, especially in the use of very high frequencies or short waves. The piezoelectric oscillator is essentially a piece of crystalline quartz. Methods and apparatus have been worked out to use such a device to control the frequency of a radio transmitting station, thus giving constant frequency stations.

"There is increasing use of apparatus for measuring the field intensity of radio waves; a number of methods, some of them rapid and convenient, are being used extensively by investigators."

Dr. L. W. Austin stated that measurements show the average intensity of signals from European and California stations has been somewhat less during 1924 than in 1923. The variations of the intensity of received signals from the high-power station at Bordeaux, France, have been found to be the same in France and in the United States, whereas no such correspondence in the received signals is found for measurements in the two countries on the transmitted waves from the high-power station at Rocky Point, Long Island. Measurements of the strength of signals from European stations show a drop in signal strength just after sunset in Europe. Observations of signals from high-power stations over greater distances than have been hitherto attempted, as for example, from Java to California, show that the low frequency stations transmitted to greater distances than hitherto indicated. Measurements at frequencies above 3,000 kilocycles indicate that the fading of such signals is greater, and the reliability of transmission less, at distances under 500 miles than at greater distances. In the winter frequencies above 5,000 kilocycles are observed to be transmitted much better in the daytime than at night, the reverse of conditions with lower frequencies.

Dr. A. H. Taylor reported that the Committee on "Variations of Radio Wave Direction" had found that a shift of the apparent direction of the waves from long wave stations occurs at sunset. The direction shifts toward the east before sunset, returns to normal at sunset, and then usually shifts to the west. The exact cause of this has not yet been fully determined. Some variations of direction in broadcast station transmissions have been found at night. At very high frequencies the changes of direction are very rapid and very great, so that direction measurements are quite impossible.

Measurements of atmospheric disturbances produced in low frequency receiving circuits during the last three years indicate that their intensity was greatest in 1922 and least in 1923. Observations of atmospheric disturbances indicate that their direction often corresponds accurately to the position of storm and cloud areas over the country. At frequencies of more than 3,000 kilocycles atmospheric disturbances are comparatively mild in the daytime, but at night in the summertime they are worse.

Mr. E. F. W. Alexanderson, in presenting the report of the Committee on "Measurement of Interfering Radiation," said that a portable direct-reading instrument for field strength measurements has been developed, which would make it possible to determine the precise amount of interference not only on the main wave of a station, but in the side bands and harmonics. The use of a standardized direct-reading instrument of this kind will make it possible to obtain actual statistical data on interference produced by various radio stations and other sources.

Overhauling Your Radio Set

By A. P. PECK

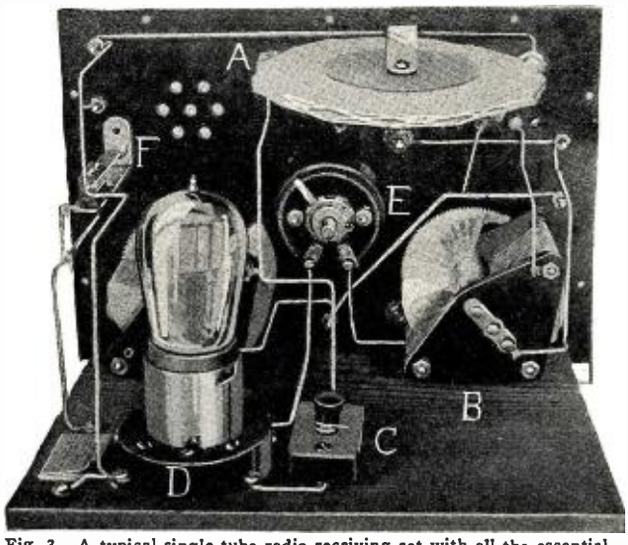


Fig. 3. A typical single tube radio receiving set with all the essential parts lettered for reference.

THE spring of the year seems to be universally set aside for the cleaning and overhauling of all appliances necessary to human welfare. "Spring cleaning" is a well-known by-word to the housewife. Every spring the careful automobile driver either spends his Sundays in completely cleaning or overhauling the car, or else drives it to his favorite garage to have this work done. And so it should be with every radio set owner. During the long winter evenings, when "DX" reception is at its best, the radio set operator seldom, if ever, thinks of looking over his set unless something goes radically wrong with it so that reception becomes impossible. Thus, in order to keep up a receiving set at its highest efficiency, and to avoid annoying trouble just at a time when the set is most desired, a certain time of the year must be set aside for going over the set completely.

In order to satisfactorily carry through the overhauling of a receiving set, a definite system must be followed. The object of this article is to point out the various steps in the overhauling of an average receiving set. You will find that practically everything contained herein will pertain at least in part to your particular type of set, regardless of its style. Owners of crystal detector receiving sets will take care of their various coils and variable condensers in exactly the same manner as is described for vacuum tube sets. In the last part of this article will be found a few notes for the especial benefit of those using crystal detector receiving sets, either in ordinary crystal circuits or in a reflex circuit using vacuum tubes in combination with the crystal detector.

It is a very good idea to determine beforehand just when you are going to start overhauling your set. It is best to contemplate spending at least a day in this work and, after deciding upon the time, see that you have the following materials on hand. With these at your command, you can proceed quickly and systematically with the cleaning and overhauling and you will not have to stop to procure other materials during the process. Beside your regular radio tools and soldering materials you will need:

Fine sandpaper.
A fine file.
Shellac.
Thin lubricating oil.
Two or three strips of cloth free from lint.
A soft, clean varnish brush, one inch wide.
Several pipe cleaners.
A generous stick of sealing wax.
A strip of flannel.
A battery voltmeter.

THE ANTENNA

The logical place to start in with the overhauling of a radio set is at the antenna and ground. The antenna is the long wire located either outdoors or within the house, which, in turn, is connected by means of another wire to the radio receiving set, and the whole of which serves to pick up the radio waves sent out by various broadcast stations. When an aerial is suspended indoors and away from sudden atmospheric changes, as well as rain and snow, there is very seldom any trouble with it unless the wire connecting the antenna itself with the receiving set becomes broken. In such a case, it must be mended by soldering the two ends together after thoroughly scraping them. For complete instructions on soldering, refer to the article by the writer which appeared in the March issue of Radio News.

With the outside antenna, however, the troubles are slightly different. Here corrosion will often take place, due to the action of the elements on the wire. The corrosion is particularly noticeable at the joints, that is, where the antenna and lead-in are connected. This joint should, of course, always be soldered, but even in such an event there is often sufficient corrosion to prevent good connection between the antenna and the lead-in wires. Such can readily be determined by inspection. Lower the antenna to the ground and look over the joints thoroughly. You may find small cracks in the solder, an evidence of corrosion. In such a case, unsolder the joint, scrape both of the wires thoroughly and resolder.

Much has been written in various publications regarding the effect of corrosion on the antenna wire, aside from the joints, upon transmission and reception. It will, however, be found, in the case of broadcast reception, that even a quite badly corroded antenna wire will give excellent results, provided the connection between the antenna and lead-in is firmly soldered and electrically perfect. In transmitting sets, particularly of low power and those operating on a short wavelength, corrosion of this nature has a detrimental effect, but as far as the broadcast listener is concerned, it may be completely disregarded. Therefore, after you have made sure that all the joints on your antenna are perfect, you may entirely forget about the corrosion on the rest of the wire.

Now that you have a perfectly soldered joint, it is a good idea at this time to guard against further corrosion. An excellent method of accomplishing this is illustrated in Fig. 1. Wrap several layers of friction tape over the joint, continuing the wrapping for an inch or so on either side of the twisted parts of the wires. Draw the tape tightly so that is will adhere firmly to the wire. Then paint this tape covering with shellac, being sure that all of the tape, as well as a short length of wire on either side of the covered portion, is completely covered by the liquid. The aerial can then be immediately hoisted into place, allowing the shellac to dry after the antenna is in position.

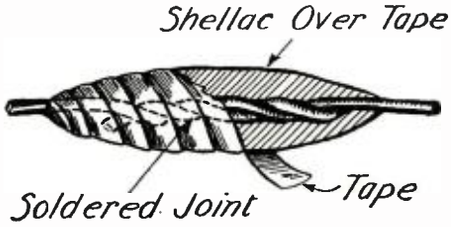
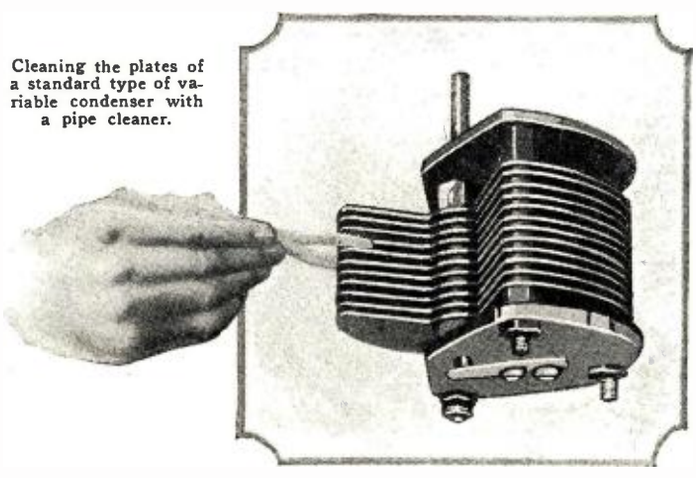


Fig. 1. The above illustration shows how to protect a soldered joint from corrosion by the use of several layers of friction tape coated with shellac.

Cleaning the plates of a standard type of variable condenser with a pipe cleaner.



THE AERIAL SWITCH

If your lead-in is provided with an aerial switch so that the antenna may be connected to the ground when not used for reception, this switch should be looked after. It is probably located out in the open and, therefore, quite subject to corrosion. Clean the blade and jaws with fine sandpaper so that they make a good contact. Unless the wires connected to the switch are soldered in lugs which, in turn, are clamped under screws, remove the wires, polish them thoroughly with fine sandpaper and replace, tightening the machine screws as much as possible.

If a lightning arrester is used, be sure that here also the connections are clean and tight. If that type of arrester is employed, which is equipped with a spring clip for fastening the connections, remove the wires, clean them and insert them in the clips after bending the latter out a little so as to restore the spring of the metal and so as to insure firm contact. If the wires are held to the arrester by machine screws and nuts, clean as before and tighten the nuts thoroughly.

All of these precautions are taken so as to be sure that the current set up in the antenna by the radio waves will reach the receiving set with as much strength as possible. Now, that this has been accomplished, we must provide a satisfactory return connection. That is, the ground connection must be carefully and thoroughly made or otherwise all of the time spent in working on the antenna will bring small results. The average radio receiving set is grounded to a water pipe or to a length of iron pipe driven into the ground and the wire is connected thereto by means of a ground clamp. Here is another point where corrosion may take place, particularly if the connection is exposed to the outside atmosphere. If the ground clamp is badly corroded, replace it with a new one after thoroughly cleaning the pipe at the point where the connection is made. Here you can also prevent future corrosion to a very great extent by the use of tape and shellac. Cover the entire ground clamp, an inch or so of the wire connected to it and an inch of the pipe on either side of the clamp with tape, leaving no openings for the entrance of air to the clamp and pipe. Then apply a coat of shellac and allow it to dry. The effect of the tape and shellac is to prevent dampness and atmospheric moisture from reaching the metals and so corroding them at the point of contact.

Before we leave the subject of collective agencies, as antennae or aerials are sometimes termed, let us note in passing the loop antenna. An ordinary type is illustrated in Fig. 2 and the two flexible wires which connect this piece of apparatus to the receiving set are shown. As the loop is turned, these flexible wires are twisted, and through continued use will sometimes break. Often the wires under the coverings break, but the open point is not noticeable because the insulation remains intact. Such an event would be denoted by a sudden cessation of reception or at least a greatly reduced volume. In such a case, install new flexible wires. Even though there is no trouble as yet with these flexible wires, but if the insulation is badly worn and twisted, install a new pair anyway. This will guard against future trouble.

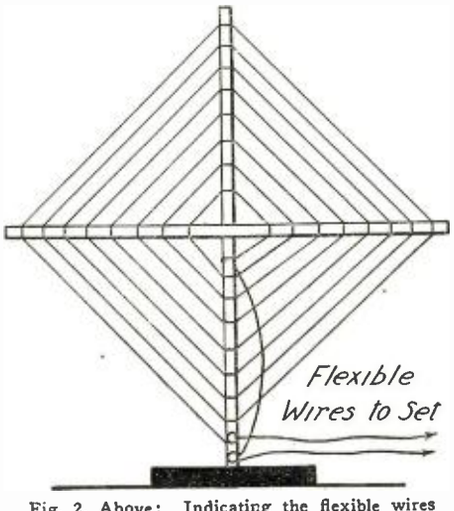


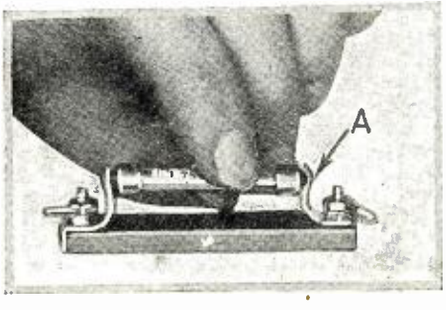
Fig. 2. Above: Indicating the flexible wires leading from a loop antenna to a receiving set which are liable to break in use. Fig. 5. Right: A cartridge type grid leak, the care of which is described in the text.

After you have finished your complete inspection of the antenna and ground systems, you will be ready to start on the receiving set itself. The first thing to do is to disconnect all wires from the receiving set, including the antenna, ground, all batteries and phones or loud speaker. Better remove all wires from the batteries also, so that the loose ends will not short circuit. Place the batteries to one side until they are ready for their share of attention. Do the same with the loud speaker or phones and then remove the receiving set from the cabinet. You will then be ready to completely inspect the various component parts of the set under the best conditions. Here you will find that a flashlight will come in handy for getting a closer view of the various parts that may happen to be hidden by other instruments. A flashlight may often disclose a loose or broken connection or a defective instrument which would otherwise pass unnoticed.

We show in Fig. 3 a rear view of a typical radio receiving set with the various parts that will bear inspection and overhauling. If careful attention is paid to every point outlined below, you may replace the set in the cabinet with perfect assurance that it is ready for another season of good results.

The various points indicated in Fig. 3 are as follows: A indicates the inductance coil, which may be any one of many various types. B is a variable condenser. Practically all of them are of a type similar to this one and will be taken care of in the same manner. C indicates a combined grid condenser and variable grid leak. This instrument is completely sealed in and usually needs no attention whatsoever, unless it has been used so often that the resistance unit is worn away. In such a case, it will be necessary to replace the leak with a new one. D indicates the vacuum tube socket in this receiving set, while E is the rheostat and F an open circuit jack.

We will now deal with the care of the various instruments in detail. Consider all types of inductance coils, an example of which is indicated by A, in Fig. 3. Dust collecting on the surfaces of coils has a detrimental effect which cannot be overlooked. This may be quickly and easily removed if a soft, clean varnish brush about one inch wide is used. Simply brush the dust off the surface of the coil, carefully working into all crevices and corners. This applies to all types of coils, either of the low loss type or those wound on cylindrical tubes. In any event, remove all dust.



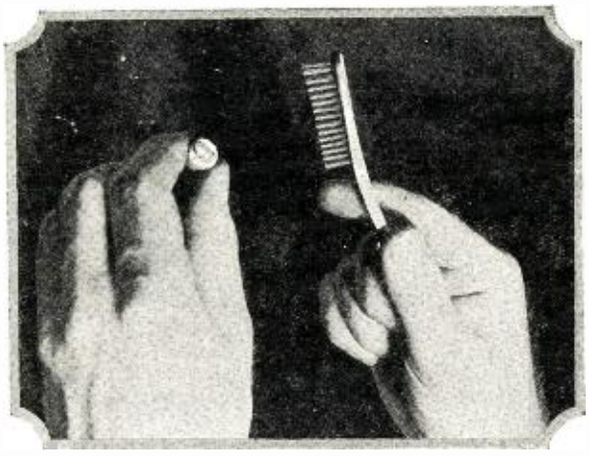


Fig. 10. Using a tooth brush and alcohol for cleaning the surface of a crystal.

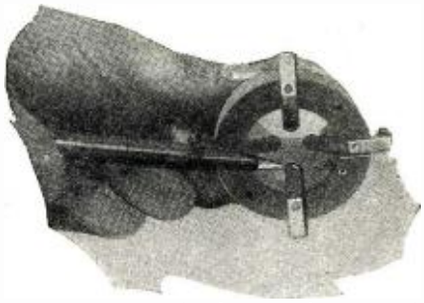


Fig. 7. The pencil points to a bent contact spring on the vacuum tube socket.

The condenser next comes in for its share of attention. Dust often collects between the plates of the condenser and thus forms a partial connection between the various plates with the result that the operating efficiency of the receiving set is lowered. This point would seem to be a very hard one to get at, but if you will take an ordinary pipe cleaner and bend it into a loop, as shown in Fig. 4, you will be able to run it in and out between the plates of the condenser and so remove every trace of dust and dirt therein. Treat all of the variable condensers in your receiving set in this manner, being careful to get in between each and every plate.

The variable type of grid leak was mentioned above. If, however, you use one of the tubular types, such as illustrated in Fig. 5, it is well to remove the cartridge from the clips, bend the latter together slightly and, with fine sandpaper, brighten the tips of the cartridge so that they will make good contact with the springs. Then replace the leak in the clips.

Now we will turn to the vacuum tube socket. All the remarks below will pertain to each and every socket in the receiving set, regardless of the number. Each one should receive the same careful attention. A standard socket is shown at D, in Fig. 3, and another one in Fig. 6. In the latter, we have removed the socket from the set so that the parts of it can be more plainly seen. Note the flat springs pointed to by the pencil in the photo. Often these springs become weakened, due to continued pressure, and do not make perfect contact with the prongs of the tube. In such an event, you can reach one finger inside the tube socket and bend up the ends of the springs so that their life is restored and so that they will firmly press against the prongs on the base of the tube. These prongs are indicated by the pencil in Fig. 7. They should be noticed also and if they are at all dull or corroded, scrape them lightly with fine sandpaper or a file so that they are bright. Then when

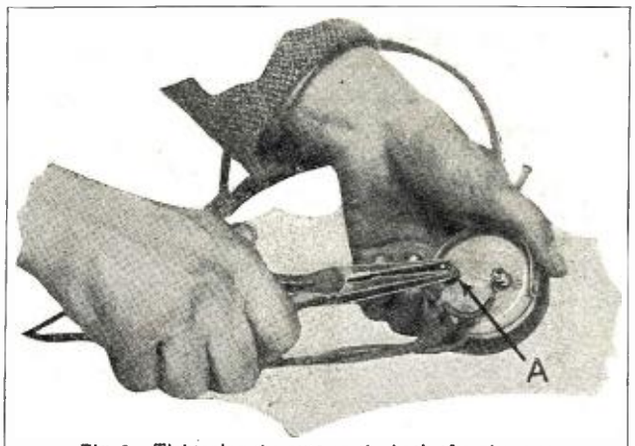


Fig. 9. Tightening the nuts on the back of a phone so that the connecting wires are securely fastened. New connecting wires should be inserted if necessary.

you replace the tube in the socket you may be sure that perfect contact will be made between the prongs and the springs and no losses will occur at this point.

We will now consider the rheostat indicated by E, in Fig. 3. You may have noticed occasionally in the operation of your set that the filament seems to flicker occasionally and at the same time music is affected. This may frequently be due to a loose contact arm on the rheostat, which should be immediately remedied. So, in your overhauling, look at these arms and move them back and forth several times in order to see whether there is any looseness. If the arm does not seem to be making perfect contact with the wire wound on the sector, remove the arm, bend it down slightly and replace. It should then make perfect contact. With carbon-pile rheostats you will seldom, if ever, find any trouble. Just brush off the outside of the container so that no dust collects thereon, forming a leakage path, and further attention will be unnecessary.

The jack, indicated by F, will give a little trouble if dust is allowed to accumulate in any great quantity on the short insulating strips which separate the spring or springs from the frame. The varnish brush mentioned above will remove any dust found here.

After you have completed the cleaning of all the instruments, bring a soft cloth into play to dust off the panel, the baseboard and all the crevices around them. You will not be able to get it all out with a cloth, but do the best you can. Then take the stick of sealing wax mentioned above, rub it briskly with the piece of flannel cloth until it is thoroughly electrified and run the end of the wax along the various cracks and crevices where the cloth could not reach. The wax, being electrified, will attract fine particles of lint and dust to it that cannot be removed by any other process and the result will be a very clean set. This method of removing foreign material can also be applied to other points on the receiving set where a cloth or brush cannot be used.

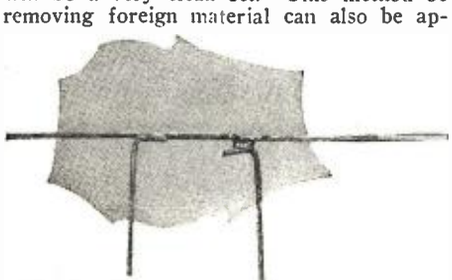


Fig. 8. Above left: A well soldered joint. Above right: A joint which, while soldered, is not very strong and should be resoldered.

Next, look over the connections of the set. You may find one or more connections made as indicated in Fig. 8. Such a type is very bad and is liable to cause trouble, as it may break when least expected. In such an event, get out your soldering iron and make the connection so that it appears as shown in Fig. 8. Such a connection is as nearly electrically perfect as it is possible to make one. After you have gone over the wiring, take each and every wire between your fingers and tug it slightly at any place where it is connected to other wires. You will quickly locate any loose and broken connections by this method and they may be quickly and easily repaired.

This completes all of the overhauling work necessary on the set itself. The loud speaker will seldom, if ever, need overhauling, as most of them are completely enclosed and so are not subject to the action of dust and weather conditions. If, however, you have a radio receiving set which employs headphones, these will need some attention. If you will look through the small hole in the center of the cap you will undoubtedly notice a small rusty spot inside. Removing the cap, you will find that this rusty spot is on a thin disk of soft iron. You can remove this disk, but take great care not to bend it. Remove the rust with fine sandpaper and place a drop of very thin oil on the metal and spread it out. Then wipe the disk off carefully, still taking care not to bend it, and replace in the phones in the same position as it was removed. In other words, have the same side of the diaphragm, as this disk is called, on the inside as was in that position before the cap was removed. Do the same with the disk, or diaphragm, in the other receiver. If the diaphragms are so badly rusted that the metal seems to have been weakened, address the manufacturers of your receivers for a new pair of diaphragms. Also, while you have the phones in your hands, examine the cord and make sure that it is not frayed or broken. If it is, install a new one. Also, with a pair of pliers, tighten the nuts on the backs of the receivers, as indicated by A, in Fig. 9. If the tips enter the casing of the receiver, tighten up the set-screws with a screwdriver while you have the cap and diaphragm off the receiver proper.

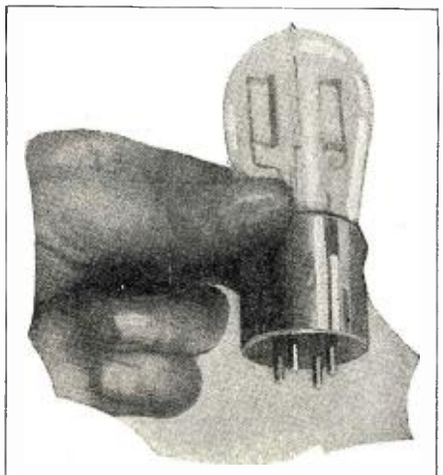
Before you put your radio set into operation, and even before you connect the batteries to it, test these latter with a voltmeter. Undoubtedly the "A" battery, regardless of its type, has received careful attention, as a drop in voltage here is quickly noticeable. However, the "B" batteries are often neglected. If you use dry "B" batteries, test each unit separately. If a 22½-volt unit has dropped to less than 19 volts, replace it. In the case of a 45-volt unit, 39 volts is about the lowest at which it will give satisfactory results. Storage "B" batteries require constant attention just the same as "A" batteries and have undoubtedly been cared for regularly. Therefore, in your overhauling, just give these batteries their usual care.

TO CRYSTAL USERS

Below we give a few points which will be of interest to those who use crystal reciving sets or who are employing crystal detectors in reflex receivers. It may be that recently the signals have started to get dim or the set does not seem to work as well as it formerly did. If the overhauling of the set as described above does not seem to bring back satisfactory results, remove the crystal from its clamp or cup and scrub the surface carefully with alcohol, taking care not to touch that surface with the fingers. A small brush, as indicated in Fig. 10, will greatly assist in this cleaning process. While you have the crystal out of the cup, clean the end of the contact which touches the surface of the crystal. A fine file or sandpaper will accomplish this very nicely, and will provide a clean contact for the freshly cleaned crystal.

Just because your radio receiving set happens to be functioning quite properly at the present moment, do not think that it may not need overhauling. If it has been in use for a period of six months or so, it is undoubtedly ready for a complete overhauling and the time to do it is before something goes wrong. So now set aside your day for the spring cleaning of your radio set and be assured that you will never regret the time spent in this work.

Furthermore, you will be able to enjoy summer reception with a minimum of noises in the set itself. Static alone is bad enough and you should take every precaution to prevent set noises from annoying you. Overhauling the instruments as described above will accomplish this.



Showing the prongs or contact pins on the base of a standard vacuum tube such as used in radio receiving sets.

Fair-Sex Inventor

By GAIL SAVAGE.

RADIO'S WOMAN INVENTOR

Above is a photograph of Gail Savage, radio's woman inventor, and her two contributions to the art, a tape antenna and a combined loud speaker and audio amplifier. Cups granted for them are shown also.

THOUGH the first real thrill to an inventor comes when he or she finds that the new invention really works, the second and greatest thrill is felt when others are convinced that it works and are "sold" on it. I believe that anyone who has been through these first two thrill stages has a fair idea of what the inventor's reward is.

But the reward of public approval and acclamation, though perhaps the one that warms the inventor's heart the most, is not actually the one of most importance. An invention that wins the confidence and recognition of the public nearly always brings reward in another way also, and this may not necessarily be money.

I am fortunate enough to have submitted two new inventions in the radio field that have brought to me two handsome silver cups, and no matter what the financial value may prove to be if the articles find a real place in radio, my big thrill came with the news of winning the cups.

These cups, both of striking beauty, were awarded by the judges of the new inventions sections of the First Radio World's Fair, held at Madison Square Garden, New York City, and at the Second Annual Chicago Radio Show, held at the Coliseum in Chicago.

PORTABLE AERIAL

The first was awarded for a portable antenna for its "uniqueness and compactness and the fact that it can be used indoors, outdoors and for portable use, such as on automobile trips or camping parties." This, substantially, was the statement of the judges in making the award. I might almost call this a pocket aerial, because, unless you are afraid of tearing your vest pocket, you might almost squeeze this antenna into it. It looks and works like a surveyor's tape, contains 100 feet of copper ribbon, has spring action which allows the ribbon, when strung up, to withstand even the worst gale, is insulated at both ends and can be locked in position at any distance up to the 100 feet of the ribbon's length. It was my idea to invent something in an aerial that would prevent kinking and tangling and reduce the number of operations in erection that are now required. The judges who awarded me the cup were kind enough to say that my idea has been realized.

The second cup, which I won two months after the first, at Chicago, was awarded for a combined amplifier and loud speaker. This invention makes possible loud speaker reception in conjunction with a one-tube set. On a base about six inches square there is the mechanism for two stages of audio frequency. The loud speaker, which is a part of the whole, is a top made of wood and shaped like a metronome, the little instrument that used to beat time for us on the top of the piano when we were children. Its acoustics were found to be exceptional because of bridges similar to those used on a violin. These bridges, four of them, separate a stem coming down through the center of the speaker from the top, and the sides of the shell itself. The speaker unit fits into the end of the stem.

It is interesting to know that the two inventions were successful, yet perhaps one of the reasons they were successful was because the industry is so young. This illustrates what can be done in a new industry, and especially one of the scope and importance of radio. Probably in a few years my little contributions to the science may seem like nothing in the face of what is bound to develop and they may even be obsolete by that time. One might even wonder then why they were called inventions at all and were not listed simply as developments in radio that were a natural consequence rather than a direct creative effort. I emphasize this to illustrate just what a tremendous opportunity is offered by radio in the inventive science and how the real breadth of the field yet remains to be tapped before new ideas are exhausted in radio appliances.

Radio took a grip on me from the first. Perhaps that accounts for how and why I happened to design something new. I am giving this answer here because that is the question my friends ask me most often. They want to know how I, a young woman with a family and a home to care for, could find time or show the interest in radio that was required in the completion of my two inventions.

THE IDEAS

They were the development of natural ideas at first, the idea for the antenna coming to me when I saw so many people on the roof of our apartment house having all kinds of trouble trying to erect them from coiled wire and the like. They couldn't avoid getting it all tangled and the insulation necessary seemed to be a great source of trouble. And, in addition, if they had too much wire or tape for the distance available, they were forced to cut the copper and thus waste some of it, in case they wanted to use it again. That planted the seed in my mind for the idea, but I really didn't begin to carry it toward fruition until one roof climber got his wire so badly twisted that he gave the whole thing up as a bad job and hurled his antenna material into the ash can. I was convinced then that an aerial could be devised that would be easier to handle and give better results than the one then reposing in the ash can where its possibilities of giving even bad reception were badly handicapped.

The completion of the combined amplifier-loud speaker idea came after I had learned that no one-tube set had the power to give loud speaker reception and that an owner of such a set was doomed to sit for life wearing earphones clamped to his head unless he got a more powerful set. The amplifier-loud speaker gives the power necessary to amplify the reception from the one-tube set and the loud speaker itself is attached, making one article do where two were required before.

From being an "amateur" listener at first, I graduated into that class of fan which liked and accepted the listening, but whose members wanted to go farther and delve into the intricacies behind the listening and learn why certain causes resulted from certain effects and why the whole field of radio couldn't be entered into by anyone through experimentation.

I make no claims at being an expert set builder, nor am I willing to undergo an examination that even an amateur might give me. I read the radio magazines eagerly, and a new circuit always interests and intrigues me, but I still think that the field is so new and there is so much to be learned and the whole science is progressing so fast that very few can keep pace with it. I explain all this to make clear that I am making no claims as an authority on the subject, but am just one of the millions of fans who are helping to establish the new science,

(*Continued on page* 2116)

This sketch shows a possibility for making radio a very great aid to the police. The idea is an English one. A loop antenna and small receiving set are sewed into the officer's coat.

New Miniature Radio Phones Are Worn in Ear

By C. A. OLDROYD

From England come the latest in earphones. These new ones are possibly the smallest yet devised which are commercially practicable.

A NEW phone for radio receiving sets is so small that it is worn in the operator's ear. The actual size of these instruments can be gauged by comparing the phones shown in Fig. 2 with the child's hand holding one of them. The permanent magnet is of horseshoe shape, and fitted outside the phone case proper. The magnet is bent so as to help hold the phone in position when in the ear.

The magnet coils are contained in a very small metal case; each set of phones has a resistance of 3,200 ohms. The phone ends are in a small metal nozzle fitted with a celluloid ring at the end; this ring holds the phone securely when inserted into the ear. The weight of each is only half an ounce.

As the diaphragm is very light and small, the phones give clear and pure reproductions of broadcasting. It can be adjusted by means of a small milled ring over the coil case. A locking ring then fixes the position of the adjusting ring.

Two phones, together with a long flexible cable are contained in a small leather pouch measuring but 3½x2 inches. The case is small enough to be placed in a vest pocket.

For portable sets, the new miniature phones should be a great advantage, as they require next to no space. Ladies will also welcome them, for they need no longer fear that their hair will be disarranged when wearing the new phones.

For secret radio, such phones are indispensable; with their aid, a detective, for instance, will be able to carry an "invisible" set on his person. One phone only would be used, and the other ear left free.

For a secret radio set for police, a small one-tube set, together with a coil antenna, is worn while on duty; the cable leading from the ear to the set would be flesh-colored and so defy casual inspection.

Through the set, reports from headquarters would reach the officer without any loss of time, and he could be informed of the latest happenings, or of changes in plans made, without having to return to headquarters.

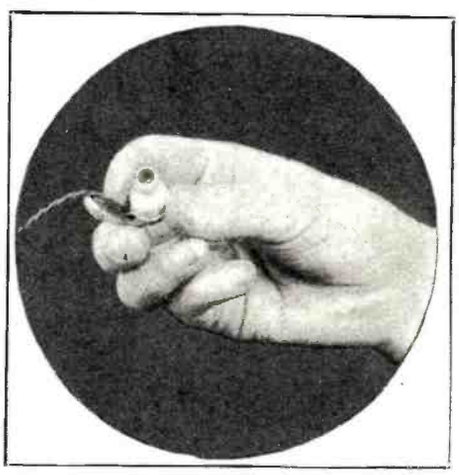
The method of wearing the miniature earphones is plainly shown in the above photo. The advantage for listeners of the fairer sex is at once obvious.

COURT UPHOLDS RADIO REGULATIONS

A FEDERAL Judge of Tennesse fined an unlicensed amateur radio operator for illegal operation of a radio transmitter with malicious intent. Although the fine was light, compared with the maximum penalty, $500 or a year's imprisonment, it is believed by officials of the radio section of the Department of Commerce that this case will serve as a warning to others who try to obtain their "fun" by spoiling the pleasure of regular radio fans.

Radio Supervisor Deiler had been receiving numerous complaints from Knoxville radio fans, that someone was jamming the atmosphere regularly when broadcast programs were on the air. One public-spirited citizen offered a reward of $100 to anyone who discovered the owner of the offensive transmitter. Another fan located the illegal set, reported it to inspector J. N. du. Treil, who called on the alleged amateur. He found him operating a spark coil transmitter and without receiving equipment. Later he filed a complaint with the U. S. Attorney, to the effect that Section 1, of the Act of August 13, 1912, regarding the illegal use of a radio transmitter to create willful interference was violated. The culprit confessed that he operated the set solely to interfere with the broadcast reception of a neighbor, and the case went to court, resulting in the imposition of the fine.

This case is an example, cited to show that radio laws and regulations are rigidly enforced throughout the country in an effort to keep the air channels clear for all kinds of radio traffic including broadcast reception. Listeners and amateurs should report all violations of the radio laws and regulations, co-operating with the Department of Commerce.



The comparison between the small earphone and the hand holding it in the above photograph will give a very clear idea of the actual size of this new device for radio.

Television for Amateurs

By S. R. WINTERS

Here is a preliminary report of a new and simple device which makes the transmission of sketches possible to amateurs.

THE army of approximately 20,000 radio amateurs may be on the threshold of a new and fruitful period of experimentation. Radio vision—the sending and receiving of photographs, sketches, script, maps and autographed letters—is now in its infancy, just as radio telegraphy was 20 years ago. This revolutionary system of the transmission and reception of distant scenes by radio has been proven sound in principle; it remains now for the real experimenters to translate the laboratory achievement into practical performance.

THE INVENTOR

C. Francis Jenkins, inventor of the motion-picture projecting machine and credited with many other far-reaching discoveries, has not only developed a system for the sending and receiving of pictures and sketches by radio, but has demonstrated its value in performance tests in the laboratory and afield. Very recently he has invented and built a small and simple machine that will put radio vision within the reach of the radio amateur. It marks the introduction of a practical realization of what Mr. Jenkins prefers to call a service to the eye, just as radio now is a service to the ear.

The machine built for use by radio amateurs is inexpensive and, when compared with its marvelous accomplishment, is very simple in construction. This unit may be connected to a small electric motor or victrola as a governor control, which engages with a gear as a means of driving a shaft. On each end of this shaft a brass cylinder is mounted. A second threaded shaft engages with the cylinder shaft through a pair of gears. Mounted on this threaded shaft is a pair of arms connected together with an insulated bakelite bar. The rotation of this threaded shaft moves the bar of bakelite longitudinally with respect to the cylinders. Furthermore, mounted on this insulated bar are two contact fingers, one coming in touch with the cylinder used for sending photographic impressions and the other makes contact with the cylinder employed in receiving the maps, sketches, pictures, etc.

TRANSMISSION

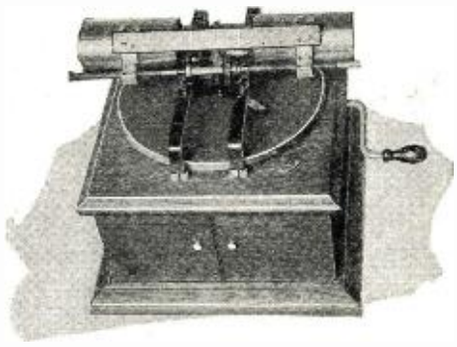
The message, whether taking the form of a business letter or a sketch to represent a radio diagram, is written with a pen on white paper. The ink used in making this impression is peculiarly adapted to this purpose, having been invented by Mr. Jenkins. This strip of paper containing writing to be sent by radio is wrapped around one of the brass cylinders and secured thereto with a fragment of sticky paper. A switch is closed in an electric circuit which connects the cylinder at the contact finger with the transmitting machine. Whenever a line of writing passes under this contact finger a radio wave is propagated into space just as the closing of a telegraph key sends forth an electric impulse. At all the receiving stations of this photo-letter system of communication the incoming radio signals pass through the contact finger on the receiving cylinder and make a chemical mark on the paper. That is to say, every time a line of writing at the sending station passes under the contact finger a mark is made on every receiving station cylinder.

Mr. Jenkins told the members of the Third National Radio Conference that he would not ask for any special allocation of wavelengths for the transmission and reception of pictures and photographic copies of messages, letters, sketches, etc., by radio. This means that radio amateurs in their experimental efforts in the field of radio vision may further investigate the possibilities of short wave-lengths or high frequencies. Therefore, when the President of the American Radio Relay League speaks optimistically of the potential value of short wave-lengths he may also include in the picture the prospects of radio vision within these once idle and worthless bands of frequencies. Mr. Maxim states: "This new territory, of unplumbed possibilities, and a great and far-reaching achievement of the radio art is rapidly gathering headway as these thousands of experimenters take up and solve the problems they encounter on these short waves.

The including of a Jenkins' duplex photogram machine, so called, in the radio equipment of the amateur station means that when these pioneers in wireless development tire of exchanging telegraphic code with friends in Australia that they can switch to the picture-sending unit and show the Australian amateurs, at long range, scenes of the objects about them. These photographic impressions may take the form of a pencil-writing greeting, a sketch of the antenna system at his station, a map of the section in which he lives, or a picture of the transmitter that he uses. Irrespective of the subject thus treated, there will be an irresistible fascination in this unbroken ground of experimentation.

IN USE

This so-called service to the eye, to quote



A phonograph may be used to synchronize the copying devices at the two stations.

Mr. Jenkins, in introducing the system to the United States Post Office Department, is "a method of transmitting messages by radio instead of by steamship, Washington to Panama in five minutes. It has the authentic character of an autographed letter and the speed of radio. It is the beginning of a radio service to the eye, where heretofore radio has been an address to the ear only. Will the time soon come when the Post Office Department will deliver by radio photographic copies of our business letters at the speed of light, rather than the relatively laggard delivery of the originals by mail plane? Such an exchange of intelligence would wonderfully speed up industry because, like an army, industry can go no faster than its means of communication."

Fitting, is it not, that Mr. Jenkins, whose mechanical ingenuity conceived the beginning of the billion-dollar-a-year motion picture industry, should also invent the practical machine that ushers in radio vision to the 20,000 amateur radio stations? He has been experimenting along the line of picture projection for more than 30 years. He has been issued more than 300 American and foreign patents—ranging from spiral liquid containers to self-starting devices for automobiles. He foreshadows a time when radio vision will make it possible for us to view the Olympic games in Europe, and people of other nations will be enabled to see at long range the inaugural ceremonies of a President of the United States. The placing of duplex photogram machines in the hands of radio amateurs is a step in that direction. It means a thorough exploitation of the abstract idea of seeing as well as hearing by radio.

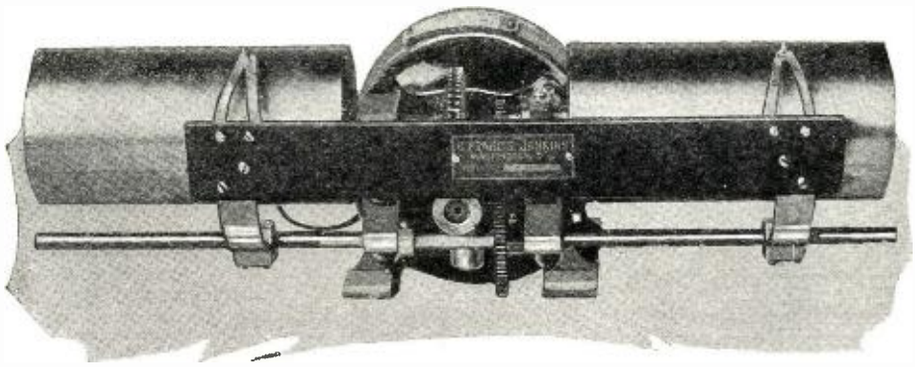
The action of the apparatus is the simplest possible. The picture to be transmitted is drawn on paper with a copper sulphate solution in such a way that when the needle passes over the written lines the chemical ink transmits an impulse through the cylinder and needle, which is, in turn, sent into the radio transmitter.

At the receiver, an amplifier is used after the detector, and the amplified impulses sent out by the transmitter are passed to the receiving pen and cylinder. A paper moistened with potassium iodide or ferrocyanide is placed on the receiving cylinder. When the amplified current passes through the needle the electrolytic effect discolors the paper, giving perfect reproduction of the original picture.

THE "PENS" ARE SIMPLE CONTACT POINTS

The beauty of this system is, of course, its simplicity. The victrolas at the two stations may be exactly synchronized by adjusting their governors. The cost of the two-cylinder arrangement is small; in fact, it may even be constructed by the amateur. The motor method is likewise simple.

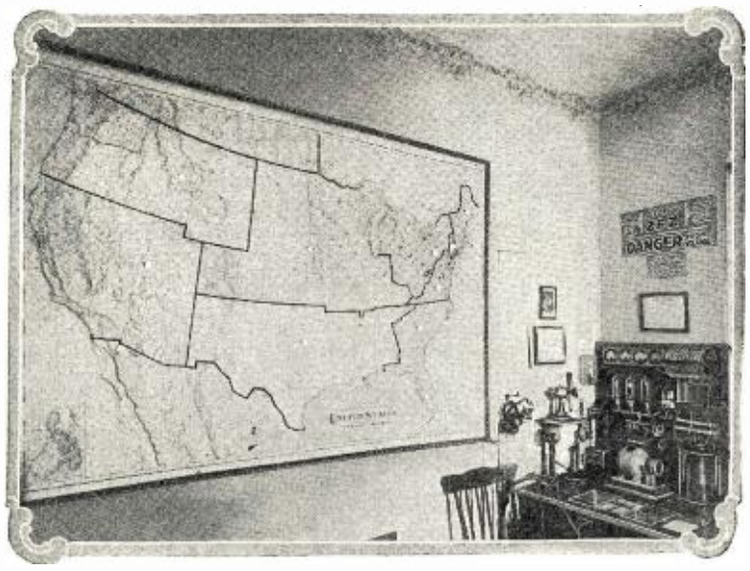
This little arrangement bids fair to open up a whole new field to the amateur experimenter.



Another form of the device employs a small motor for turning over the cylinders which carry the "pens" and the chemically treated paper.

Hamitorial

A League of Notions



Station 2FZ, Bronx, New York. Note large map, divided into the nine radio districts, each section having miniature lamps which light, giving pleasing effect.

NOW here is another one. Within the last two years, the Hams have done themselves noble in the matter of international communication, and have also just about worn the Q sigs threadbare in their conversation with gents who use a different slang from their own and eat soup for breakfast and do such other queer things.

A timely suggestion, it seems, is for us to exhume the League of Nations notion so lately and firmly interred at Washington, D. C. There are several reasons for this suggestion.

First of all, what does a guy do when he gets into communication with an F (Frenchman) or somebody or other? He gets his call, a check and then transfers congratulations as best he can through the agency of the Qs. That finished, the only thing left is to pass a 73 on and go tell the gang about what he has done.

Now, as far as the good of the race is concerned, what a waste of good time and plate juice. Further, what is the tie that binds all the amateurs of the world together? Certainly, after a Ham has logged a few of the Fs and Gs, the thrill begins to pale, and then when he busts the antenna meter making him hear you, and succeeds two or three times, the thrill and feeling of brotherhood again loses a bit of its old-time kick.

Therefore, me bucks, I submit the following to the executive committee and ask your closest co-operation so that you may thoroughly understand the deep, underlying principles of international law and common sense which is the foundation of this, our fraternity, etc., ad infinitum.

The point is this. Since the matter of interocean and international radio among the Hams is a matter of not far distant future, it seems logical to suggest some international organization to immediately step in and take charge of such matters as may need their attention.

The present A.R.R.L. is in an advantageous position to start such a movement. There is lots of interest in the other countries and there is lots of information in each of them that the Hams of other nations would find of great account if they could get to them. So why not start a little of the old pep on the road toward such an organization?

Among other things, the condition of the amateurs in other countries is not so high-falutin as in our own. A few hints from us and a little advice now and then might do a lot to help them and, incidentally, to help ourselves.

But, with the exception of the G stations alone, there is the barrier of language which has to be overcome before any such arrangement can be brought about. Now here is where the little suggestion comes into play.

Of course, the magazines could print a dictionary of technical terms in all languages, including the Scandinavian, and let the Hams "bone" nights learning to spell the mess, but it seems to me that there is a much better and more logical method easy at hand.

When the old Q sigs were first opened to the eyes of the struggling bugs, in the days when the old closed core and rotary were the stuff, an operator could tell the other fellow just about what he had in the way of equipment and almost what he was working on without ever using anything but the new abbreviations. Now it's different. There are a thousand and one things about the tube outfit with no designation by international agreement at all.

With a well-designed set of code letters and words, it would be possible to carry on intelligible conversation between all the nationalities of the earth without infringing on any language.

This step is much easier to take than would appear at the first glance. Get together a few of the old-timers who have had a wide experience in pounding the brass, getting the traffic off the hook and cleaning the rectifier plates. Set 'em around a table, place a tentative list before them and let them chew the rag over it for a few hours. The result will be a few broken heads, more busted feelings and a darn good list of abbreviations.

The only trouble here is that some enterprising brother may conceive the idea of erecting a new international language to vie with the dozen or two fightnig for the chief spot at present. But the old-timers, methinks, can care for this particular genus with ease and alacrity. Hi.

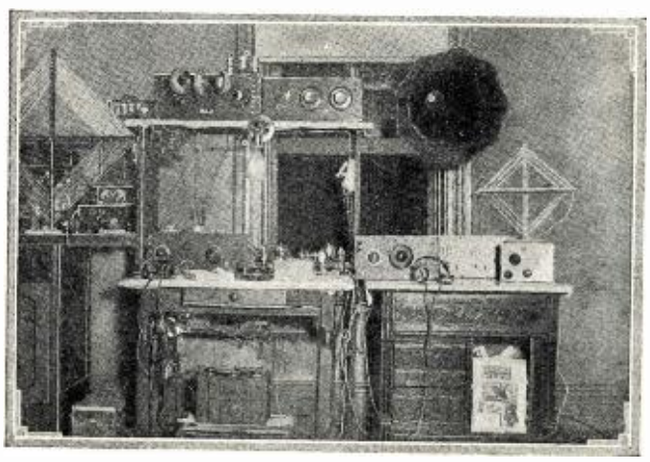
Then when a tentative American list is finished and has received the hisses and adulation of the gang, the next step would be to pass it over to some of the boys abroad. There are lots of the Big Boys who know a co-worker or two on the other side who could be depended upon to pass the good word along. A little explanation and a wait of six months or so until they had time to digest the idea and add a few of their own ideas to it.

Now, with matters taken this far, it would be comparatively simple to carry on the business of getting together, through the use of a little expert knowledge in the other languages and the addition of a few more abbreviations. Then a few interocean meetings could be held via the old C.W.

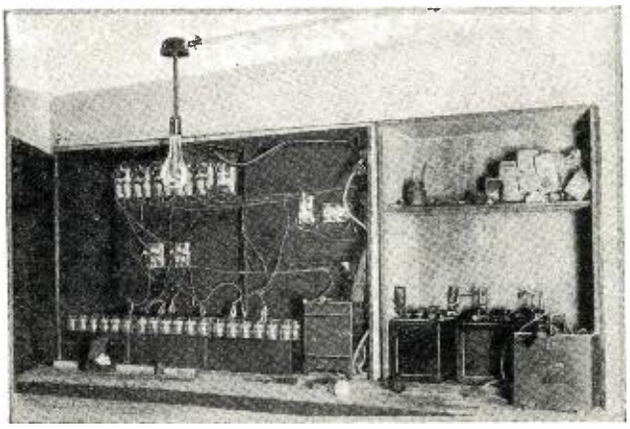
And here let me sling a few random prophecies. Now the matter of making contact with the foreign fellows is getting to be almost a daily occurrence. A few more trials and some improvements on the present style and arrangements will bring the thing to be a nightly affair instead of a weekly one.

Within a year or so at the outside there will be one or two paths carrying traffic to Europe—and maybe S. A.—as they are now carrying traffic nightly from the 2s to 5s and 7s. This may seem pretty much, but it's not. Wait until the time comes and see.

And when it comes, there will have to be something done about all the previous suggestions. Because, when you start a relay from Paris or London to San Francisco, you've got to have just as definite arrangements for the traffic routing as you do now



9BUI at St. Louis, Mo. On the top shelf can be seen a long wave set, immediately below it a short wave receiver, and to the right a regular B. C. L. outfit.



Showing a storage "B" battery installation which serves the purpose of furnishing plate supply to the transmitting tubes, much better results being obtained than when using a motor-generator.

when handling it from coast to coast of the United States.

Then, when the time comes, there will have to be an organization to make the arrangements spoken of above. Now this is one way of doing it with the least possible trouble and taking advantage of the factors and organizations already established. It is no self-respecting bunch of hams of any country who have not their own national society. These societies can begin to get together through the same old C.W. mentioned above. Then they can form a loose but definite organization among themselves to take care of suggestion, international arrangements, etc. The big point here, of course, is that they should, as soon as possible, get accustomed to doing business with each other so that should some emergency, or a sudden desire to grab some publicity or a little help, arise in some one of the countries, a communication to the other leagues will not create such a surprise.

A few preliminaries, such as appointing somebody as a sort of corresponding secretary and someone else as a president to sign the secretary's messages, is a matter that could be easily taken care of. Then, after the temporary organization was completed, each of the national leagues could appoint a delegate in any way they see fit and the delegates could carry on their business of organization entirely through the medium of the aforesaid C.W., therefore beating the railroads, the steamship companies and the Pullman porters out of some good jack! MIM.

Then, after all this has been done and relay circuits arranged to all civilized countries, including the Scandinavian the grand climax could be put on the air in the form of a sort of international convention open to all and pretty much within the reach of all. That is, within the reach of all who could rig up enough radio frequency on the short-wave receivers.

By a system of relays, using the aforementioned abbreviations, it would be entirely possible for the Ham in New Zealand to have an almost constant contact with the European gents.

International Ham radio is just in the offing. So the gang might as well begin to think along some of the lines hinted at here. The best way to solve any problem is to meet it before it arises. After it comes up, of course, there are always details that were forgotten in the carefully laid plans; nevertheless, the greater part of the work is done and the details are not so important.

So why not get in a few letters about it and give a few ideas of your own? Everyone should have a crack at it so that the best possible solution will be the one finally selected to serve.

And another word as to the abbreviations. They are needed almost immediately, if a sensible transfer of technical knowledge through the air is to be possible. Anybody can read a diagram or a hook-up since they are written in almost the same way the world over. But when it comes to giving the constants of condensers and coils, it's a different matter. Here some method of abbreviation is necessary.

Come on, gang, do your stuff.

—Jay. Hollander.

[*The first International Amateur Radio Conference took place in France early this month (April)—indeed a great step forward in "making ends meet." Mr. Lloyd Jacquet was sent as a representative from the United States.* — Editor.

Hams Asked to Help Government

AGAIN it's the amateur who is in the fore. Realizing the potential possibilities of the "Ham," the Government is slowly but steadily giving him more leeway and co-operation, and now that short wave experiments are under way, special schedules of transmission are being formulated; the Army and Navy are both vieing with each other in getting "on the right side" of the OMs, and it is safe to say that the near future will witness some wonderful improvements in the short waves.

Recent high frequency, or short wave, transmission tests from the Naval radio laboratory at Bellevue, D. C., have proven so successful over long distances that one of these transmitters is now being used regularly each night as part of the Washington system.

Within three months it is hoped that seven or eight of the Naval District Communication Centers can be equipped with small high frequency receiving sets for practical and training purposes. In the interest of developing amateurs into prospective Naval Reserve radio operators, the Department of Commerce has been asked to prepare data and instruction on short wave communication for distribution.

The Navy is greatly interested in having a broad study of high frequency, low power communication conducted and urges that amateurs picking up NKF, Bellevue, on 81.5 and 54.3 meters Monday, Wednesday and Friday nights, communicate with Bellevue. The Bellevue set used for official communication, operating on 71.5 meters, transmits between 500 and 1,000 words each night to San Diego and Balboa. It has been so successful that these stations have been permitted to "unguard," that is, not listen in for the Annapolis arc set.

This set at NKF is operated by a radio relay from the Navy Yard at Washington, where a 50-watt, 30-meter set is controlled by wire from Naval radio central in the Navy building. The oscillations of the transmitter are controlled by a special crystal at the desired frequency. The only antenna is an ordinary galvanized iron pipe about 35 feet long and 2½ inches in diameter located on the laboratory roof. There are no masts or wires so familiar in high-power work. Compared to most Naval radio stations, the power used in this work is very low, being between 8 and 10 k.w., whereas Annapolis is 350 k.w.

Signals from Bellevue's short wave transmitter have been copied in Australia, and were picked up by the U. S. S. *Canopis* while 7,330 miles distant. The battleships *Tennessee, Utah* and *Wyoming,* and the U. S. S. *Patoka* also have reported long distance, short wave reception.

Operators at the Balboa station built themselves a home-made set, while the operators on the *Canopis* constructed a single circuit, regenerative tuner, which functions well at very long ranges. This last set included a detector tube and one step of amplification. Low loss basket-weave coils of fixed value, having 11 turns each, three inches in diameter, were used. VT-1 tubes were used without grid leaks. The coils were mounted on a wooden frame so as to facilitate sharp tuning, and an air-type, 11-plate, continuously variable condenser was employed. The set at Balboa has also received Polduh, England.

Steps are being taken by the Navy to install experimental short wave receivers in the Philippines and Hawaii, while extensive studies in this work are planned during the fleet maneuvers in the Pacific.

New QRA's

3IW—H. A. Robinson, Silver Lake Farm, Willow Grove, Pa. All rpts. appreciated and crds QSL'ed.

9BZX—(Re-assigned) Isadore J. Rocklin, 3227 Jennings St., Sioux City, Iowa. 5 Watts CW. All crds QSL'ed. Pse correct your call book. TNX.

9CTV—Clement Pack, 131 Broad St., Menasha, Wis. Pse QSL crd. All crds answered same day.

9DCY—P. C. Biedenharn, 1914 Garrard St., Covington, Ky. 5 Watts CW, ICW es Fone.

(*Continued on page* 2118)

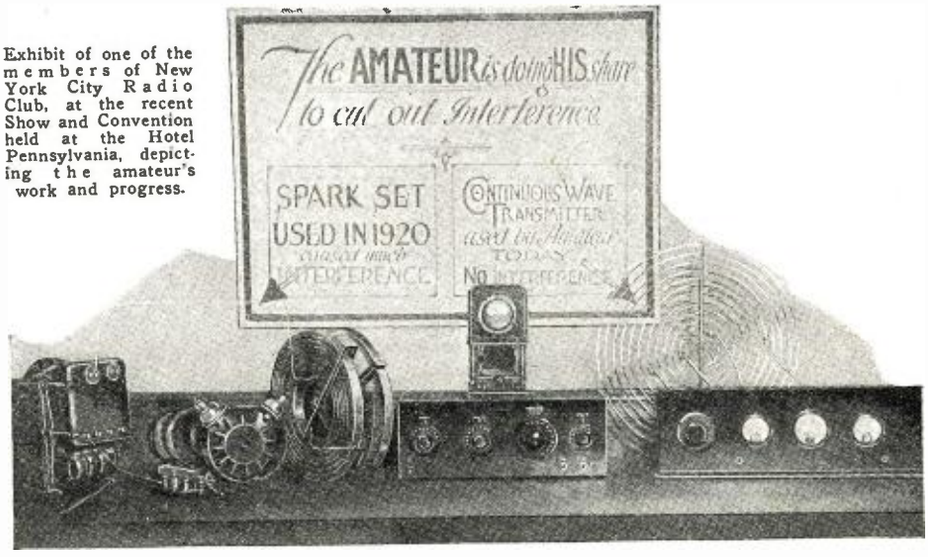


Exhibit of one of the members of New York City Radio Club, at the recent Show and Convention held at the Hotel Pennsylvania, depicting the amateur's work and progress.

A New Radiation Eliminator

The radiation eliminator herein described recently appeared on the market and should stop unnecessary radiations.

The essential parts of the radiation eliminator.

EVERY broadcast listener and amateur has a pet grievance, but the one grievance that leads all the rest is radiation from regenerative sets improperly tuned. How many times we have been listening to the golden notes of a singer or to the mellow music of a violin, only to have some too enthusiastic neighbor try for a DX station and thereby make the night hideous with a wild collection of the well known squeals and howls that would do credit to a close debate occurring at the local zoo.

There are many receiving sets on the market today that do not radiate, but for every one in use—well, we just cannot even guess how many sets there are that yell, shout and scream. The average set that is built in the home work-shop has a tendency to radiate badly. It would be almost an impossibility to give the reasons for this, as they are different on nearly every set that is built.

However, to combat this great disadvantage of radio reception a vast amount of research work has been performed. For many years nearly every large research laboratory and a number of amateur experimenters have been seeking a device to prevent a set from broadcasting the above mentioned nuisances. One of the first steps forward in 1925 was the announcement by a large radio corporation of such a device that has been eagerly awaited for a long time.

The only extra apparatus that is necessary to entirely eliminate radiation from a set is a choke coil and a small condenser placed in the circuit, as shown in the accompanying diagram. Also it will be noted that the antenna connection, instead of going to the usual place for this type of circuit, is connected at the point C to the grid of the audio frequency amplifier tube. The choke coil A is placed in series with the phones and plate circuit of the audio frequency tube. The condenser B connects the plate of the audio frequency tube to the grid of the detector tube. The remainder of the circuit follows the usual practice.

The operation of the revised circuit is that the received signal is impressed upon the grid of the audio frequency tube instead of the grid of the detector tube. The audio frequency tube acts as a radio frequency amplifier with the result that radio frequency variations are set up in the plate current of this tube. The insertion of the choke coil A results in the development of radio frequency potentials, which are impressed on the grid of the regenerative tube through the small condenser B. Due to the fact that this condenser has a very small value and the capacity between the grid and plate of the audio frequency is very small when the regenerative tube oscillates, a negligible amount of radio frequency current goes out of the antenna with the result that no disturbance is produced on neighboring antennae. The overall result on the received signal is a material increase in selectivity and there is in general no loss whatsoever in efficiency. When storage battery tubes are used there is in many cases an increase in efficiency.

The function of the choke coil being to develop a potential over a considerable range of wave-length, it is made in several sections having natural periods of 300 and 400 meters. The more sections that are used, the more uniformly will the efficiency be maintained over the range of broadcast wave-lengths.

The accompanying illustration shows the size of the device as compared to the hand of the ordinary man. The device is so simple that almost anyone can install it in a few moments with the aid of a few bits of wire and the ordinary household tools.

From the foregoing it will be seen that the necessary apparatus for preventing radiation is very easy to connect to any existing circuit. Several times in the past few months there have been agitations started to eliminate from the air sets that radiate and so are an annoyance to listeners in the vicinity. That this apparatus has been perfected is at once a step forward in the right direction for the ultimate good of all concerned.

HOW MANY BROADCASTERS DO WE WANT?

THE question of how many broadcast stations the radio world wants on the air—or, rather, how many can the Department of Commerce accommodate?—has become most pertinent.

The department has just issued a list showing the wave-length distribution for the existing 78 Class B private broadcast stations of the country, excepting nine on the Pacific Coast. For these 78 stations there are 47 separate channels; six of them are split three ways, 20 are divided between two stations and the 21 others are assigned exclusively.

How long a station can hold an exclusive wave-length is another question, for there are 21 more projected Class B stations said to be under construction or planned, and the nine Pacific Coast stations to be taken care of.

The Commerce Department has announced that this list includes all the waves there are for the Class B's to use; literally, "there isn't any more" wave space. Secretary Hoover is without authority to deny a station a license if it meets operating requirements. He will hesitate, therefore, to tell an applicant he cannot have a license, although he might be justified in many instances in doing so.

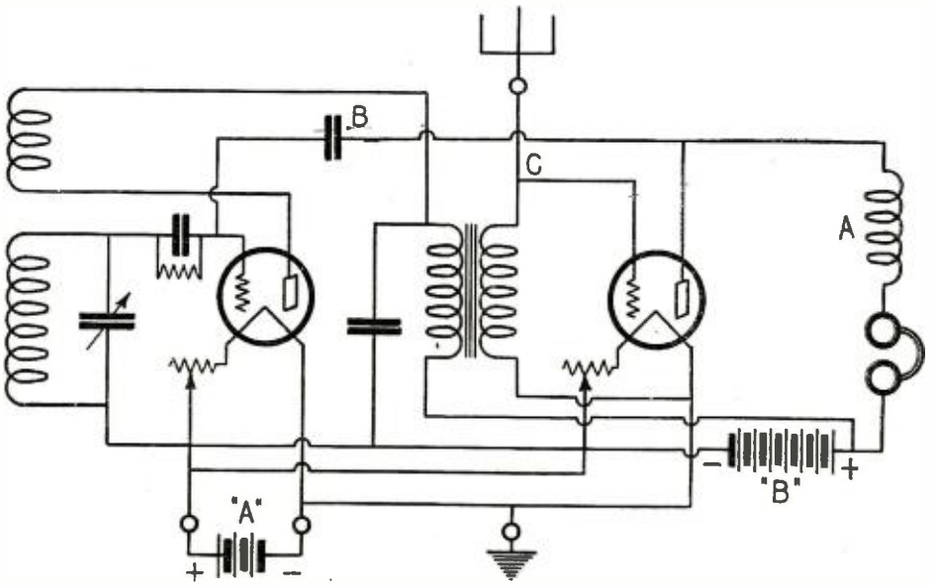
Reviewing the situation in some of the congested localities, it is soon seen that the broadcasting field is not only well covered, but is jammed. In New York there are eight B stations, including one in Newark, on the air using six wave-lengths; how can any more be licensed? Yet there are several other applicants.

WEAF, WJZ, WNYC and WHN have exclusive wave-lengths, which might be shared with four new-comers, but would this plan interest the radio public? Most of these stations are quite popular and one is a municipal station, whereas the new-comers represent unknown quantities.

The situation in the Chicago district is perhaps worse. There are 10 stations there sharing five wave-lengths—an even split. But there are several well-known companies and concerns waiting to open Class B stations, it is understood. Philadelphia has four large stations and two wave-lengths. Fortunately, the congestion is not as bad elsewhere.

How Mr. Hoover's aides will decide the question is not known. It may revert to the public in the form of a sort of referendum, when the actual applications from these 20 odd stations come in. If so, Mr. Hoover may ask the prospective broadcasters and the radio fans what to do.

Should nationally popular stations like WEAF or WJZ be forced to share their wave-channels, dividing time with unknown and unestablished stations? Will a station operated by Messrs. Blank & Co., in New York, give reliable and entertaining service of benefit to the radio world, or as much so as the two stations mentioned as examples? Would it not be better to license new stations in the crowded districts like New York as Class A stations, sharing their wave-channels with several other distant stations in other radio districts?



Circuit diagram showing where the instruments for eliminating radiation are placed.

Push-Pull Amplifiers with Standard Parts

By PHILIP K. WINSLOW

The efficiency of the push-pull amplifier in point of perfect tone reproduction has long been known. Here is a method of building it which uses only standard parts which every experimenter owns.

BECAUSE the push-pull audio frequency amplifier has seemed to require two special transformers, many radio fans have been deterred from adopting it by the extra cost involved.

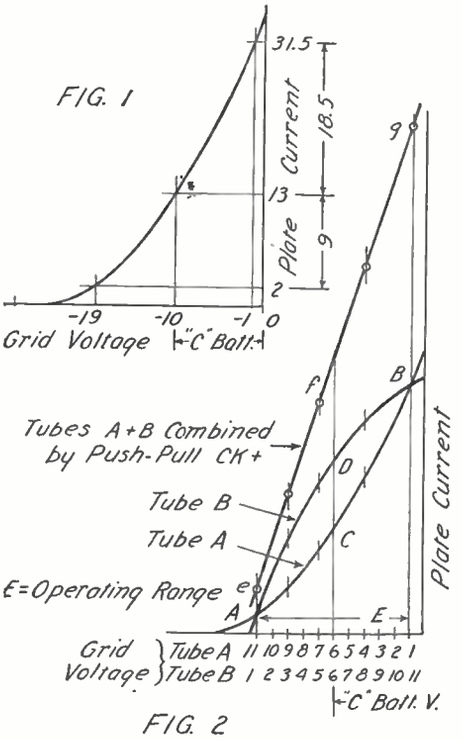


Fig. 1 shows the familiar characteristic curve of the average tube. Fig. 2 shows push-pull combination effect.

Here is a method of construction which requires only one transformer and that of the standard two-winding type. The results will be equally satisfactory.

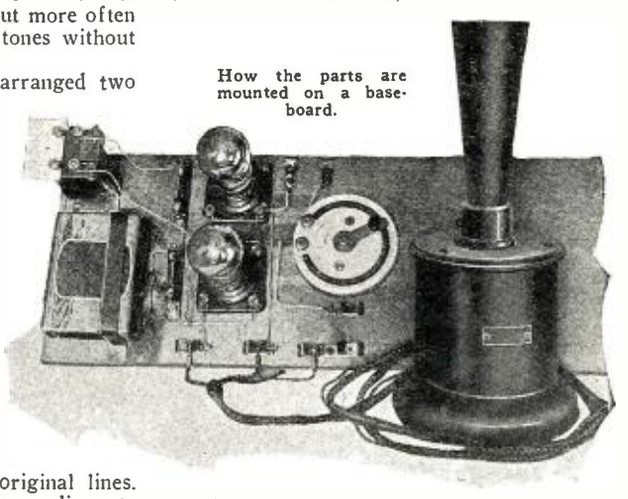
Before going into details of *how* to construct this particular circuit, it may well be asked, "Why build a push-pull at all?"

To answer clearly that sensible question, let us go a little into the fundamentals of amplifier design. In the earlier stages of an amplifier, it is not necessary for a tube to give out much energy because the apparatus it feeds (the inter-stage transformer and the grid of the next tube) requires very little energy. However, as the stages increase, more and more power is required.

From the standpoint of power output alone, the two tubes might be connected in parallel, but having them in the so-called "push-pull" circuit clears up a certain kind of distortion and so this circuit is always used. A study of the familiar vacuum-tube characteristic curve, as shown in Fig. 1, will explain this. Suppose a 10-volt negative "C" battery is used, and that the incoming signal superimposed a maximum of nine volts, alternately + or —, on the steady C voltage of the grid. The actual grid voltage then swings from — 1 to — 19 volts, and the plate current rises and falls also. But the latter is not proportional to the former because the tube's response falls off at the lower end, *i. e.*, the characteristic is curved. This curvature, while most pronounced at the lower end, really exists throughout the working range. One of its effects is to "heterodyne" two strong audio notes, producing a "beat" note which is sometimes heard as a high-pitched buzz, but more often spoils the clarity of the other tones without attracting attention to itself.

Suppose, however, that we arranged two tubes in a circuit so that while the grid voltage of one was decreasing that of the other was increasing. Then, by putting the plate currents through a transformer so as to reverse the effect of one tube, we could make the two outputs add up. Doing this graphically in Fig. 2, where ACB is the curve of one tube and ADB that of the other (with direction reversed in the output transformer), EFG is the resultant current, and this line is evidently much straighter than either of the original lines. Hence the heterodyning of one audio note with another will be much less than with either tube alone or with the tubes in parallel.

The usual way of arranging tubes in push-pull is shown in Fig. 3. All the elements of this diagram are familiar to radio fans, and need no explanation except the symbols "I" and "O." These stand for "inside" and "outside," respectively, and identify coil ends that have the same polarity at any instant. To connect coils in series, we connect an I to an O, just as we connect a + terminal of one battery to a — terminal of another battery. When a direct current flows into such a junction point, as where the "B" battery connects to the output transformer, half of it flows through the upper coil, creating a magnetizing force acting upward, and the other half flows through the lower coil, creating a magnetizing force acting downward. When a signal comes in from the previous stage, it generates an alternating voltage in the secondary of the input transformer acting at a given instant in the direction of the nearby arrows. Now measuring the grid-filament voltages, this new voltage will tend to reduce the effect of the "C" battery on the upper tube and increase it on the lower tube. So the plate current through the upper tube and its coil is increased, giving an *increased upward* magnetizing force in the core of the output coil. At the same time the plate current in the lower tube and coil is reduced, giving a *reduced downward* magnetizing force. The latter has the same effect as the former—to increase the magnetism in an upward direction. A moment later, with the reversal of the incoming wave, the whole action is reversed, and both tubes act to increase the magnetism downward. This alternation of magnetism induces a voltage in the output secondary which sends current through the loud speaker.



How the parts are mounted on a base-board.

For some reason, probably the slight increase of cost, manufacturers seldom put out transformers with coils in sections. Some pains are needed to make the two sections equal, and probably the demand does not justify it. There are on the market only two or three makes of transformers with which to construct this circuit, and an output transformer must be used to combine the outputs of the two tubes. To avoid this, it is only necessary to secure two essentials: (1) A mid-point for the grid return-wire at the input side, and (2) a mid-point for the "B" battery at the output side.

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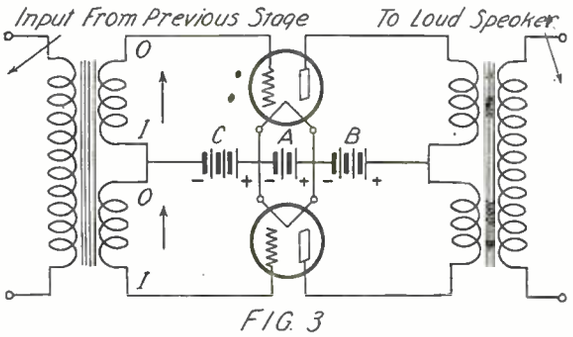
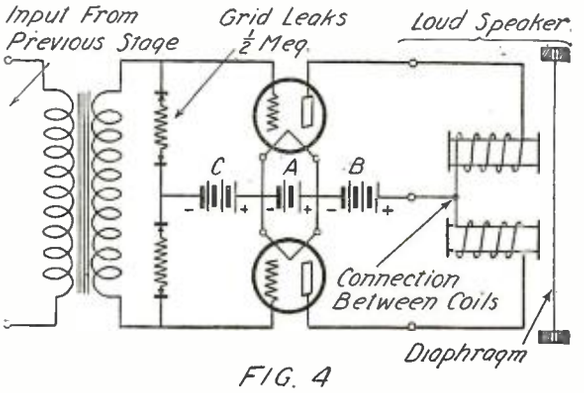


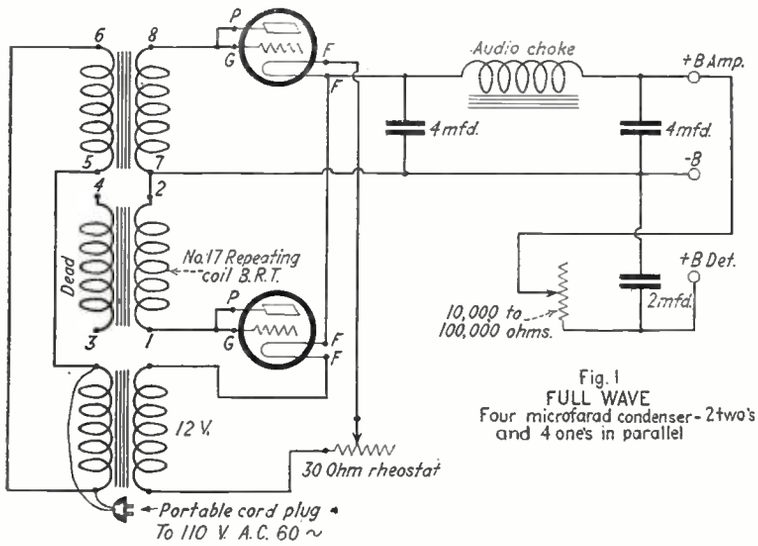
Left: The ordinary 2 tube push-pull amplifier. Right:. New method giving excellent results.



"B" Battery Eliminator from Standard Parts

By DONALD E. LEARNED

Here is a rectifier for supplying "B" current that anyone can construct.



A hook-up of the "B" battery eliminator which may be constructed from standard parts. Little difficulty will be experienced in building it.

Fig. 1
FULL WAVE
Four microfarad condenser - 2 two's and 4 one's in parallel

PROBABLY the greatest nuisance connected with the operation of a radio set is the battery supply. "A" batteries lose their kick and the set no longer amplifies as it should. "B" batteries run down and develop high resistance cells, so that they cause howls, weak signals and loss of distant reception. Storage "B" batteries are some improvement, but they must be charged occasionally. Dry batteries are very expensive from the viewpoint of current cost, about two hundred times as expensive as commercial current.

However, to utilize commercial current, it is necessary to smooth it out, make certain voltage reductions, and highly desirable to interpose some sort of insulating device between it and the set. Devices which do the above operations are already on the market under various trade names, but the item of first cost makes many radio fans hesitate to invest.

These devices are not complicated, but the construction of them presents quite a few problems if the necessary transformer is built at home. However, a little shopping at the radio stores and at the second-hand telephone supply houses, will land the apparatus needed and an evening's work will complete the assembly.

Obtain from a telephone supply house a high impedance repeating coil and 5 two-microfarad condensers (10 one-mfd. condensers will do). The coil obtained should be wound with wire, 30-gauge or larger, and should have four separate windings of approximately equal resistance, any one of which should have sufficient impedance to use as the primary winding on 110-volt 60-cycle current. This coil should be tested as to insulation between windings at 220 volts 60 cycles by connecting one end of each winding to either side of the test voltage. The condensers should also be tested on the same voltage.

CHOKE COIL

An audio choke coil will also be needed to act as a filter to cut out the hum of the supply current. This may be a telephone choke or retardation coil, the secondary of an audio transformer, or the primary of a bell-ringer transformer. Providing the unused winding is not short circuited, all windings may be left in place on the core.

In addition to the above apparatus, the following is also needed:

1 6- or 12-volt bell ringing transformer (must handle ½ or ¼ amp., respectively).
1 6- or 30-ohm rheostat for 6- or 12-volt respectively.
2 Tube sockets.
2 ¼-amp. amplifying tubes.
1 Variable resistance, 10,000 to 100,000 ohms.
1 10-ft. portable cord and plug to connect to house circuit.
3 Binding posts, —B, +B Det., + Amp.
1 Box, panel and base, 7 x 12 inches in size; or one 7 x 12-inch mounting board.

Mount the apparatus in the cabinet, or on the mounting board, as preferred. The condensers may be stacked to conserve space, and fastened down by passing a leather strap over them, and securing the strap to the base with screws and washers.

Wire as shown in Fig. 1, windings 1-2 and 7-8 being connected to assist each other. The winding numbers are standard with most coils. Connect the portable cord to the primary of the bell ringing transformer and to either 3 and 4 or 5 and 6 of the repeating coil. Wire the filament circuit according to Fig. 1 for a 12-volt supply and according to Fig. 2 for a 6-volt supply.

ANOTHER FORM

Fig. 2 is given for the utilization of a telephone retardation coil, or a transformer of ratio 1:1 up to 1:1 ½. While this gives only half wave rectification, it will operate very quietly if the filter system (choke and condenser bank) is good. Specifications for the retardation coil are the same as for the repeating coil except that it has but two windings.

A word as to the operation of these plate-current supply devices. It sometimes happens that the user connects one to a set that has insufficient negative bias on the tubes, causing quite an audible hum, due to overload. This is hard on tubes as well as the user's ears. This outfit will supply sufficient plate current for eight tubes, if they are properly biased. Add "C" battery to the point where it begins to cut down on the signal on the audio stages, and on the radio stages if they are non-oscillating. The writer applied a 12-volt bias to the radio stage of his set, with a reduction from 20 milliamperes to 5 milliamperes in plate current and increase of signals. This conserves the life of the tubes as well.

CONTROL

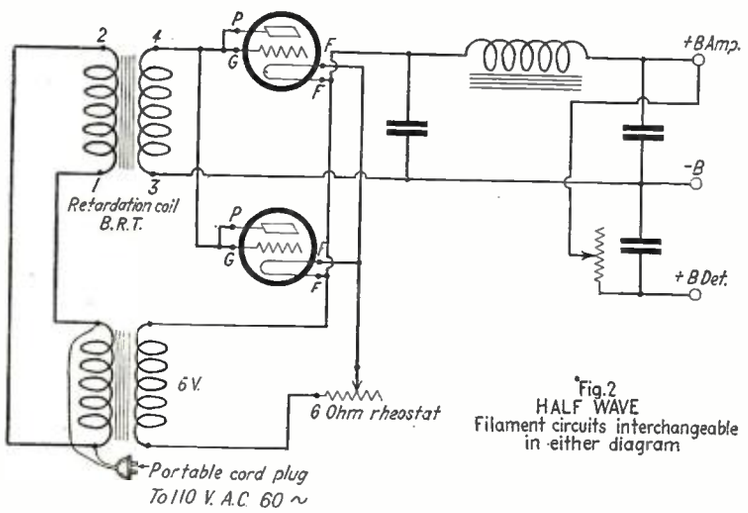
Control of the output voltage of the set may be had by adjusting the rheostat, and of the detector voltage by means of the adjustable resistance. And this last is a real control, too. Also keep in mind that the output voltage is from 155 volts on down, depending on the load. Do not turn the tubes high on a one- or two-tube set.

Old tubes will sometimes work very nicely in this outfit, but be sure to check them with a good tube, for a paralyzed tube may be so far gone that it will not pass enough current to keep the condensers charged. For an eight-tube set, nothing but the best should be used.

The writer will be glad to receive any comments on the above device, and will be glad to advise further on receipt of stamped, self-addressed envelope.

SPECIFICATIONS WRITER'S OUTFIT

The writer used a Kellogg No. 17A repeating coil, No. 40A retardation coil for filter choke, a Dongan 6-8-14 bell ringing transformer, Kellogg No. 34 condensers (2 mfd. paper) and a Durham adjustable resistance. Output voltage on a four-tube set, 135 volts, computed by milliammeter and counter emf. method, detector voltage variable from 45 volts to 6 volts calculated by substitution method. Voltmeters are not reliable unless checked with a milliammeter, as they consume a very appreciable proportion of the output current, thus lowering the voltage. The writer also recommends the use of VT-2 or 202 tubes in conjunction with an Acme 75-watt filament transformer for extreme load conditions.



Another form of the eliminator employing a different form of coil for furnishing "B" supply only.

Fig. 2
HALF WAVE
Filament circuits interchangeable in either diagram

STANDARD HOOK-UPS

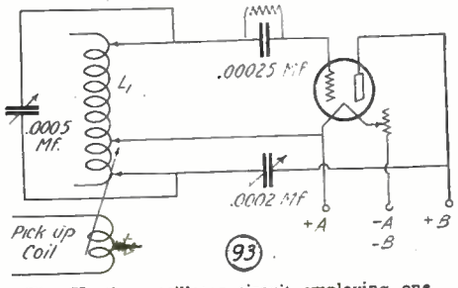
EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

Handy Reference Data for the Experimenter

HARTLEY OSCILLATOR

Circuit No. 93. In the accompanying diagram is shown the fundamental circuit for the Hartley oscillator and a pick-up coil for the Super-Heterodyne receiver. The inductance L1 is composed of 50 turns of No. 22 D.C.C. wire wound on a 3-inch tube. The pick-up coil, L2, has 10 turns of the same size wire wound on the same tube spaced about ½ inch from the first mentioned winding.



The Hartley oscillator circuit employing one tapped coil and a pick-up coil

The oscillations are controlled by the variable condenser of 23 plates and also the amount of inductance that is in the grid and plate circuits. The amount of plate voltage necessary for oscillation depends upon the type of tube that is used. It is advised that a 201A or 301A type of tube be in the circuit, as a higher plate voltage may be applied to this tube, though other types of tubes will operate satisfactorily.

THREE CIRCUIT OSCILLATOR

Circuit No. 94. Another type of oscillatory circuit is shown in Fig. 94. In principle it is the same as that of Circuit No. 93. Three honeycomb coils are employed to form the inductances, and the 23-plate condenser is connected across the grid coil for controlling oscillations. The same data for tubes that was indicated in the former oscillator applies to this circuit, too.

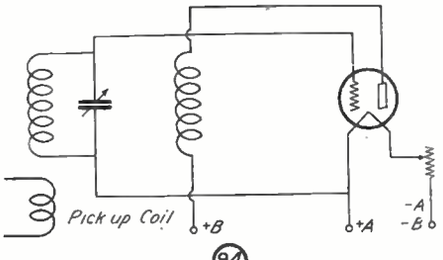
Both of these hook-ups are given in these columns because every Super-Heterodyne circuit has its fundamental, some such circuit for changing the incoming frequency to the wave-length that the intermediate transformers are designed for, by heterodyning. Also the principle of oscillations and how they are produced in a circuit should be thoroughly understood by every experimenter.

THE TROPADYNE SUPER-HETERODYNE

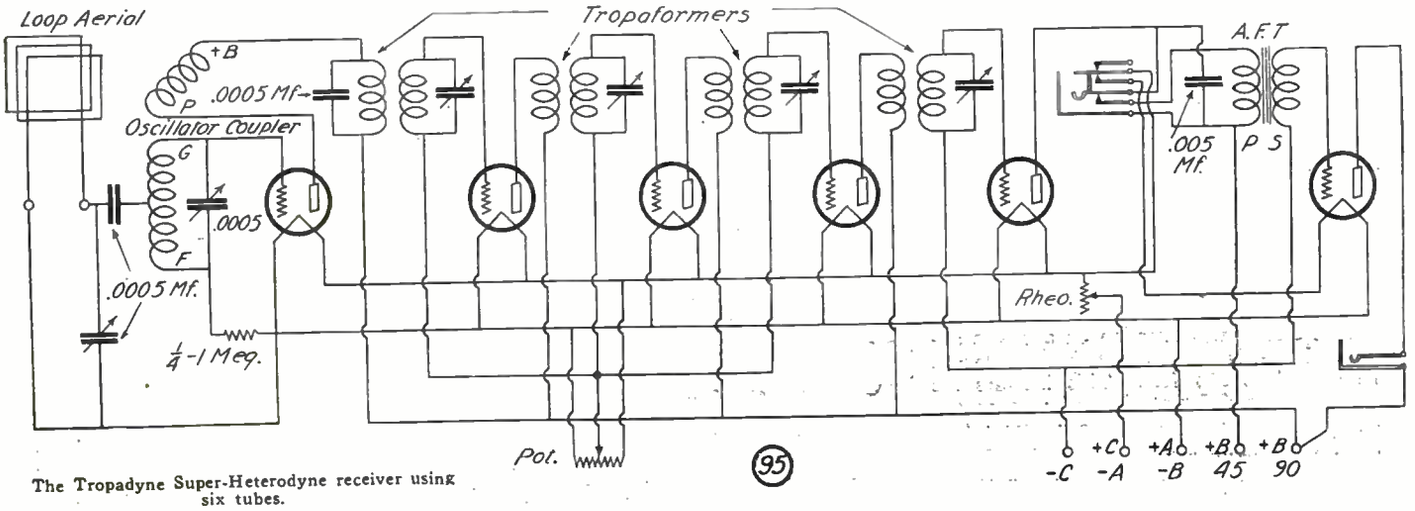
Circuit No. 95. The value of the Tropadyne need not be told to readers of RADIO NEWS, as the merits of the circuit have been told in the August and November, 1924, issues. In the first place there are but six tubes used, giving as much volume as the average set using more tubes. The selectivity of this set is excellent. Two lengths of three-inch tubing, one three inches and the other four inches long, are required to wind the coupler and the oscillator coils on. The primary and secondary coils are wound on the 3-inch tube and are designated as AG and GF, respectively. The primary coil AG consists of 8 turns of No. 24 S.S.C. wire and the secondary GF is 50 turns of the same wire, both coils being wound in the same direction. On the 3-inch tube that is 4 inches in length, wind on 12 turns of No. 20 S.S.C. wire and then wind on 55 turns of the same wire. On these two tubes the two windings are spaced ½ inch apart. The two variable condensers have a capacity of .0005 mf., *i. e.*, 23-plate condensers. The remaining apparatus has the values indicated in the diagram. The frequency changer tube, which is the first one at the left in the diagram, is placed in the layout of the apparatus between the two condensers. This is done in order to make the connections as short as possible to this tube and condensers. The size of the panel necessary for this receiver is one 7 by 30 inches, which size allows sufficient space for wiring.

Above are given the constants for a coil that is used as a coupler when an outside antenna is used. The coil is shown in the circuit diagram published in RADIO NEWS, issue of August, 1924, and is designated by the same letters. Although this circuit functions very satisfactorily on an outside antenna, it performs excellently on a loop antenna, and if this is used the coupler need not be constructed.

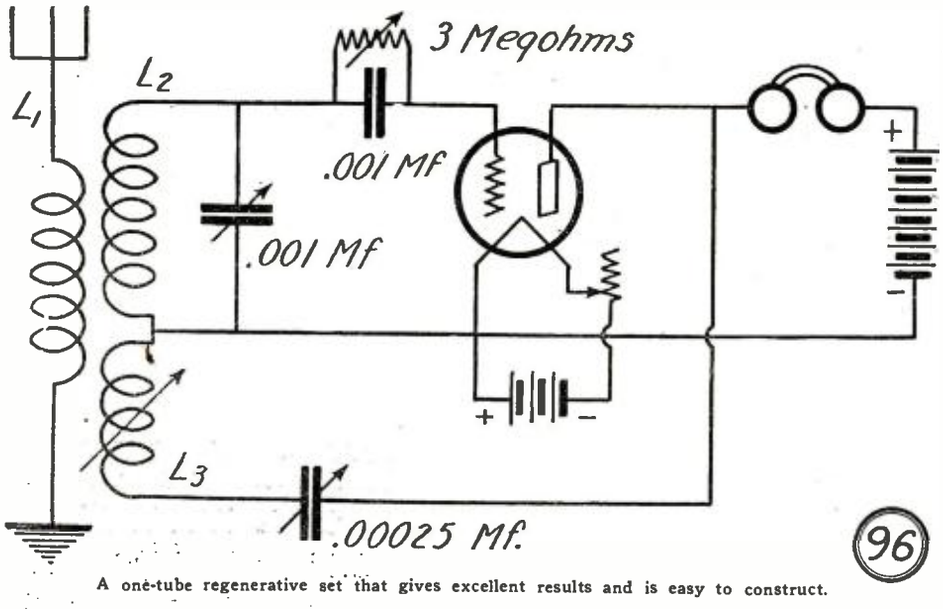
The connections of the Tropadyne are similar to the standard Super-Heterodyne, except for the first tube. It will be noticed, however, that there are no grid condenser and grid leak in the circuit of the second detector. These two pieces of apparatus were eliminated because it was found that distortion was decreased to a minimum by operating the tube on the lower bend of the tube's characteristic curve. This is accomplished by connecting the grid return lead to the negative terminal of the "C" battery, which acts as a grid bias for the audio frequency amplifier tube. This applies a negative potential to the grid of the detector, and therefore very little or no current is absorbed by the detector, and the selectivity of the intermediate amplifier is considerably improved. With a "C" battery of 9 volts and a plate voltage of 45, the selectivity is so great that powerful local stations otherwise broad in tuning are tuned in and out with the vernier alone. This battery does not decrease the volume and the quality of reproduction is remarkable. The data for the construction of the intermediate transformers will be found in the issues of RADIO NEWS that are referred to above. These transformers are tuned by variable condensers across the secondaries, so that each transformer is operating on the same wavelength.



The three-coil oscillator circuit.



The Tropadyne Super-Heterodyne receiver using six tubes.



A one-tube regenerative set that gives excellent results and is easy to construct.

A SIMPLE REGENERATOR

Circuit No. 96. One of the most interesting circuits for the experimenter is the hook-up shown in Fig. 96. It is an adaption of the famous Hartley oscillator circuit. The apparatus required for this circuit can be easily made by the average experimenter. The inductance L2 is wound on a bakelite or hard rubber tube 3½ inches in diameter and consists of 35 turns of No. 18 D.C.C. wire. Directly over this winding is placed L1 which is 10 turns of the same size wire. The movable part of the coil, L3, was wound with twenty turns of No. 20 D.C.C. wire on a bakelite tube 2¾ inches in diameter. The tube on which are wound L1 and L2 is placed with its axis parallel to the panel. In the end opposite that which has the inductance L1 on it, drill two holes diametrically opposite to take the bearings of the rotor, L3. These bearings are made of small machine screws. The rotor does not have to be controlled from the front of the panel, as it remains in the same position after once being set. The two variable condensers are placed at the left-hand side of the panel with the inductances directly in their rear. With this arrangement very short leads are the result.

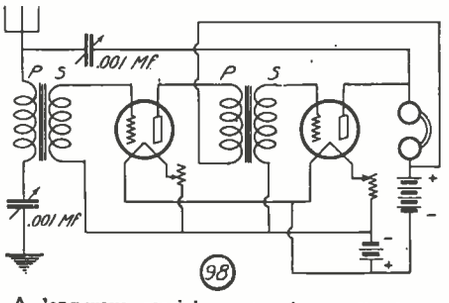
The tuning of the set is extremely sharp, and as may be expected a vernier control must be used on the .001 mfd. condenser. The close approach to the point of oscillation is evidenced by the fact that the circuit does not "spill over" into oscillations suddenly as is the case with nearly all regenerators. As the regeneration control condenser is increased, the amplification increases continuously, gradually working into the condition for oscillation. The approach is so close that both the incoming signals and the regenerative whistle can be heard at the same time when the tuning is very close.

The adjustment of the movable part of the coil is made as follows: The set is tuned for the longest wave-length it is desired to receive, with the movable coil at right angles to the main coil. This is the condition for least amplification or feedback. The movable coil is rotated until the set just begins to oscillate. It need not be adjusted after this, and it will be found that the tuning may be done entirely by the .00025 mfd. condenser.

This circuit will function on any size antenna, but it is advised that the total length be limited to 120 feet. This includes the lead-in. The different sizes of antenna are compensated by the tuning condenser; that is, if the set has been calibrated and a different antenna is used then the readings will be different also.

COMBINATION TRANSMITTER AND RECEIVER

Circuit No. 97. Have you ever wanted to do some experimenting along the lines of combining a transmitting and receiving set? If so, doubtless visions of motor-generator sets, 500-watt tubes and such things have crossed your mind and so discouraged you. Yet here is a circuit that requires none of these expensive things and will illustrate very well the principle involved.



A long-wave receiving set using audio frequency transformers for coupling.

The inductance consists of 30 turns of No. 14 D.C.C. wire wound on a 3-inch bakelite or hard rubber tube. As the variable condenser of .001 mfd. capacity (43 plates) is the only tuning instrument in the circuit, a vernier attachment of some sort is necessary.

In the ground circuit the double pole double throw switch connects either the microphone or the telegraph key in the circuit. In the circuit of the key there is a single pole single throw switch for short circuiting the key when the D.P.D.T. switch is thrown to the right side. When this short circuiting switch is closed, and the other switch is in the position indicated in the preceding sentence, the circuit may be used for receiving signals.

This circuit operates best when there is a 201A or 301A type of tube used, because the high plate voltage can safely be applied to the plate of these tubes. The wave-length range may be varied by substituting other inductances for the one mentioned above. Many interesting experiments can be performed and much practical experience may be gained with this circuit.

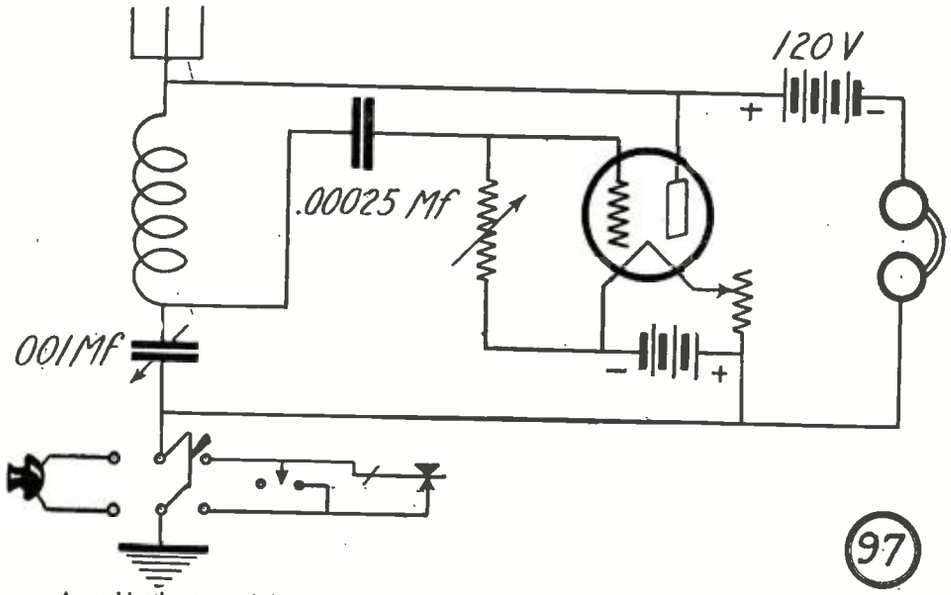
This combination circuit will operate very well with an antenna of about 100 feet in length, and if a cage type of antenna is used the results should be excellent.

It should be remembered when this set is operated as a transmitter an amateur license is necessary. An excellent instrument to make in conjunction with this set is a wavemeter to determine the frequency of the transmitter. Constructional details may be found in former issues of RADIO NEWS.

LONG WAVE RECEIVER

Circiuit No. 98. Very few experimenters are aware that audio frequency transformers may be used as shown in Fig. 98. This hook-up is one which will make the set operate on a wave-length in the neighborhood of 6,000 to 10,000 meters and up. As may be seen in the diagram two variable condensers are employed, having a capacity of .001 mfd. (43 plates).

If the experimenter has several types of transformers on the bench, it would be an interesting thing to determine what sort of reception would result with several stages of this sort of amplification. There is no reason to believe that it would not be possible to pick up the long wave stations using a circuit of this type, because the longer the wave-length, *i. e.*, the lower the frequency, the more efficiently will the set operate. If the input transformer of a pair of push-pull transformers is available, the tapped winding would be used to change the wave-length, as tapping in one, either part of or the whole winding would act as a different amount of inductance in the circuit. This transformer would of course be used in the antenna and ground circuit, as primary and secondary.



A combination transmitting and receiving set which may be built by the experimenter and which should give excellent operating results.

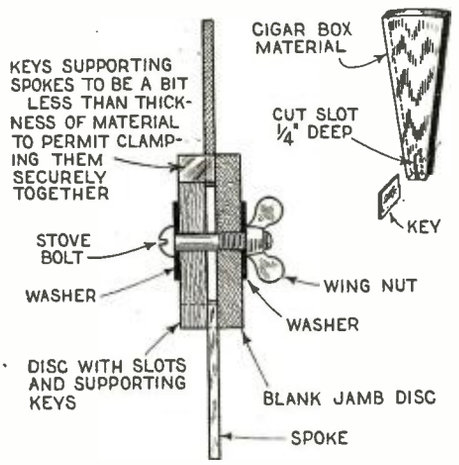
Awards of the $50 Radio Wrinkle Contest

First Prize

A LOW LOSS SPIDER-WEB COIL WINDER

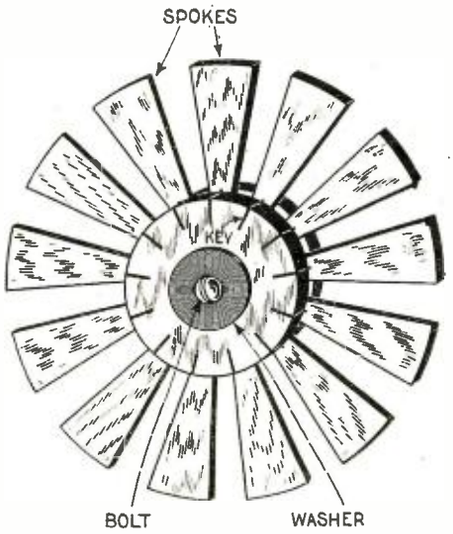
By H. A. MACDONALD

There are many different methods of preparing coil forms, the majority of them requiring holes drilled around the circumference of the disk. The form here described eliminate all such drilling and also pegs that wear and get loose in their sockets. The materials necessary are a side of a cigar box (straight grained), a ⅜-inch piece of hard wood from which the disks may be cut, a piece of strip copper about ½ inch thick, and a ¼-inch stove bolt. A fret or scroll saw is necessary to cut the slots.



Showing how the various parts of the coil winder are assembled.

Cut from the cigar box material 13 spokes, as shown in the accompanying sketch, clamp them together and even them off with sandpaper, making them all the same shape. While the spokes are clamped together, mark off a center line (at the edges of the spokes which are clamped between the disks or the inside ends nearest the center) and saw a slot ¼ inch deep. This slot acts as a support and centralizer for the spokes, which slip into the key carried on one face of the disk, as described later. The slot permits the spokes to be slid off after the coil has been wound.



The final assembly of the winder is a simple matter, as shown above.

Next cut two disks from the ⅜-inch material and divide one of them into 13 equal parts on the outer circumference and draw lines to the center. A second circle is drawn ¼ inch nearer the center, which acts as a guide for the depth of the slots carrying the keys. These slots are sawed also with the scroll saw. The keys are cut from the thin sheet copper and fitted to the slots, the width being a little less than the thickness of the spokes. If these keys are exactly the width of the spokes when the disks are clamped together, it will be impossible to remove the spokes after the coil is wound. These keys are glued in the slots on one disk only, the other disk acting merely as a backing to clamp against. A ¼-inch hole is drilled through the two disks to take the stove bolt, which may have a wing nut to tighten with.

Slide the spokes on the keys and place the blank disk in position, clamping with the wing nut and stove bolt, using washers as shown. After winding coil, paint the intersections of windings with collodion and allow to dry about 15 minutes before removing from the form. The resulting coil will be one having as few losses as possible and in addition once made the form may be used indefinitely with no appreciable wear.

Prize Winners

First Prize $25

A LOW LOSS SPIDER-WEB COIL WINDER

By H. A. MACDONALD
Care of J. E. Sirrine & Co.,
Greenville. S. C.

Second Prize $15

A NEW RADIO LOG

By HERBERT C. McKAY,
Eustis. Fla.

Third Prize $10

HOME-MADE DIAL INDICATOR

By JAMES A. MALONEY,
524 Crown Ave.,
Scranton, Pa.

Note: The next list of prize winners will be published in the July issue.

Second Prize

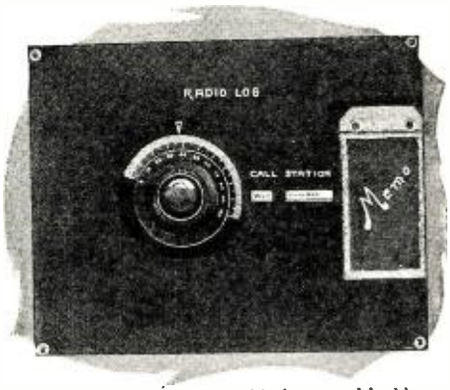
A NEW RADIO LOG

By HERBERT C. McKAY

A radio log such as is illustrated in the accompanying photograph will appeal to the large number of fans who have sets that may be logged. It is comparatively simple to construct and should prove of great aid to any receiving equipment.

The panel may be of any stiff material. For the best appearance a thin radio panel may be used, or for ease of construction a good grade of black cardboard. A sub-panel is also necessary, which may be of binders board, or stiff cardboard about ⅛ inch thick. These two panels should be 8 x 10 inches. The log itself is made of heavy white bristol board and is 9⅞ inches in diameter. Four cardboard washers and a 3- or 4-inch dial constitute the remaining material. The memo. pad may be purchased at a stationery store for a few cents and cut down to required size.

The two panels are cut exactly to size. On the face of the sub-panel and on the back of the panel describe a circle exactly the size of the recording dial, 9⅞ inches. Drill out both centers. Place panels together and drill screw holes in each corner, for fastening the panels together. Using the drilled hole as a center, cut a hole in the panel the size of the dial (which we will assume to be three inches) so that the dial will revolve freely in it. If the panel is of any great thickness, bevel it so that the indicating point will come near the graduations on the dial. Then cut the openings through which the call letters and the station name appear, these also being beveled.



A recording log such as this is a good looking and convenient adjunct to the set.

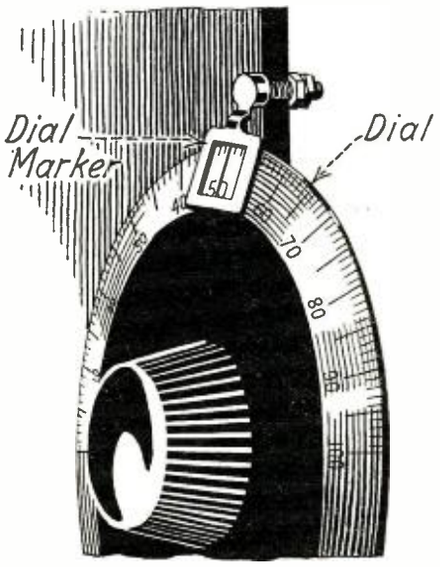
Before assembling, four cardboard washers are prepared so that the cardboard may turn freely between the two panels. This cardboard log is pivoted on the sub-panel by means of a split-rivet or similar means. After the two panels have been fastened together by small bolts and nuts (or in case cardboard is used, paper clamps), make sure that the recording dial and hole are *concentric*. Spread glue thinly upon the back of the dial and set it firmly upon the recording log. Allow the glue to dry thoroughly. The face of the panel may be finished in any way that the constructor may desire.

Third Prize

HOME-MADE DIAL INDICATOR

By JAMES A. MALONEY

The majority of the dial markers that are on sets today have one great disadvantage, which is that if the markings on the dial are viewed from an angle, an error of as much as one division may be made. With



Dial indicator made from switch point and sheet brass.

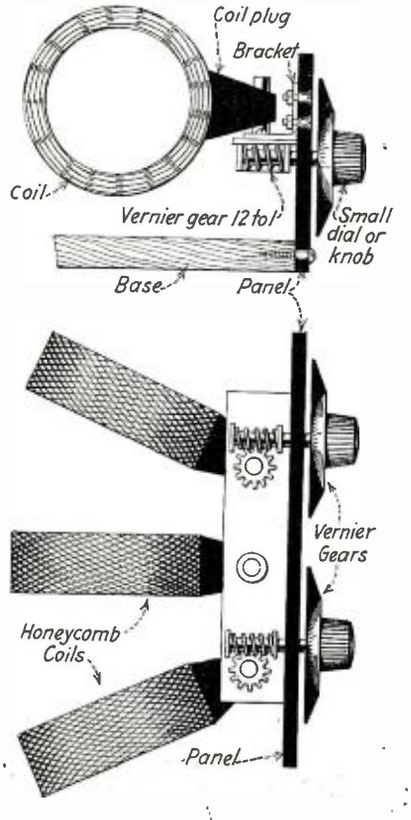
the marker described, this error is eliminated, as the marker is almost touching the dial.

From a piece of 3/32-inch metal, file out the marker shown in the sketch. The shaft is 3/8 inch long and as wide as the switch point, to which it is soldered. The opening through which the dial markings are seen is 1/4 x 3/8 inch, with 1/16 inch frame. The shaft is bent so that the marker is at the same angle as the beveled edge of the dial. Across the middle of the marker is soldered a piece of No. 26 wire, which acts as a line to accurately take the readings. To make the marker match the rest of the set, the whole thing may be nickeled. A hole is drilled in the panel just above the dial through which is placed the switch point with the attached marker.

HONEYCOMB COIL MOUNTING

One of the most difficult instruments to construct so that it will operate smoothly and have a fine control is a three-coil variable mounting. In the sketch is shown a mounting that any experimenter may make, which should be satisfactory.

The vernier gears shown are taken from a discarded mandolin or may be purchased at a hardware store. The sub-panel that the gears are mounted upon is of bakelite or hard rubber and should be about four inches in length. The two brackets that hold this



A few odd worms and gears afford an excellent means for use in a coil mounting.

sub-panel to the panel of the set are made of brass strips 1/4 inch wide and 1/16 inch thick.

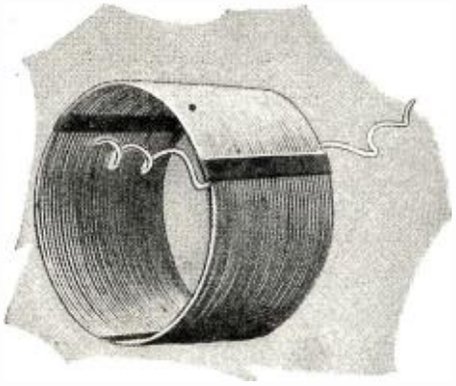
The first operation in the construction of this mounting is to drill the sub-panel as shown. Dimensions will not be given here as they depend upon the type of gears used and also the type of coils. However, a precaution might be mentioned. Be careful in drilling the sub-panel to keep the drill at right angles to the sub-panel so that the shafts of the gears will run true. As may be seen in the sketches, the worm parts of the gearing system are attached to the dials of the set.

The manner of attaching the coils to the gears may be done in any number of ways. The simplest is to drill a hole in the standard mounting that comes with the coils of such a size that they may be fastened securely to the vertical shafts of the gears. It will be found that this system of mounting honeycomb or spider-web coils is one of the best that has yet been tried.

Contributed by John Hayek,

A LOW LOSS SPACE-WOUND COIL

The following is a description of a coil having very low electrical losses and sufficient mechanical strength to enable it to be used under the most rigid conditions.



An efficient form of inductance. The coil is space wound and is self-supporting.

This coil eliminates two undersirable features found in other popular low loss coils, *viz.*, the danger of short-circuiting turns as in the "basket-weave" type and the high distributed capacity as found in the "pickle-bottle" type.

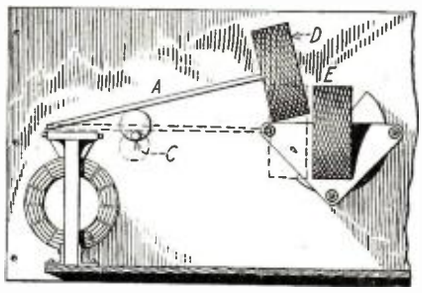
Any size wire between No. 12 and 20 will be satisfactory for winding the coil. However, it is recommended that No. 16 or 18 be used if possible. Obtain a bottle whose diameter is equal to that of the coil to be constructed. From a piece of gum paper tape cut out three strips 1/16 inch wide and approximately three times as long as the finished coil is to be. Several rubber bands will come in handy here to hold the tape strips on the bottle while the wire is being wound on. The turns should be spaced by a string which is wound on along with the wire. Ordinary wrapping twine will be satisfactory for the smaller wire, but something bigger should be used for the larger sizes. When the correct number of turns have been wound on, fasten the end of the wire by another rubber band and remove the string. Apply a thick coat of collodion on the wire over the tape strip. Allow this to dry and put on a second thin coat. Moisten the tape not covered by the wire and collodion and press down while it is still sticky. When this dries, break the bottle and remove the completed coil.

Contributed by E. F. Powell.

A SIMPLIFIED COUPLING CONTROL

The receiver constructor is often confronted with the problem of an unsymmetrical panel layout in favor of proper instrument spacing and efficient wiring, a neatly arranged panel seldom giving apparatus arrangement to permit of best efficiency and short connecting leads. For best efficiency, inductance coils are mounted directly on the condenser by which they are tuned, being placed at right angles to the plates. Variable inductive coupling to such coils generally presents a difficult construction problem, which is quite simplified in the method illustrated.

A is a length of 1/4-inch dowling, fastened by a small hinge and supported by a post on some one of the instruments, such as an audio transformer. C is the shaft back of the panel, upon which is secured a small cam at an off-centered point, 180 degrees rotation of the dial on shaft C giving maxi-



Easy way to mount honeycomb coils. A small cam allows a vernier coupling adjustment to be had.

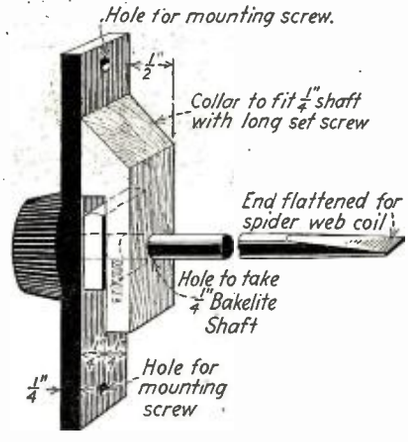
mum to minimum coupling between the two coils. The diameter of the cam used will vary with the length of A, also with the distance between the shaft C and the hinge; the longer the length of A, or the shorter the distance from C to the hinge, the smaller the cam must be. If D is the regenerative coil and the hinge is fastened to the first audio transformer, the wooden dowel can be replaced by a small brass rod and used as the connection between coil and transformer. Exact measurements of course must be determined in individual cases. If coupling changes obtained by rotation of the dial are too abrupt, this may be remedied by sliding coil D back on the dowel, giving greater spacing between D and E.

Although honeycomb coils are shown, the system is quite adaptable to other types and conditions, arrangements of which will be immediately suggested to mind.

Contributed by E. E. Griffin,

SPIDER-WEB COIL MOUNTING

One of the most difficult coils to mount as a rotor is a spider-web coil and the arrangement here is one that may be built with little trouble, and it should prove to be very satisfactory. A piece of hard wood 3/4 inch square and 3 inches long is cut and filed, as shown in the accompanying sketch. A hole to take a 1/4-inch shaft is drilled through the middle section, and it might be well to add a caution here—be sure that the drill is held in a perpendicular position with respect to the face of the mounting. The



Arrangement for mounting spider-web coil rotors.

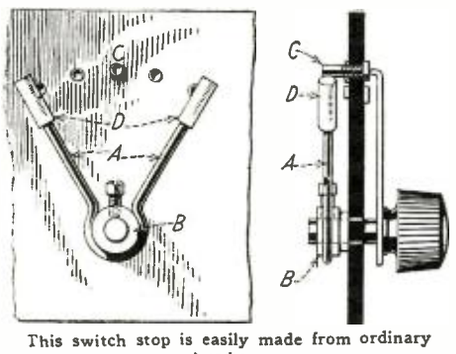
shaft is a hard rubber or bakelite rod 1/4 inch in diameter flattened at the end, so that it may be slipped through the turns of the spider-web coil. The collar shown may be one from a discarded dial and fitted with a set screw of such a length that it will strike against the side of the mounting, thus forming a stop and preventing the pig-tail con-

nections of the rotor from being twisted off. With the bearing secured to the panel as shown and the set screw tightened to the shaft, the shaft may rotate through about 300 degrees, smoothly and with no end play. The mounting can be fastened to the panel with the two screws above and below the shaft.

Contributed by W. C. Hall.

BACK PANEL SWITCH STOP

For the fan who is particular about the appearance of his panel, this switch stop will be a welcome idea. This stop requires no holes in the panel and may be adapted to the majority of the switches on the market.



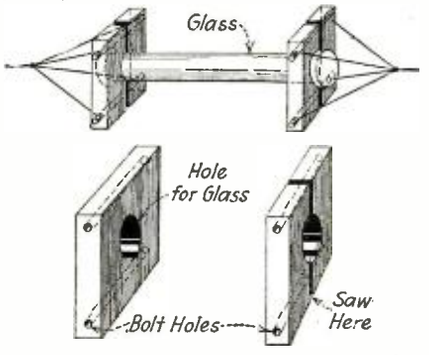
This switch stop is easily made from ordinary bus-bar.

In the accompanying diagram a length of square bus bar A is bent around the collar of the switch lever, B. This bus bar is bent so that the switch will stop at the end points, the bus bar being stopped by a piece of heavy wire soldered to the middle switch point, as shown at C. A length of spaghetti is placed over each end of the stop as indicated at D. This bus bar is soldered to the collar of switch lever.

Contributed by Lawrence Engebretson,

GLASS ANTENNA INSULATOR

A cheap and efficient antenna insulator can be easily made as shown in the sketch. Pro-



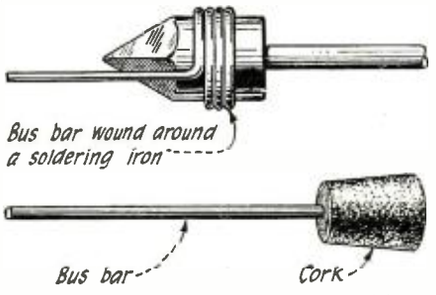
A good antenna insulator can be made with two blocks of wood and a glass towel rack.

cure glass towel rods, which may be purchased at any plumbing establishment, about 15 inches in length. Two blocks of wood for each insulator 5 inches square and ¾ inch thick are drilled as follows: In the middle of the block a hole slightly smaller than the rod and through the block perpendicular to the large hole two holes large enough to take a ¼-inch bolt ¾ inch from the top and bottom of the block. The blocks are then sawed in half through the three holes. The glass rod is placed between the two halves of a block and fastened there by tightening the bolts through the small holes. The supporting wires of the antenna may be fastened to the bolts.

Contributed by Raymond Hadley,

USES FOR BUS BAR WIRE

Have you ever, while wiring a set, found that your soldering iron was ⅛ of an inch too large to get into some corner? Instead of tearing the set apart next time, just allow the soldering iron to cool off and wrap a piece of bus bar around it. It will do the

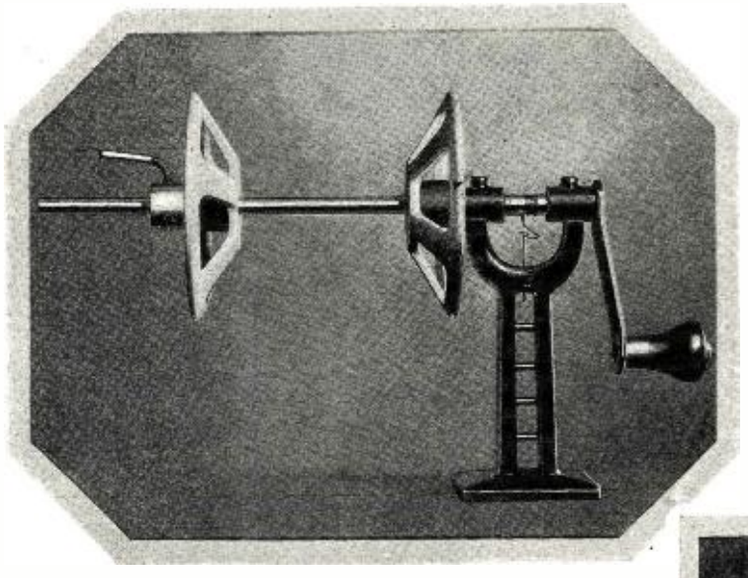


An easy way to solder out-of-the-way joints, using bus-wire.

trick very nicely. If there are a number of such places in your set, procure a large cork and insert about three inches of bus bar in it. This will serve as a soldering iron, the only disadvantage being that it will not stay hot very long.

Contributed by A. A. Blumenfeld.

Novel Coil Winding Machine



THE pastime of winding coils has become exceedingly popular nowadays, and it would be a difficult job to conceive of a dyed-in-the-wool radio fan who does not have a great number of coils of wire and tubes of insulating material scattered around either in his bedroom or the cellar, depending upon where he exercises his radio proclivities.

There are many ways of winding coils; the writer has often rolled the forms on a table with one hand while guiding the wire with the other. He has also used various means of mounting the outfit in bearings to be turned with a crank.

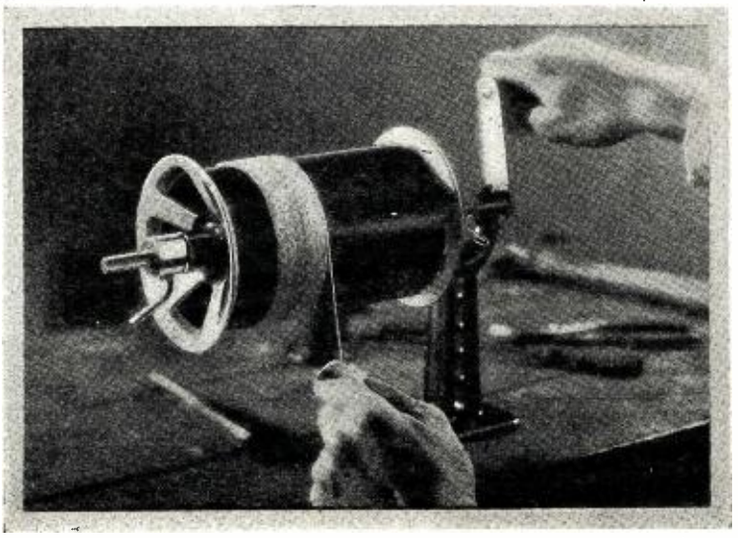
But these are all makeshifts, and the difficulty experienced in trying to make the affair work properly generally more than counteracts the expected advantages.

A new coil winder recently placed on the market which has many novel features. Coils one-half to five inches in diameter and from one-eighth to ten inches long can readily be wound with little difficulty.

The photographs show a new type of machine put out by a leading tool manufacturer; it is very simple in construction and just as simple to operate. The photographs are sufficiently plain so that no further description is necessary. Many kinds of single or multi-layer coils can be wound on this machine, using cylindrical forms, and spaced winding can be obtained by winding two strands at the same time, removing one strand after the operation is completed.

When fine wire is being wound on a coil form, there is a tendency for the wire to lap over itself. This necessitates turning the handle backwards, until the wire is again straight. A small spring brake when depressed, allows the coil to be reversed in direction, and prevents the wire from unwinding when in the normal position.

The stand is provided with holes which allow it to be fastened to the workbench, or if so desired, the coil winder may be placed in a vise in any particular position. The base is of cast iron finished in black enamel, while the center rod is of steel. Both coil guides are of aluminum and are tapered so as to conform with the size of the various forms to be wound. A small wooden knob on the handle completes the outfit which is trimmed with red.



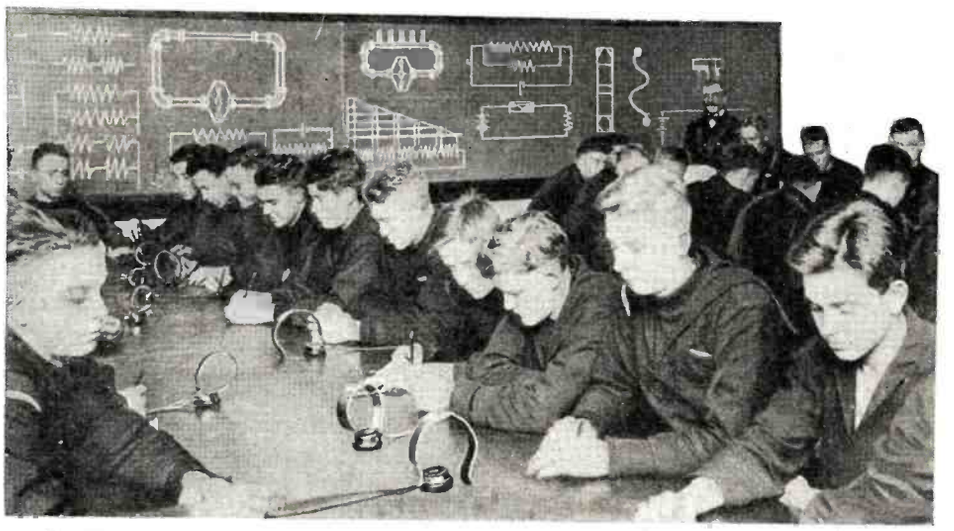
Specialize!

By HOWARD S. PYLE

MR. PYLE gives an excellent illustration in the accompanying article of how to get started in radio.

The radio field today is becoming so tremendous that it has long ago been split up into various sections. We have specialists in broadcasting, specialists in set manufacturing, specialists in the manufacture of instruments, specialists in radio laboratory work, and dozens of others in an ever-increasing number.

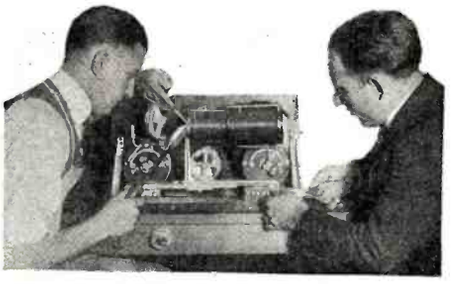
The young man who thinks of starting in radio will do well to first familiarize himself with the particular branch of radio in which he thinks he is most interested. It is impossible, today, to be a radio man and know the entire art. It has become too big for that.—EDITOR.



One of the most important facts to the commercial operator is the code. Above are shown Navy students studying it.

JUST the other day a stranger called on me, and after introducing himself as a man who had just recently become a "radio addict" said, "I understand that you have been in the radio game for a good many years; perhaps you will be willing to advise me just what particular set or type of set I should purchase, to get really satisfactory entertainment from the broadcast stations?"

A common enough question, particularly to those of us who have been associated with the science for some time. My visitor naturally assumed that I could advise him quickly and accurately, and was therefore considerably surprised when I replied, "I'm



The advent of broadcasting has inaugurated the trade of radiotrician.

sorry, but I am afraid that my advice would be of little value, and I am sure that you could obtain much better information from some reliable house dealing in radio broadcast receivers and parts."

To him, perhaps, it did appear a bit odd that a radio man of long experience would suggest that he turn to a non-technical and comparative newcomer in the profession for the information which he desired. But was it? Suppose we analyze the present radio situation and compare it with that of a few short years ago.

Fifteen—ten—yes, but a scant five years ago, a man either was or was not a radio man. The term signified that he had a pretty thorough understanding of the applications of radio in all its branches and was a good all around radio technician. Today, there IS NO SUCH MAN! I'll try and qualify that statement in the following paragraphs.

A BIT OF HISTORY

Let us go back, say ten years. To be a good general radio technician, a man was required to be familiar with the theory, functioning, installation and operation of radio telegraph apparatus of the spark type. Such equipment was at that time, with few exceptions, used solely for communication between vessels at sea and from ships to shore.

A short time later the first arc installations, opening the field of high power, point-to-point service, began to make their appearance. This made an additional subject to be mastered by the man then engaged in the profession as well as by the student of those times. Constant improvement in spark transmitters as in receiving equipment further added to the necessity for diligent application to study.

Followed the introduction of the high frequency alternator for high power work. Another phase to be mastered, still keeping pace with arc and spark equipment which continued to hold the fore in their respective fields.

Vacuum tube investigation next came in for a share of attention, and then the war with its feverish activity—the rapid development of oscillating vacuum tube circuits—fast moving improvement in existing apparatus of the older systems—the problems arising from increased traffic and the resulting interferences, which followed the signing of the armistice.

And then—radio broadcasting with its myriad of applications—its trick circuits—the invasion of the field by all classes of experimenters and their resultant development work.

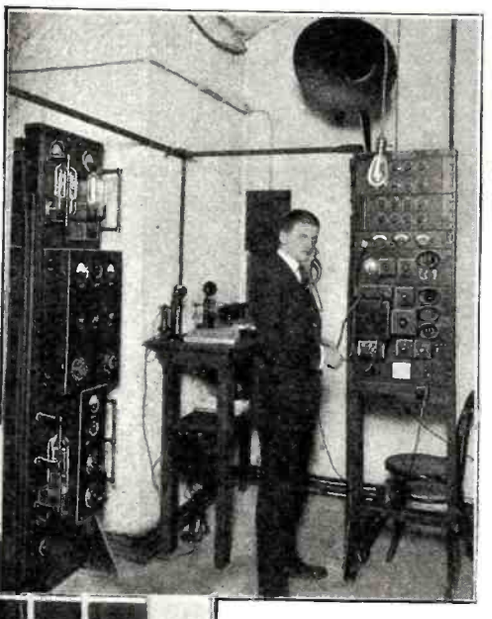
Meanwhile, elaborate experimental work had been going on in "wired wireless" or carrier current transmission—in communicating with submarines and aircraft—the introduction of high-speed automatic transmission—radio transmission of photographs—the radio compass—a hundred variations from the original "ship to ship" and "ship to shore" wireless of not so many years ago!

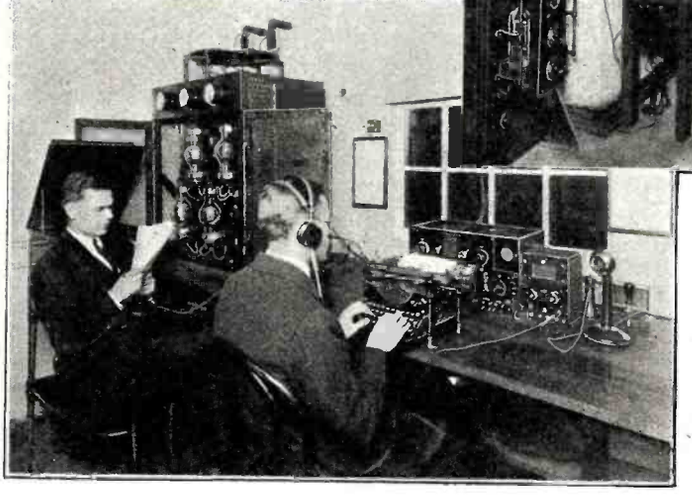
Where is the man who can keep intimately abreast of progress along ALL these lines? He simply DOES NOT EXIST! It is no reflection on the ability of our present-day electrical and radio engineers to make such a statement; it is simply beyond the possibilities of the human mind to grasp and retain such a mass of information as is essential to be an all around radio technician today.

There is but one answer that applies alike to the young fellow contemplating entry into the radio field as a career and to the "old-timer" who is struggling in a vain effort to keep up with the fast moving developments of the science: he must specialize!

Radio has developed into a highly special-

(*Continued on page 2114*)





The two photos here show some of the diversity of the industry. Above is a broadcast station control board and below at the left is the operating room of a coastal station.

Radiotics

HOW DOES IT WORK?

"Five-tube receiving set brings in distant stations WITHOUT ACCESSORIES list $60." This remarkable set was in the Oakland (Calif.) *Tribune*. December 27, 1924. This receiver sure is worth sixty of the hard earned ones—no batteries, phones or antenna being needed. We would like this system, as battery costs do make a big hole in the old pay check.

Contributed by W. R. Hansen.

IS THIS SAFE AND SANE?

In the *St. Louis Post Dispatch* of February 15, 1925, in an article on selecting tubes, they refer to "the various amplifier ROCKETS." Although directions are lacking, we believe that when the filament battery is connected. the ROCKET shoots to the desired station, thus making the operation very simple.

Contributed by C. F. Johnson.

SIMPLE? TRY IT YOURSELF

On February 8, 1925, the *Rochester (N. Y.) Sunday American* gave this advice: "Turn dial number two until whistle in the SHAPE OF A V is detected. Then GET INTO THE EXACT CENTER OF THE V and slowly disengage the PLACES of condenser number one." Outside of needing an X-ray outfit to find the V-shaped whistle and a panel stretcher to move the condenser about, nothing much is required.

Contributed by G. H. Putnam.

QUITE A STROLL

The *Montreal Standard*, of February 21, 1925, printed a photograph with the caption, "English radio fan and the set ON WHICH HE WALKED to Boa Vista, Brazil. 7,000 miles away." We have heard of riding across the desert on a bicycle and other marvelous feats, but this Englishman is strides ahead of these.

Contributed by W. E. Hawthorne.

LOVING COILS

In the January 24, 1925 issue of the *New York Sun* appears an advertisement telling about "a low-loss OSCULATOR coil." This must be an invention for the radio set of the lovelorn. Boy, page the sob-sisters!

Contributed by Fred Alexander.

THE STRONGARM CIRCUIT

The following is taken from the *Acme Apparatus Company's* advertisement in January, 1925, issue of RADIO NEWS: "The Acmeflex set brings DISTANT STATIONS RIGHT INTO THE HOUSE." Before using this, don't forget to warn friend wife that callers are coming, as it might be embarrassing to have some broadcast stations stroll in the door.

Contributed by F. N. Bryce.

'RAY FOR UNCLE

In the Reading (Pa.) *Eagle*, January 15, 1925, there was offered for sale —"Three-tube Uncle Sam TUNES set complete. Price reasonable." We were aware that the gent of the stripped pants and plug hat did lots for the "dear pee-pul," but we did *not* know that he was tuning sets.

Contributed by Thomas Seidel.

A DAMP CIRCUIT

The following advertisement of the *Florence Radio Co.* appeared in the *Toronto Daily Star* of February 17, 1925. "One Neutrodyne JET Work Rite mahogany cabinet—" Umbrellas are supplied by the owner to keep the excess liquid notes from soaking the listeners.

Contributed by Thomas Mulcahy.

SOME INSTRUMENTS

The *Ace-High Magazine* in the first February issue contained the following in its Exchange columns: "One AMPLIFICATOR; 1 tube, 6 volts; 143 plate condenser—" Does an "amplificator" amplify radio or audio frequency, or does it amplify any old thing that comes along? As for the condenser, they forgot to advertise the block and tackle with which to mount it.

Contributed by Jos. Stewart.

INNOVATION IN "B" BATTERIES

In the *Australian Wireless Review*, of November, 1924, an article was found: "The 'B' battery —— of 120 BOLTS ——." How the radio art does progress! We wonder if these are "bolts from the blue" or the common stove variety.

Contributed by E. P. Blackwood.

If you happen to see any humorous misprints in the press, we will be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. We will pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

Editor RADIOTIC DEPARTMENT,
c/o Radio News

A VERSATILE CONDENSER

In the December issue of *Radio* there appears the advertisement of a condenser. In part it reads: ". . . for any circuit, the Hico is a real worker. Four capacities. Beautifully made. LIVE HEAT. ELECTRIC SOLDERING IRON, LIGHT, DURABLE GUARANTEED ELEMENT." And we believe, folks, that at a slight additional expense it could be fitted with hot and cold water, and all the other comforts of home.

Contributed by G. M. Hawes.

NEW GUN

The Baltimore (Md.) *Evening Sun*, of January 23, 1925, ran an advertisement concerning something that the Navy should be informed of. It reads, "$55.00 Three-Tube Halowell REFLEX RIFLE, $22.50." Now, gentle reader, we ask you. did you know that reflexed tubes were used on guns? Maybe the Swiss Navy uses them on their cruisers.

Contributed by Eugene Smith.

ATTENTION, POWER LINEMEN

The fellows who work on high voltage lines will be glad to learn that the *Wholesale Radio Service Co.*, of New York City, advertises in their catalog their "genuine. moulded BAKELITE SOCK." Also think of the comfort of no more garters and no wrinkles about the ankle.

Contributed by S. T. Belden.

MEDICAL AID FOR TRANSFORMERS

In the *Pittsburgh Post Radio Broadcasting News*, of December 24, 1924, is an item telling about an interesting medical operation: "The thickness of the core was reduced to reach the saturation point, which would reduce the HYSTERICS." Now, if there is an hysterical transformer in your set (detected by howls, yells, etc.), call in Dr. Hackensaw and have him amputate some of the core.

Contributed by John March.

FOR THE DX HUNTERS

In the January 17 issue of the *Radio World*, we find a circuit diagram for the "DX WINDER." Well, boys, such a thing sure would simplify matters. Merely reel in whatever program you wanted, although we can't see how on earth the rope is to be stored in a "two by twice" apartment.

Contributed by H. Dunker.

TUBES HALVED

The *Minneapolis Sunday Tribune*, of February 1. 1925. ran an advertisement which reads: "½ TUBE RADIO SETS, $15.00." Now that's what we call cutting operating expenses, although just which half of the tube has been eliminated has been kept a dark secret.

Contributed by Berdette Fogle.

VERY TICKLISH

Here's a hot one from the Correspondence Dept. of the *Montreal Daily Star*, of January 17, 1925. M. B. McM. asks: "Which ends of the TICKLED coil go to the plate or high ratio transformer?" It's this way, Mac old boy: you catch a snipe in the full of the moon and with one of its tail feathers gently stroke the coil. The ends will wiggle violently and automatically go to the correct places.

Contributed by Eric Foster.

MR. BELASCO, PLEASE NOTICE

In the Charlotte (N. C.) *Observer*, of January 29, 1925, the *Specialty Shop* advertises: "One new SUPERHERODYNE." Is this the instrument that the heroine uses when she locates the stolen papers in the villain's safe, thus saving the hero from a fate worse than death?

Contributed by Thos. Pitts.

BACK TO THE FARM

In the *American Radio Transmitter*, for January, 1925, a set is advertised using "WD 12 RUBES." We were aware that there was great agitation in Congress over the Farm Bloc. but by Chowder, we didn't know that it influenced radio, too. It is reported that the sockets are a combination milk stool and mowing machine seat.

Contributed by E. K. Lewis.

MUST BE A ROUGHNECK

On December 26, 1924, the Miami (Fla.) *Herald* had the following advertisement: "LOW SPEAKER—A1 shape $85." No wonder the owner wanted to get rid of an instrument that had as bad manners as that one had. Imagine how embarassiug it would be if the minister came to dinner and vivid "coises" floated in from the horn.

Contributed by A. H. McKillop.

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratory tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Apparatus ready for the market or already on the market will be tested for manufacturers, as heretofore, free of charge. Apparatus in process of development will be tested at a charge of $2.00 per hour required to do the work. The Laboratories shall be glad to furnish readers with technical information available on all material listed here on receipt of a stamped envelope. The Laboratories can furnish resistances of the various instruments, amplification curves of transformers, losses in condensers, etc., and other technical information. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

Apparatus Awarded Certificates

FARRAND-GODLEY LOUD SPEAKER

Electrical tests of radio apparatus indicate that a considerable amount of distortion present in the average broadcast receiver is often caused by the loud speaker. Many of the lower tones of orchestral music are often lost when using some types of loud

speakers. This speaker has no horn, but employs an 18-inch paper cone diaphragm. It responds to a wide audio frequency range and the quality of reproduction, as well as the volume, is good. Manufactured by the Farrand Mfg. Co. $32.50.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 719.

MU-RAD "B" RADICATOR UNIT

With this unit the radio set owner may operate his set directly from the 110 volt, 60 cycle lighting circuit. The unit consists of a step-up transformer, two UV-201A or C-301A tubes as rectifiers, and a filter. The whole is encased in a metal box and occupies small space. It effectively

supplies plate current for an eight tube set at both detector and amplifier voltages. No objectionable hum is present. Manufactured by Mu-Rad Laboratories, Inc. $49.50.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 709.

MILLIVOLT TESTER

The radio experimenter and set builder often requires a test set for determining the continuity of coils and circuits. The millivolt tester manufactured by the Adbro Mfg. Co., serves this purpose very well. To use, simply clamp one of the cord tips of a telephone headset in the chuck on one end of the tester.

The cap of the tester is then removed and the inside moistened. After replacing the cap, a loud click will be heard in the headset when the other cord tip is touched to the end of the cap. A click will be heard with a resistance as high as 1,000,000 ohms in the circuit. Price $1.25.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 734.

LINCOLN COLLAPSIBLE LOOP AERIALS

These aerials are of excellent construction, having insulated stranded wire supported by a wooden frame that sets in a folding metal base.

The loops are made in two styles, one with three terminals having one tap connection and the other with a four point tap switch. The loops have 17 turns, being 18 inches on a side. Manufactured by the Lincoln Radio Corp. Price of plain loop, $6.00, and of tapped loop, $8.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 710 AND 711.

NION FIXED DETECTOR

This fixed crystal detector is of the cartridge type and is very sensitive. The crystal is enclosed in the insulating tube with nickel plated lugs at each end for connections. Manufactured by the Keystone Products Co. Price, $1.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 737.

EASTERN R.F. TRANSFORMER

The "pickle bottle" coil shown in the illustration is self-supporting and of excellent electrical design. The primary is wound directly on the secondary, as shown. Brackets are furnished for mounting. It covers

the entire broadcast range when used with a .00035 variable condenser. Manufactured by the Eastern Coil Corp. Price, $2.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO 735.

BALKITE "B" CURRENT SUPPLY

This chemical rectifier is very quiet in operation. It furnishes "B" battery current for detector and amplifiers of standard receiving sets. It gave excellent results when used with an eight tube Super-Heterodyne, causing no objectionable hum. It is designed for use with the 110 volt, 60 cycle lighting circuit. Manufactured by the Fansteel Products Corp. Price $55.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 713.

JONES DISPLAY OUTFIT

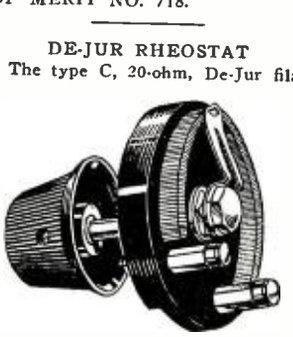
This display outfit consists of a panel with 12 instruments mounted upon it. Six of the instruments are telephone jacks of various types. The other six are switches. The mechanical construction of the in-

struments is good. The switches are provided with red bakelite knobs and furnished in sizes ranging from single pole single throw to double pole double throw. The jacks are furnished in sizes ranging from single circuit open to double circuit filament control. Submitted by the Jos. W. Jones Radio Manufacturing Co. Price 70c to $1.60.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 718.

DE-JUR RHEOSTAT

The type C, 20-ohm, De-Jur fila-



ment rheostat is manufactured by the De-Jur Products Company. The instrument is well constructed and safely carries the current required of it. The molded part is of bakelite. Price, $1.10.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 730.

CRYSTAL DETECTOR

Maurice Schwartz & Son submitted a sample of their adjustable

crystal detector. This instrument is of the double crystal combination type and is very sensitive and easily adjusted. The base is of fibre.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 736.

DE-JUR POTENTIOMETER

The type C, 400-ohm, potentiometer is of the same general construction as the De-Jur rheostat described above. Excellent contact is maintained between the lever arm and the resistance element. Manufactured by the De-Jur Products Company, New York City. Price, $1.25.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 731.

GARDINER & HEPBURN JUNIOR CONDENSER

Where a small vernier condenser or a balancing condenser is required for use across the main tuning condenser of a single dial set, this little

instrument will be found very convenient. It is of the same general construction as the usual grounded rotor type except that it is very small in size and has a maximum capacity of .000022 mfd. Manufactured by Gardiner & Hepburn, Inc., Philadelphia, Pa. Price, $1.50.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 732.

FIL-CO SWITCH

The illustration shows the filament switch manufactured by the DX Instrument Company, Harrisburg, Pa. The switch is neat and compact and

of high grade workmanship. It is positive in action and safely carries the filament current used in the average radio set. Price, 50c.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 733.

VARIABLE CRYSTAL DETECTOR

The Mar-Co variable crystal detector consists of a crystal and contacts

inclosed in an insulating cylinder which may be rotated for adjustment. The cylinder is supported in a metal casing mounted on a hard rubber base. It is small in size and sensitive. Manufactured by the Martin-Copeland Company, Providence, R. I.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 724.

HAFNER HYDROMETERS

Hydrometers for testing the condition of "A" and "B" storage batteries are manufactured by the Hafner Mfg. Co., 3128 Caroll Ave., Chicago, Ill. The hydrometers are of the usual construction and are accurately calibrated. The "B" bat-

tery hydrometer differs from the "A" battery hydrometer in that it has a smaller intake tube so that it may be inserted in small sized "B" batteries. Price for "A" battery unit, $1.00 and for "B" battery, 75c.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 727 AND 728.

ANTENNA RIBBON

The antenna ribbon made by the Valley Narrow Fabric Co., Pawtucket, R. I., consists of webbing into which are woven thin coppered

strands. The material works very well as an antenna and is especially recommended for indoor use where appearance is important.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 706.

TECNICELL "B" BATTERY

This storage "B" battery is manufactured by the American Storage Battery Company, 326 Newbury St., Boston, Mass. It consists of 12 glass jar cells in a treated wooden tray. It may be charged at a rate of one ampere and on account of the large size of the cells, it will furnish "B"

battery current to the average set for a long time.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 712.

AUTOMITE CRYSTALS.

The Keystone Products Co., Royal Oak, Mich., also submitted samples of its automite crystals and catwhisker contacts. The crystals are very sensitive and have a rough surface that easily holds the light contact adjustment. They arrived well packed and in excellent condition. Price, 75c and $1.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 738.

CONSOLE CABINET

The Express Body Corporation, Crystal Lake, Ill., has recently placed on the market several sizes and styles of radio cabinets. These cabinets are made of Douglas fir lumber from the Pacific Coast, kiln dried and selected for grain and texture for cabinet work. The

wood takes stain beautifully and can be finished to match any furniture. The style No. 37 cabinet, shown in the illustration, was submitted unfinished.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 705.

SURE TIGHT CONNECTORS

These connectors are simply tips and lugs with clamping screws for attaching to telephone cord terminals or wires. They are nickel plated and will be found very handy around the radio laboratory. Manufactured by the Illinois Radio Co., Springfield, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 696.

YAXLEY MIDGET SWITCH

The No. 10 "A" battery switch manufactured by the Yaxley Approved Radio Products Co., 217 North Desplaines St., Chicago, Ill., is shown in the accompanying illustration. The knob turns a fibre cam that opens and closes the contacts.

The contact springs are similar to those used in telephone jacks except that they have a right angle bend that improves the operation and makes the instrument compact. Price, 60c.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 725.

COSMOS LOW LOSS COUPLER

Low loss radio instruments are essential for selective reception. The low loss tuner shown in the illustration is designed with this end in view. The coils are self-supporting and wound with large wire. The tuner covers the entire broadcast range when used with a .0005 tuning condenser. It has three windings, primary, secondary, and tickler. Manufactured by the Cosmos Radio Corporation, 145 West 45th St., New York City. Price, $5.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 726.

MUELLER SPRING CLIPS

Spring clips are always required around the radio set for battery connections and other purposes.

The Mueller clips are furnished either plain or lead coated, the coated ones being used for storage "A" and "B" battery connections. Manufactured by the Mueller Electric Company, Cleveland, Ohio.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 699.

SCIENTIFIC FIXED CRYSTAL DETECTOR

The small size of the parts of this crystal detector makes it ideal for

reflex circuits or other crystal circuits where a permanent and sensitive adjustment is desired. The detector is enclosed in a metal case, the cap of which may be removed for making adjustments of the catwhisker. Manufactured by the Scientific Research Laboratories, 502 North Howard St., Baltimore, Md. Price, $1.00.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 739.

MAR-CO DOUBLE POLE ROTARY SWITCH

The double pole double throw and the series-parallel switch manufactured by the Martin-Copeland Company, Providence, R. I., is of the panel mounted type controlled by a knob. It is of good construction and neat appearance. The illustration shows the double pole double throw switch.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 722 AND 723.

LOUD SPEAKER

James M. Davis Co., 30 Euclid Arcade, Cleveland, Ohio, submitted a

sample of their loud speaker which was found to be very sensitive and reproduced with good quality. The instrument employs a Mozart-Grand unit. It is of small size and neat appearance. Furnished with a fibre horn.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 714.

MAR-CO DOUBLE POLE SWITCH

This small size double pole double throw knife switch is of rugged construction and pleasing appearance. It is specially designed for radio apparatus and the set builder will find it very useful. Manufactured by the Martin-Copeland Co., Providence, R. I.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 720.

MAR-CO SINGLE POLE SWITCH

The single pole single throw knife switch manufactured by the Martin-Copeland Company, Providence, R. I., is of the same general construction as the double pole switch described above. It may be used in battery circuits and in various other places on the radio receiving or transmitting apparatus.

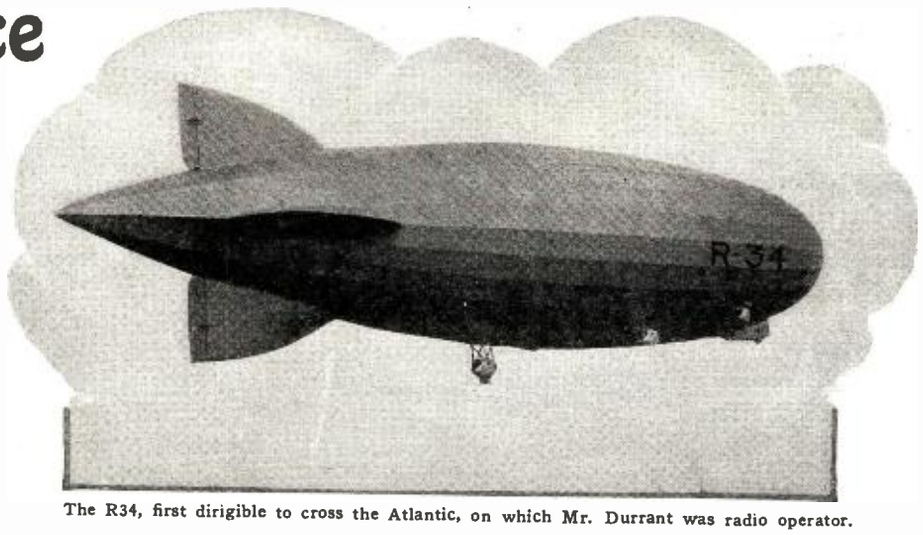
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 721.

Correspondence from Readers

A Radio Mystery

OUR readers well remember the exploit of the author of this story, Mr. Rex Durrant, R.A.F., who, in 1919, flew from England to America in the first dirigible to cross the ocean, the R-34. Mr. Durrant was the radio operator at the time, his story appearing exclusively in the August, 1919, issue of RADIO NEWS.

When we received the accompanying article, we immediately sensed a real mystery. There cannot be many radio girls in this country. We do hope, therefore, that if SHE reads these lines, something may happen after all.—EDITOR.



The R34, first dirigible to cross the Atlantic, on which Mr. Durrant was radio operator.

THE MISSING RADIO GIRL

By REX DURRANT

"WHY, hullo C., you've sure been on some long trek . . . haven't caught a glimpse of you since the Lord knows when. . . ." This was the cheery greeting I received as I entered the old Radio Club in that little village in Europe, called London, after many weary moons spent in erecting, and doing the hundred and one jobs of a radio man when one has even, as I'd been, beyond the track of railroads; out in the limitless deserts of Asia and Africa.

I was back again for a spell of leave, looking at the great metropolis which appeared just as I left it, its lights, its river, its social whirl, all at their zenith.

Attractive and mysterious as other cities can be, there is something so throbbing, alive and magnetic about London that, as the wanderer returns once again, he feels the encircling grip of her wide arms.

The steward appeared . . . our glasses were filled with a suitable mixture to keep out the fog, and a blue smoke haze arose from our pipes and cigarettes as our little circle of radio bugs got busy on a discussion of the application of radio to direct pilotless airplanes.

My latest experiments, I said, led me to believe that there will be no air pilots in a future war . . . except, possibly, the single-seater fighter. Radio tests in my snug little den on the sea coast had convinced me that distant control of a flock of bombing machines was quite within the bounds of possibility; launching into technicalities I was suddenly stopped by a chorus, "That's not good enough, boy; if you are in form for a yarn, tell us that story of the episode in New York! Oh, yes," came the incoming wave of voices . . . "I M I, I M I, come along."

Nothing loth, I suddenly saw the vision of the swirling Hudson, the Statue of Liberty . . . and . . . New York. . . . My train of thought was suddenly interrupted by the loud speaker fitted in the corner of the room rolling out the solid notes of Big Ben striking the hour of 7 p.m.

"Well, you fellows, I've got a date with the sweetest little peach in creation in 50 minutes, so I shan't keep you long.

"I suppose most of you recollect the R-34, that clipper of the clouds, that came over from Europe to U. S. A., thus bringing into actual accomplishment the dreams of Jules Verne, and Kipling; well, guys, I was the budding young radio fan aboard that craft. . . . What's that? . . . Oh, yes, I'd striven for the job long enough. . . . My fan days were over, and in the glare of the professional limelight I felt I must make good, and push the cause of radio in the air.

"It was some 'get busy' trip over the eternal cloud world of the vast Atlantic.

"You can guess the thrill I had, when I held Boston each way at 2,000 miles; . . . some DX in those days; it made me think how much we owe to DeForest, the man who put the third electrode in the bulb, and made such things possible.

"After four days of continuous air travel, the hum of the giant engines became a welcome sound; we realized that with each sweep of the propellers we were getting nearer to the New World.

"Then the sight of Chatham, Mass. . . . Martha's Vineyard . . . Fire Island, then the air on 600 meters got busy. We were called by tramps, sailing ships, liners, leviathans, to say nothing of New York with *some* bunch of call signs.

"I won't dwell on the landing, or the reporter guy, who interviewed me while I was in Adam's attire, in the bath, and wanted to know about the static and the electrical horsepower of our transmitters! Of my wonder at the speed tracks, and of the Brooklyn Bridge, as our powerful Marmon auto rushed on to Fifth Avenue; there was RADIO NEWS at the hotel bookstore just making its début; thinner than it is today, but just as cramful of interest.

"Then I met HER . . . wild horses won't drag out of me names or the meeting place; those are locked up in my own special transformer.

"I can see her now . . . lissom, dainty, fascinating; how we danced, and talked, and, through those talks, I discovered she was a . . . hold your chairs tight . . . SHE was a radio fan!

"Could I come and see her Super set? . . . somewhere near Bronx Park; Pa was on Wall Street (he wouldn't be home, and if he was he wouldn't mind two hoots) . . . We went, and got immersed in radio . . . and other things.

"The next day we were scheduled to leave . . . we spent it somewhere near Southampton, L. I. When a radio man is in love, it's like getting across your H. T. condenser when the juice is on. You curse at the time you do it, but you've a secret delight at having experienced it.

"That night came only too swiftly. . . . There was her little face smiling up at me, as, smothered in fur, begoggled, and with tight fitting phones on, I gazed down at her from the radio cabin . . . the wind was whistling in from the Great Lakes . . . time was getting short . . . a last kiss and we swept up into the midnight air.

"My aerials were soon adjusted, . . . sets going QSA . . . DUTY only, was now imprinted on my mind; for the safety of us all depended on RADIO. As the glittering lights of the Great White Way flickered at us from below, I tuned in a steady true C.W. note, calling me . . . over on the switches and my K K K rapped out into the night.

"As my hand translated the cutest clipped sending of a feminine wrist, my heart beats went up some . . . IT was HER . . . my ideal . . . I replied . . . NO, I'll be ..... if I'll tell you HER message or mine. GN GN GN our tubes whistled, but not GN OM . . . but GN MP!! . . . and sweeping along at 90 miles an hour we struck across the ocean for home."

"Well, tell us the end of the story," cried everyone.

"That's where you have me guessing," I replied . . . "I wonder what SHE will think if she ever reads this."

DR. PICKARD AND "THE LADY OF THE LAKE"

Editor, RADIO NEWS:

Month by month I have been reading your fascinating serial story, "The Life and Work of Lee DeForest." As one who also lived through the early and troublous days of radio communication, I have noted more than once slight inaccuracies in the story, and passed them aside as entirely pardonable nods from so busy a man as the hero.

In your last installment DeForest honors me by inclusion in the story of the yacht races of 1903, in the following words:

(*Continued on page* 2174)

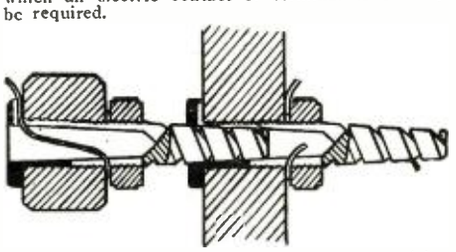
Digest of Latest Canadian Radio Patents

Compiled by G. F. SELLECK, Jr.

ELECTRIC CONTACT OR TERMINAL

(Canadian Patent No. 243406, A. E. Chapman. Filed Jan. 31, 1924; issued Oct. 7, 1924.)

This invention relates to electric contacts or terminals and has for its object to provide an improved form of device of this nature which will be of universal application being capable of being used as a plug or socket, as a battery plug or as a coil holder, as a soldering tag, as a wire terminal, or in general in any situation in which an electric contact or terminal is or may be required.



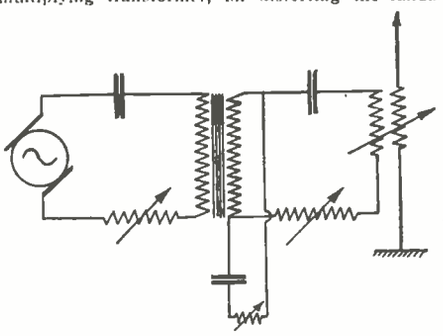
The invention consists of a device comprising an externally screwed socket terminating in a tapered shank or like member, the latter being preferably capable of fitting and biting into the socket of another similar contact or terminal. It also consists in a device of the above character in which the socket is cap-headed so that it may co-operate with an ebonite, metal or other nut adapted to screw onto the exterior of the socket.

The invention also consists in a device of the above character in which the tapered shank is formed as a helix or as a corkscrew, or as an ordinary wood or metal screw. It also consists in a device in which the whole or part of the biting surface of the tapered shank is constituted by a plurality of annular ridges of decreasing diameter toward the free end of the shank.

METHODS OF IMPROVING THE EFFICIENCY OF FREQUENCY MULTIPLYING TRANSFORMERS

(Canadian Patent No. 243260, Walter Dornig. Filed May 30, 1923; issued Sept. 30, 1924.)

Frequency multiplying arrangement for wave transmission comprising a wave reducer, a primary oscillation circuit, an iron-cored frequency multiplying transformer, for distorting the funda-



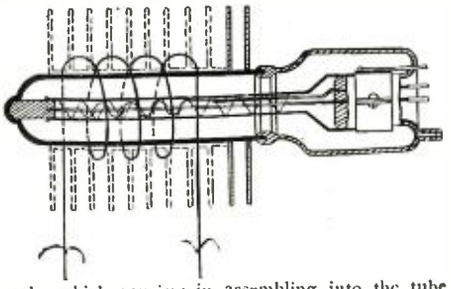
mental wave form through the magnetization curve of the transformer and for thus filtering out the multiples of the fundamental frequency in the primary circuit, a secondary oscillation circuit connected between the transformer of the wave radiator, and an auxiliary circuit connected to the transformer carrying upper harmonics of the frequency of the primary cricuit, said harmonics differing from the frequency derived from the secondary for operation purposes.

METHOD OF MAKING THERMONIC DEVICES

(Canadian Patent No. 244434, F. S. McCullough. Filed April 22, 1924; issued Nov. 11, 1924. Assigned to A. S. Rogers.)

This invention relates to the construction and manufacture of electron or vacuum tubes, especially those constructed for the handling or control or relatively large currents, such, for instance, as the so-called power tubes used in radio broadcast stations.

The invention consists of a method of preparing a high emitting low temperature cathode in electron tubes having metal shells with glass

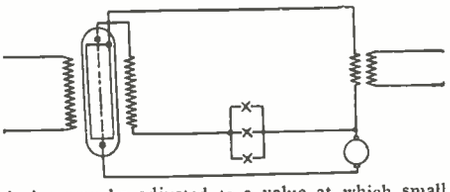


seals, which consists in assembling into the tube a cathode having a low temperature high electron emitting coating thereon, connecting the assembled tube with a pump, baking the entire tube to partially degasify it at a moderately high temperature but below the melting point of glass, then raising the temperature of the metal shell of the tube to a glowing temperature while maintaining the glass seal hot but below its melting temperature, the tube remaining in connection with the pump, and the cathode being heated in a vacuum by the radiation of heat from the shell, whereby the cathode is conditioned for service and degasified in a vacuum and in place in the tube.

ELECTRON DISCHARGE APPARATUS

(Canadian Patent No. 244350, A. W. Hull. Filed Dec. 12, 1923; issued Nov. 11, 1924. Assigned to Canadian Electric Company, Ltd.)

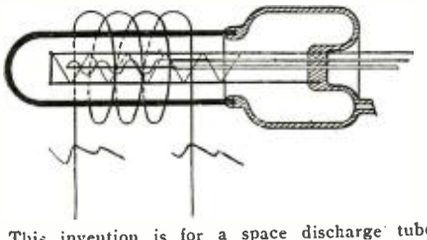
This invention relates to electron discharge apparatus of the magnetron type. In the operation of such devices for certain purposes it is customary to provide a polarizing magnetic field in order that the normal current flowing through the



device may be adjusted to a value at which small changes in the magnetizing field will produce large changes in the value of the current. If the source of potential employed for producing a flow of current through the device is a variable source the value of field strength at which the current will be reduced to substantially zero varies with the square root of the voltage and the strength of the magnetizing field required for maintaining a desired value of current will vary accordingly. The object of this invention is to provide a means for automatically varying the strength of the polarizing magnetic field to compensate for variations in the value of the potential applied between the electrodes.

THERMONIC DEVICES AND METHOD OF CONSTRUCTING SAME

(Canadian Patent No. 244433, F. S. McCullough. Filed April 22, 1924; issued Nov. 11, 1924. Assigned to A. S. Rogers.)

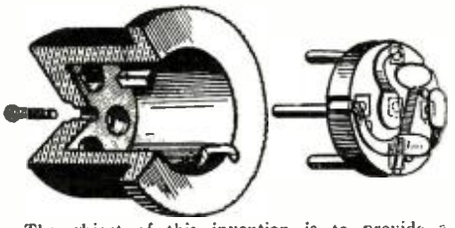


This invention is for a space discharge tube of the hot cathode type, wherein helium is present between the cathode and the anode of the tube, and for a method of making the same.

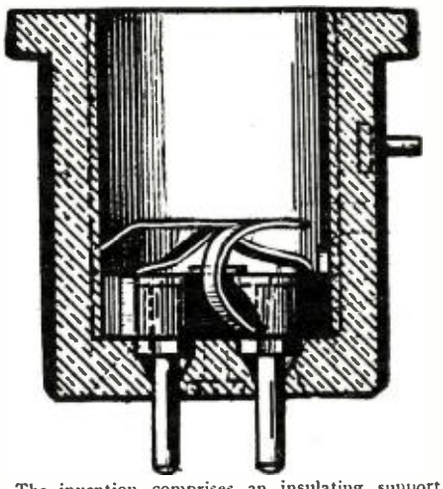
The method of making a space discharge tube having helium therein consists in assembling a tube having an anode and a cathode on which latter there is a substance capable of liberating helium when heated, exhausting and degasifying the anode and the cathode by exhaustion and baking, sealing off the tube, and applying a current to the cathode to heat the same, whereby helium is evolved in the tube

ADAPTERS FOR VACUUM TUBE SOCKETS

(Canadian Patent No. 244353, G. Butzke. Filed Feb. 7, 1924; issued Nov. 11, 1924. Assigned to Canadian General Electric Company, Ltd.)



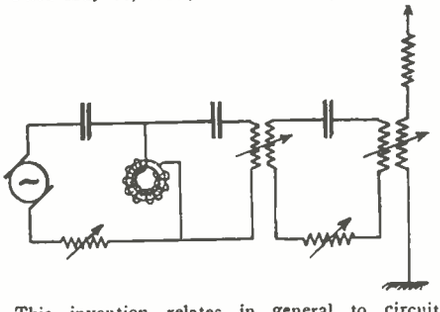
The object of this invention is to provide a hardy, compact and easily applied adapter whereby a miniature vacuum tube may be readily and properly connected to a standard radiotron socket or receptacle.



The invention comprises an insulating support having a plurality of external contacts thereon, means to position and attach said support to a socket, a plurality of opposite contacts electrically connected to said external contacts, and means to positoin and attach a small-sized tube to said support.

CIRCUIT ARRANGEMENTS FOR FREQUENCY MULTIPLYING TRANSFORMERS

(Canadian Patent No. 243718. Walter Dornig. Filed May 30, 1923; issued Oct. 21, 1924.)



This invention relates in general to circuit arrangements for frequency multiplying trans-

(*Continued on page* 2188)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions ror the benefit of all. but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.

SUPER-ZENITH

(2109) Mr. L. E. Moore, Durham, N. Y., asks:

Q. 1. Please show the Super-Zenith circuit. with constants.

A. 1. We are showing the circuit in these columns. Note that the three, four and five turn coils rotate. They are fastened to the variable condenser rotor shafts and, therefore, turn as the variable condensers are adjusted. These rotating coils may be wound on tubes 2½ inches in diameter, with No. 24 or 26 D.C.C. wire (No. 22 or 24 D.C.C. wire being used for the remaining coils).

The seven- and ten-turn plate coils are fixed, being wound on the same three-inch tube as the 61-turn secondaries, but spaced from them about one-quarter of an inch.

The object in dividing each plate coil into two sections, with one section rotable, is to maintain a constant plate condition at all wave-lengths, rather than have possible oscillation at certain wave-lengths.

It is quite necessary that each tuned radio frequency transformer (61-turn secondaries) be in non-inductive relation to one another. Placing at an angle to the baseboard, similar to a neutroformer layout, is satisfactory.

The 2,000-ohm variable resistance must be non-inductive. A regular carbon or graphite type of resistance will be satisfactory.

The aerial, if short, connects to the end of the 20-turn aerial coil which is wound on the same tube as the 61-turn secondary, but separated about one-quarter inch from it.

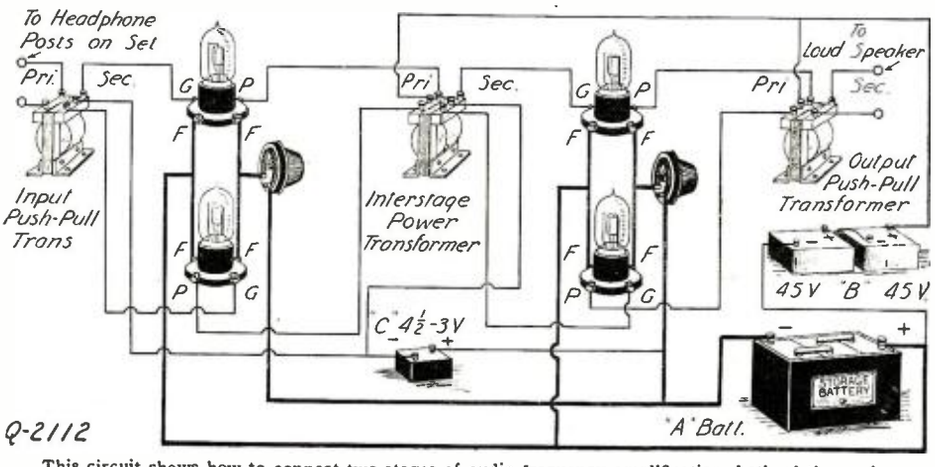
In the commercial set the variable condensers that tune the grid circuits of the second radio frequency tube and the detector tube are mechanically arranged to turn with only one knob.

Standard storage battery tubes will probably give best results.

We are showing one stage of audio frequency amplification, but the audio frequency amplification desired is optional.

Connect headphones to binding posts X1 and X2, if the audio frequency amplifier is not used.

If three variable condensers are used to tune the set, the balancing condenser will not be required. This is only used to compensate for any variations, when two variable condensers are geared together. The balancing condenser need only be of three or four plate size.



This circuit shows how to connect two stages of audio frequency amplification, both of the push-pull type. A special "interstage" transformer is required.

A single dry cell, or a single flashlight cell. will be satisfactory for the 1½-volt "C" battery.

Note that all constants shown (coil turns, etc.) must be considered as variable, depending upon individual conditions.

The construction of this receiver should not be attempted unless one has had considerable experience in making experimental sets.

Q. 2. What could be the explanation of weak signals from local stations when using a Super-Heterodyne having intermediate frequency iron core transformers marked "10,000 meters"? The filter coupler consists of two 250-turn honeycomb coils. A .002 mfd. fixed condenser is connected across each coil.

A. 2. The filter coupler must be sharply tuned (or nearly tuned) to the wave-length peak (that is, the wave-length at which the amplification is greatest) of the intermediate frequency transformers selected. For that reason it will be necessary to use larger honeycomb coils than you now have. Try two 600-turn honeycomb coils shunted by two variable condensers having maximum capacities of about .001 mfd.

SUPER-HETERODYNE DATA

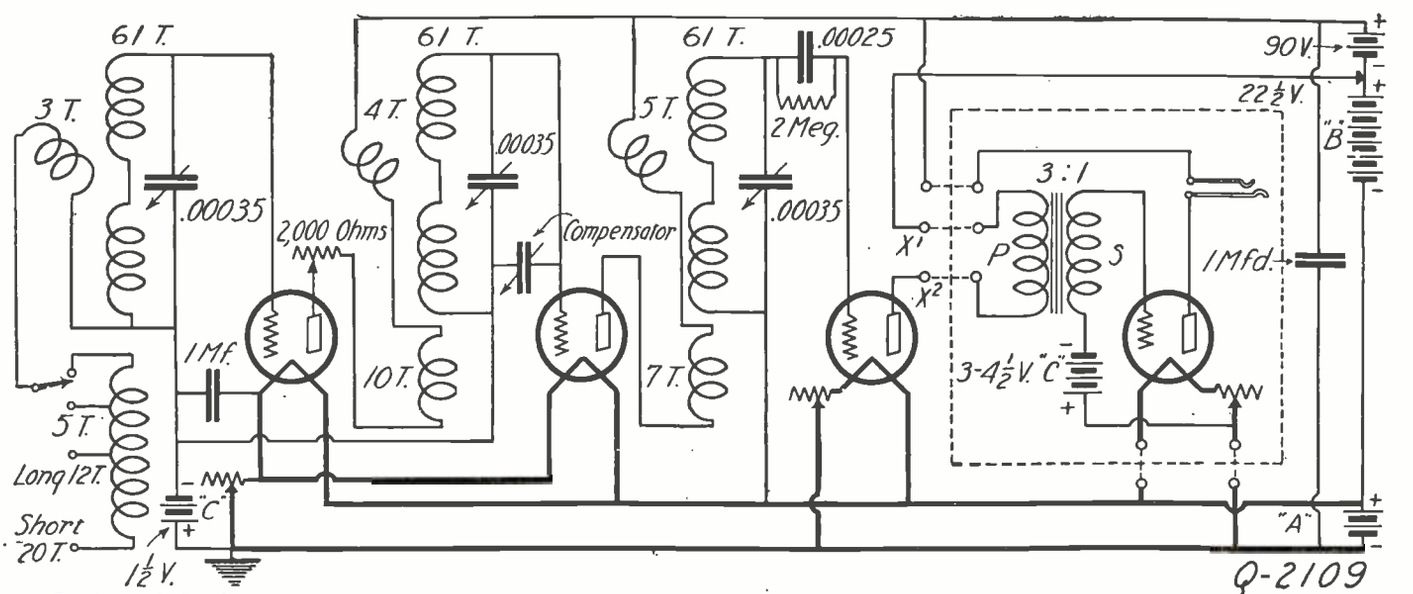
(2110) Mr. M. B. Brandt, New York, N. Y., asks:

Q. 1. Why does my set not function better?

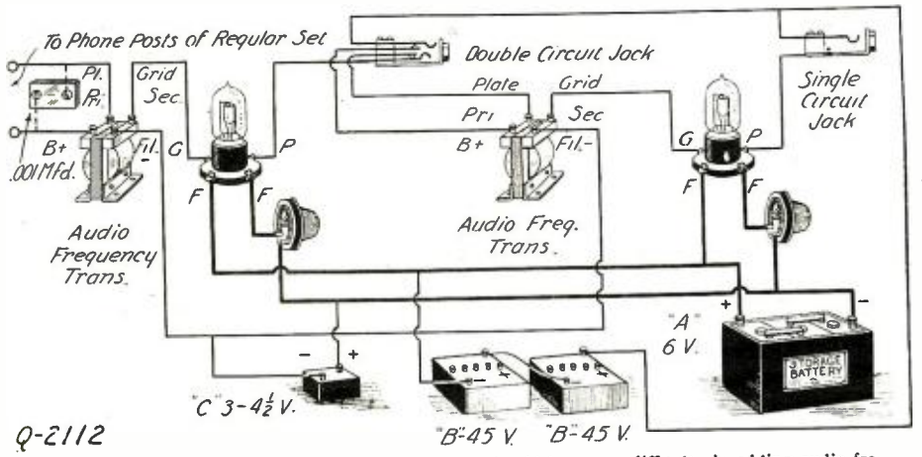
A. 1. From the data you furnish, we judge that the information you desire is contained in the answer to question No. 2 of Mr. Moore, above (Q. 2109). See the table of wave-length ranges of honeycombs appearing in the "I Want to Know" department of the January, 1925, issue of Radio News, page 1229.

Q. 2. Referring to the Super-Heterodyne article by Mr. Wilfred Taylor, page 1666, of the March, 1925, issue of Radio News, the caption of Fig. 6 refers (line 3) to "C3-.001 mfd. variable condenser, mica." What type of condenser is this?

A. 2. Condensers of the mica type are manufactured by Radio Industries Corporation, Connecticut Tel. & Tel. Co., and Crosley Radio Co.



The Super-Zenith circuit. This is a successful method of preventing tube oscillation, without using neutralizing condensers. The construction details are quite complete. Regeneration and oscillation in the first tube circuit are perfectly controlled by a variable plate resistance.



If this picture diagram is followed correctly, no one should have any difficulty in adding audio frequency amplification to any set.

See the advertising columns of RADIO NEWS.

This type of condenser comprises two metal plates spaced by a very thin mica sheet dielectric. A capacity three to six times greater than is possible with an air dielectric is the result. Such a condenser is quite suitable at the intermediate frequency wave-lengths for which it is specified.

Q. 3. Are UV-199 and C-399 tubes satisfactory for reflex and Super-Heterodyne receivers?

A. 3. These tubes will work very well in reflex circuits (excepting those of the neutralized type, in which the advantages of the standard storage battery tube are quite pronounced).

They are not as constant in operation as the standard storage battery tubes, under Super-Heterodyne demands. It is sometimes necessary to reactivate these tubes at short intervals (see the answer to Mr. Henry Smith (Q. 2067) appearing in the "I Want to Know" columns of the January, 1925, issue of Radio News).

DE FOREST D-17 SET

(2111) Mr. Frederick Neeley, Charleston, N. C., asks:

Q. 1. What is the schematic circuit of the DeForest D-17 reflex receiver?

A. 1. We are showing this circuit in these columns. In the commercial receiver the tuned radio frequency transformer shown is shielded from the rest of the set. The cores of the audio frequency transformers are grounded by being connected to the ground wire, as is also the shield of the radio frequency transformer. In the manufactured set, it has been found desirable to connect a wire from the large metal throat of the loud speaker to the ground. This ground wire has a .002 mfd. fixed condenser in series with it. We have not shown this in the circuit, as the experimenter will probably use an entirely different type of loud speaker.

The 50-turn radio frequency transformer secondary may be wound on a tube three inches in diameter. One-quarter inch from this winding, and on the same tube, may be wound the eight- or ten-turn primary. Wind both coils in the same direction with No. 22 or 24 D.C.C. wire. Connect the outside end of the primary winding to the plate of the first radio frequency tube and connect the outside end of the secondary to the grid of the second radio frequency tube.

We suggest that the experimenter try several different makes of fixed radio frequency transformers in order to find two that are suitable for this set. Iron core transformers will most likely be best.

The audio frequency transformer ratios need not be exactly as shown, but the instruments must be of good design.

A loop aerial may be plugged into the loop jack. For additional range, one may try adding a ground and an aerial. Since this will broaden the tuning and greatly reduce or entirely eliminate the directional properties of the ordinary loop, it may be best to defer the use of an aerial and ground when powerful local stations are in operation.

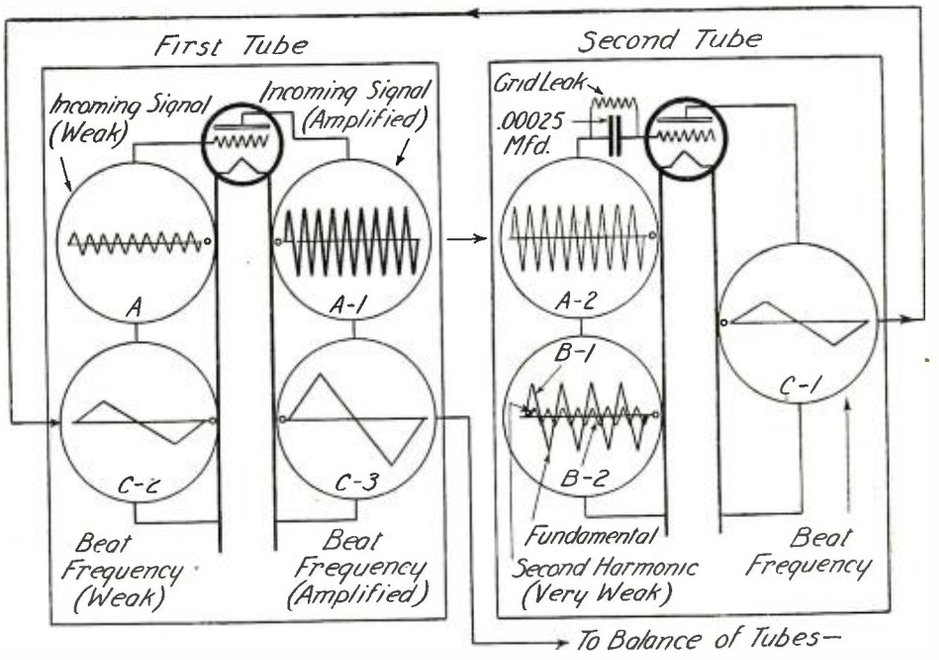
When the head-phones are removed from the jack, the loud speaker is automatically put into operation.

A standard 200- to 400-ohm potentiometer may be used. This is not shown connected across the "A" battery as usual.

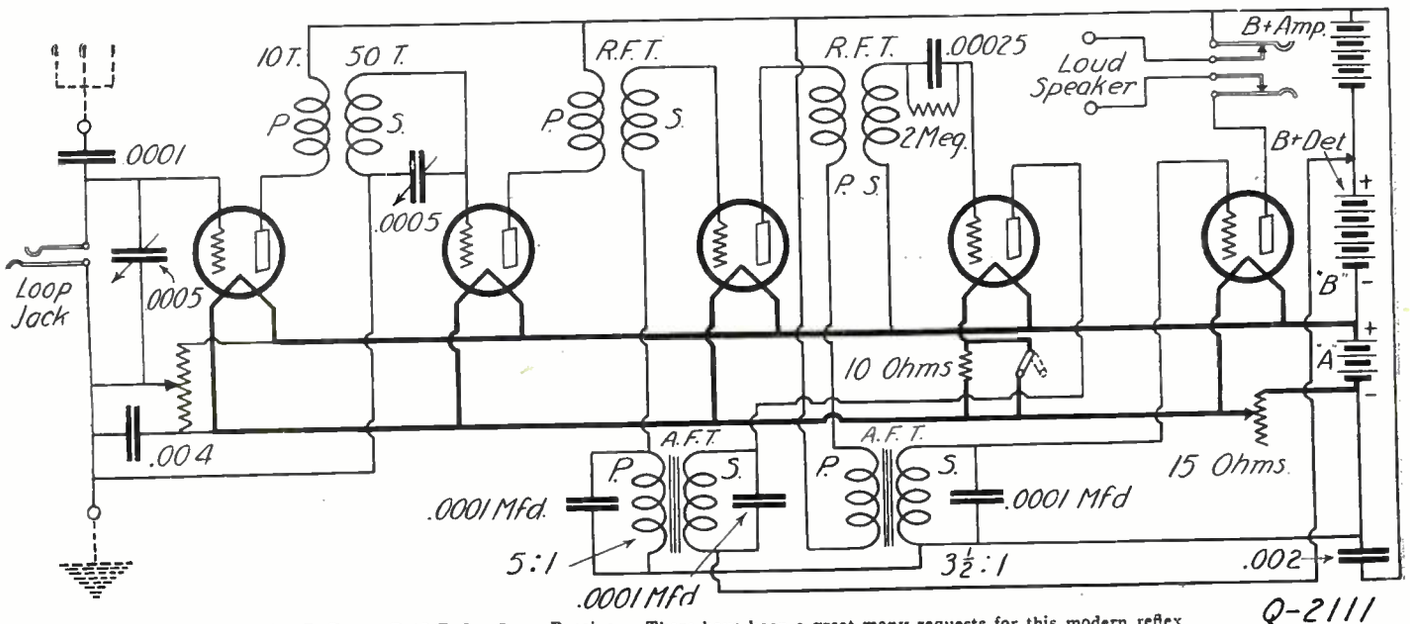
It is quite essential that low loss variable condensers be used.

Crowding apparatus closely together is to be avoided.

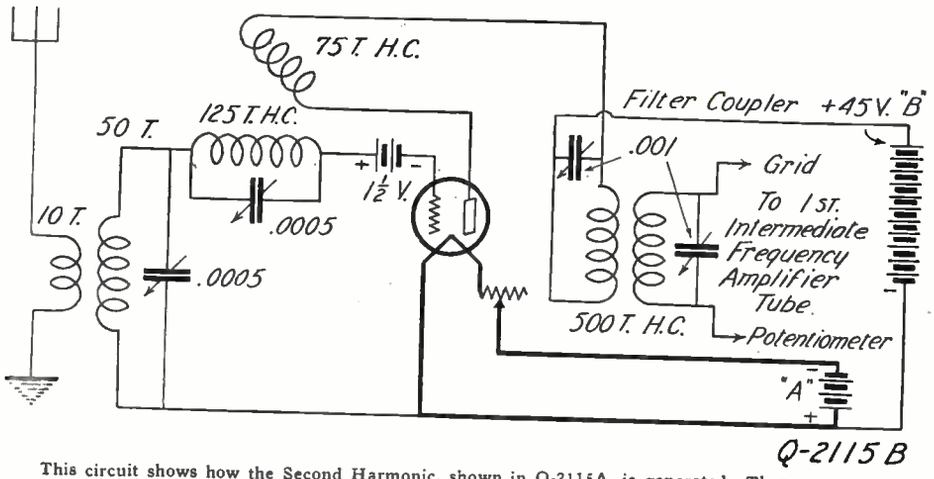
If storage battery tubes are used throughout, the 10-ohm resistance is shorted by means of the shorting switch (which may be of the push-pull type) shown. If a dry cell tube detector is used, this short is removed, thus reducing the brilliancy of the dry cell tube filament. If dry cell tubes are used throughout, the resistance is once more shorted and only two storage battery cells or three dry cells should be employed for filament lighting.



The Second-Harmonic Super-Heterodyne principle of operation, graphically shown. The accompanying text explains the system in considerable detail.



The DeForest D-17 Reflex Loop Receiver. There have been a great many requests for this modern reflex circuit. The usual crystal detector has been replaced by a tube detector.



This circuit shows how the Second Harmonic, shown in Q-2115A, is generated. There are many possibilities of the principle. The values given are variable. A loop is recommended in place of the 50 turn inductance.

Q. 2. What are the addresses of the National Radio Trade Association; National Association of Broadcasters; National Radio Chamber of Commerce; American Society of Composers. Authors and Publishers, and of the Hazeltine Corporation who, I understand, license companies to use the Neutrodyne patents?

A. 2. The Hazeltine Corporation, 15 Exchange Place, Jersey City, N. J., have turned over the right to license manufacturers under the Neutrodyne patents, to the Independent Radio Mfgrs., Inc., 165 Broadway, New York City.

The other addresses you request are: National Radio Trade Association, 1133 Broadway, New York City; National Association of Broadcasters, 1265 Broadway, New York City; National Radio Chamber of Commerce, 165 Broadway, New York City; American Society of Composers, Authors and Publishers, 56 West 45th Street, New York City.

Q. 3. What are the headquarters addresses of the Esperanto Association in England, France, Canada and the United States.

A. 3. The addresses you request are: British Esperanto Association, 17 Hart Street, London, W.C. 1, Eugland; Central Esperantiste. 51 Rue de Clichy, Paris. France; The Toronto Esperanto Society. 113 Maitland Street, Toronto, Canada; Esperanto Association of North America, 507 Pierce Bldg., Copley Square, Boston 17, Mass.

SPECIAL PUSH-PULL CIRCUIT

(2112) Mr. Lawrence Fazzano, Dumont, N. J., asks:

Q. 1. Please show a picture diagram of a two-stage audio frequency amplifier that can be added to any receiving set, preferably to the detector tube of a regular regenerative receiver.

A. 1. We are showing a picture diagram of the amplifier you mention.

If standard six-volt quarter ampere tubes are used, the rheostats may each be of 30 ohms resistance.

If the vacuum tube sockets are marked "fil. —" and "fil. +," these markings may be disregarded. It is often more desirable to connect an "A" battery negative or positive wire to a tube socket binding post marked just the opposite. Although sockets usually have polarity markings on the filament posts, as mentioned above, such markings are quite unnecessary in practical use.

The ratio of the audio frequency transformers should not be too high, otherwise distortion may be too great. A ratio of about 4:1 for the first transformer and about 3:1 for the second transformer is usually a good combination. However, individual transformers vary greatly in their characteristics and in consequence it is often possible to use altogether different ratios, with very satisfactory results.

It is occasionally desirable to use a variable resistance connected across the secondary of the first or second audio frequency transformer to improve the quality.

Also, a fixed condenser of one or two mfds. sometimes assists greatly to reduce battery noises, when connected from "B" plus to "B" minus.

Whether a fixed condenser (usually of about .001 mfd.) is required across the primary of the first audio frequency transformer (as shown by the dotted lines) will be governed by the particular conditions of your receiving circuit and first audio frequency stage equipment.

Q. 2. Please show a picture diagram of an amplifier having two stages of audio frequency amplification, both of the push-pull type.

A. 2. For such a circuit it is necessary to use a special coupling transformer having a center tap on both the primary and secondary windings.

A push-pull amplifier of two stages will require four tubes. An amplifier of the usual type, consisting of two stages, would require only two tubes. However, by using the system shown in our diagram one is assured of extreme quality and high amplification. Still greater volume is obtained by using a "B" battery potential as high as 150 volts, with a "C" battery voltage of nine to twelve volts.

Q. 3. Is it necessary to use this type of amplification after one stage of the usual audio frequency amplification?

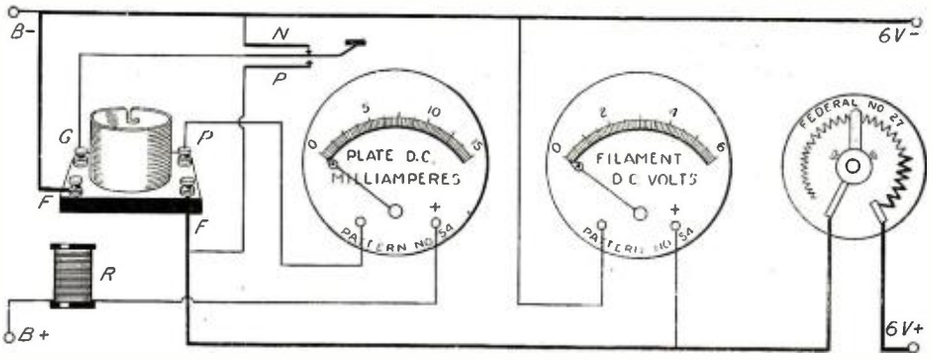
A. 3. The special push-pull amplifier connection shown in the picture diagram can be used to **amplify directly the** output of the detector tube of a set. However, unless this detector tube is preceded by one or more stages of radio frequency amplification, it will be more economical to use one stage of regular transformer coupled audio frequency amplification and then one stage of the push-pull type. Such a circuit is shown in schematic form in the "RADIO HOOK-UPS" section (circuit No. 66, sheet No. 14) of the December, 1924, issue of RADIO NEWS. In connection with this the correction mentioned in the answer to question number two, below, of Mr. T. D. Burnett (Q. 2114) is to be noted.

TUBE CHECKER

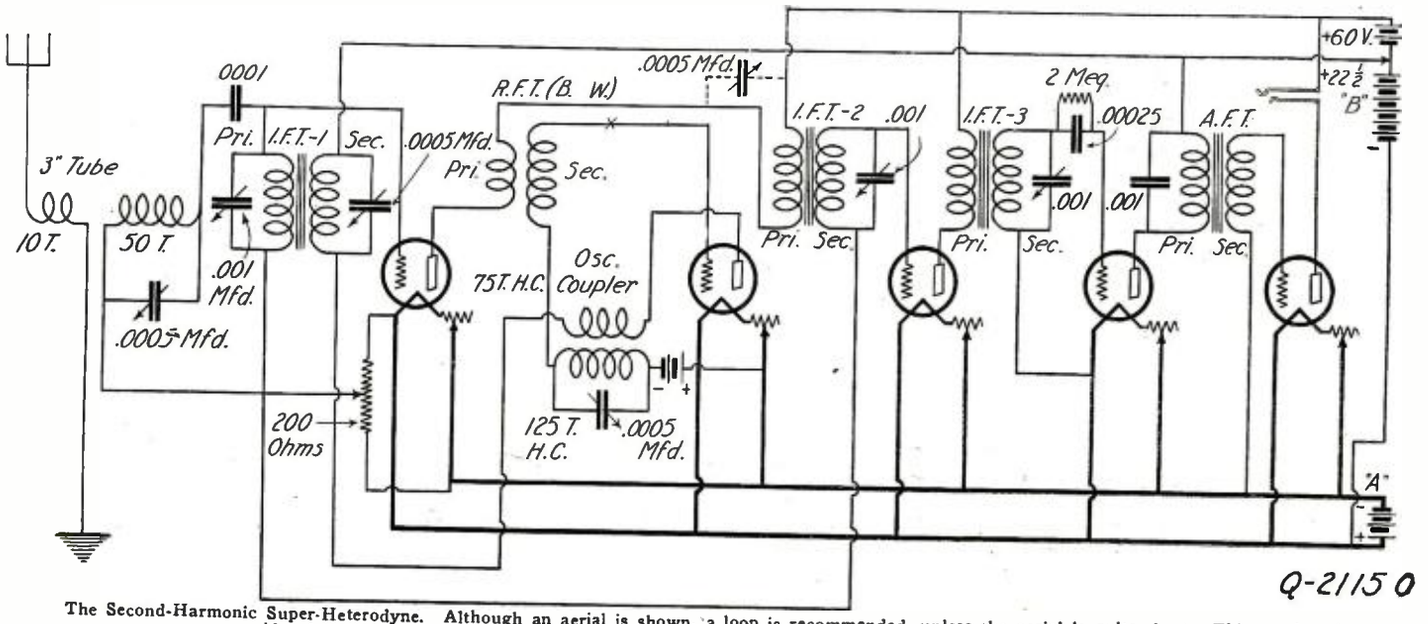
(2113) Mr. G. W. T. Kearsley, Roanoke, Va., asks:

Q. 1. Please give circuit and general information of the Jewell pattern No. 110 "Tube Checker."

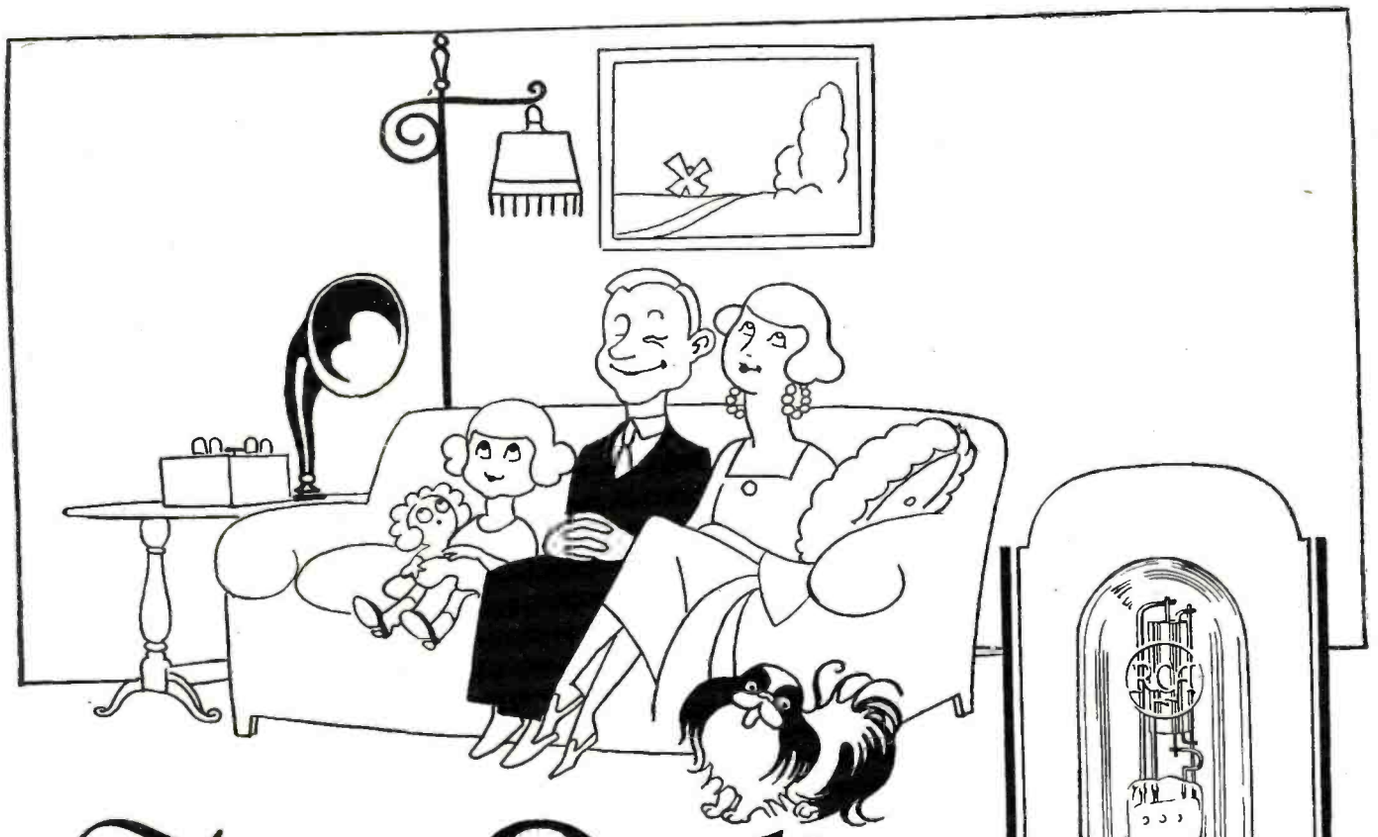
(*Continued on page* 2140)

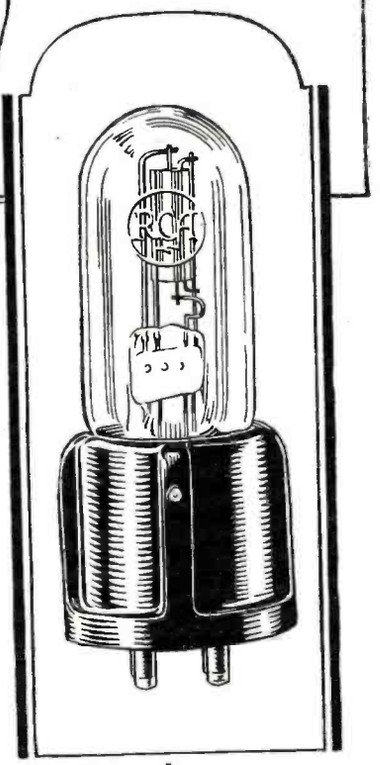


Tube Checker. This is about the simplest and most inexpensive instrument one can have for rapidly determining the D. C. characteristics of vacuum tubes.



The Second-Harmonic Super-Heterodyne. Although an aerial is shown, a loop is recommended, unless the aerial is quite short. This receiver is considered as non-radiating since the first radio frequency tube has considerable blocking effect in one direction.





There's Quality *in everything*

IN everything from a binding post to a vacuum tube, there is quality. But quality counts most in the vacuum tube. A radio set can be built for distance, for clear tone, for volume. But to get the best out of any hookup —you want to fit it with genuine Radiotrons.

No matter what type of set you have—or what type of circuit you are buying tubes for —ask for Radiotrons by name—and make sure you get the genuine by looking on the tube for the word Radiotron and the RCA mark. Quality counts!

NOW $3.00

WD-12
WD-11 UV-200
UV-199 UV-201-A

Radiotrons with these model numbers are only genuine when they bear the name Radiotron and the RCA mark.

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Sales Office: Suite No. 25
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RCA

This symbol of quality is your protection

INTERNATIONAL RADIO PROBLEMS

By CARL H. BUTMAN

With the passage of the bill carrying the State Department's budget of $75,000, plans for the international Radio Conference to be held in Washington in September are being formulated. The actual agenda depends somewhat upon what action the World Telegraph Conference at Paris takes this summer. The United States will not be officially represented, as it is not a party to the convention. A careful study of the action taken there, especially with reference to the attitude of the World Powers will, however, be made by American governmental officials and radio experts, in order that the general trend of opinion on electrical communications may be followed.

It may be found more practical to eliminate discussion on strictly technical matters, such as specific wave channels, power limitation and such matters, as they might tie up development in a mass of technicalities, which could not be changed for three or four years.

The essentials of world-wide radio communications will be covered in the Paris conference, since they are incorporated under the clause of the old telegraph convention of 1908, covering ship to shore radio communication. It is believed that the Paris conference will extend these regulations to cover trans-oceanic radio services. If this is the case, radio service in general, licenses, classification of messages, accounts and rates may be outlined at Paris prior to the American conference.

Other subjects which are likely to find a place in the discussions are general, though flexible rules to cover interference, also rates, services and methods of handling international radio traffic. The conference may thresh out wave-lengths to be used in ship-to-shore radio communication, as that question affects each country; the old plan of abolishing the spark apparatus may reappear. The assignment of suitable channels for international radio telephone broadcasting will undoubtedly be considered. Standardization is needed; abroad very long waves are used, compared with those employed in the Western Hemisphere. An international aircraft channel is becoming an important question, due to the development of air routes throughout Europe, where airships and planes fly over several different countries in a day's trip. The international angles of aircraft wave-band may be considered as well as military channels.

It is quite probable that a broader conception may be placed upon the old plan for allocating of high-power commercial stations throughout the world. Advanced thinkers on this subject believe that the location of commercial stations within the boundaries of a country is a matter for the particular country to determine. The international allocation of signals, such as distress and general calls, as well as the assignment of high-powered station call letters, will be discussed, although it is believed that this matter will continue to be handled by the central bureau at Berne. International broadcasting by amateurs may be considered, as recently the amateur has come into world prominence, and his call letters, although national, have no definite significance in another foreign country, and may be duplicated.

THE 1920 PRELIMINARY CONFERENCE

As most of the countries of the world are parties to either the telegraph or the radio conventions, it is likely that more than 50 separate governments will send delegates to the United States this fall to participate in the deliberations on radio regulations.

In October, 1920, about a year before America in general became vitally interested in radio, a preliminary radio conference was held in Washington, where representatives of Great Britain, France, Japan and Italy met to draw up an outline program for future discussion. Most of the visiting delegation were headed by the respective ambassadors and ministers, and the United States was represented by Under Secretary of State Davis, Postmaster General Burleson, Admiral Benson of the Shipping Board and Walter Rogers.

The conference laid down proposals under the following subdivisions:

RADIO PROTOCOL

The radio protocol of the Peace Conference; a universal communication union, composed of telegraph and radio sections; international telegraph, radio and cable laws, and improvements in the communication facilities between the five great powers.

The British submitted a plan for the amalgamation of all electrical communicattion rules and regulations to be submitted to a world's congress on communications, which, however, has never materialized. The standardization of stations, licenses and practically all phases of communications was proposed, including time signals and methods of reducing interference. An international alarm signal system, calculated to call operators not on watch in case of danger signals, was proposed and a new universal code or cipher system was outlined.

The old international code system, a method of communicating between stations or ships of different nations, was pronounced out of date and not adapted for radio. Provision for transmitting messages intelligible to all operators, regardless of the language they spoke, was planned for use in sea and aerial navigation; covering damages, sickness, stores, fuel, meteorology, ship and aircraft business, and other special needs.

Recommendations for some technical improvements in communication services included the adoption of high-speed printing receivers, automatic transmitters and the multiplex operation of circuits so as to handle several messages simultaneously.

Although the State Department has made no official move toward calling the nations of the world to this conference, it is understood that formal invitations will soon be sent out, and the working up of a program begun. At an early meeting of the Interdepartmental Radio Advisory Committee, on which all government departments and bureaus having to do with radio are represented, it is planned to develop a definite government policy outlined by that committee some time ago. It is probable that this committee will form a neucleus of a technical advisory committee to aid the State Department officials detailed to handle the conference.

"LET NO MAN"

Radio bugs are now talking of marriage by radio. But just think, this is what you may get when you listen in:

Minister: "Do you dit-dat-dah-dah-dah, dit-dah-dit Eloise Inch take this prunes closed firm to be your Texas Gulf Oil preferred 34 bid lawfully wedded titmouse and woodchuck fable by Millicent Muddle?"

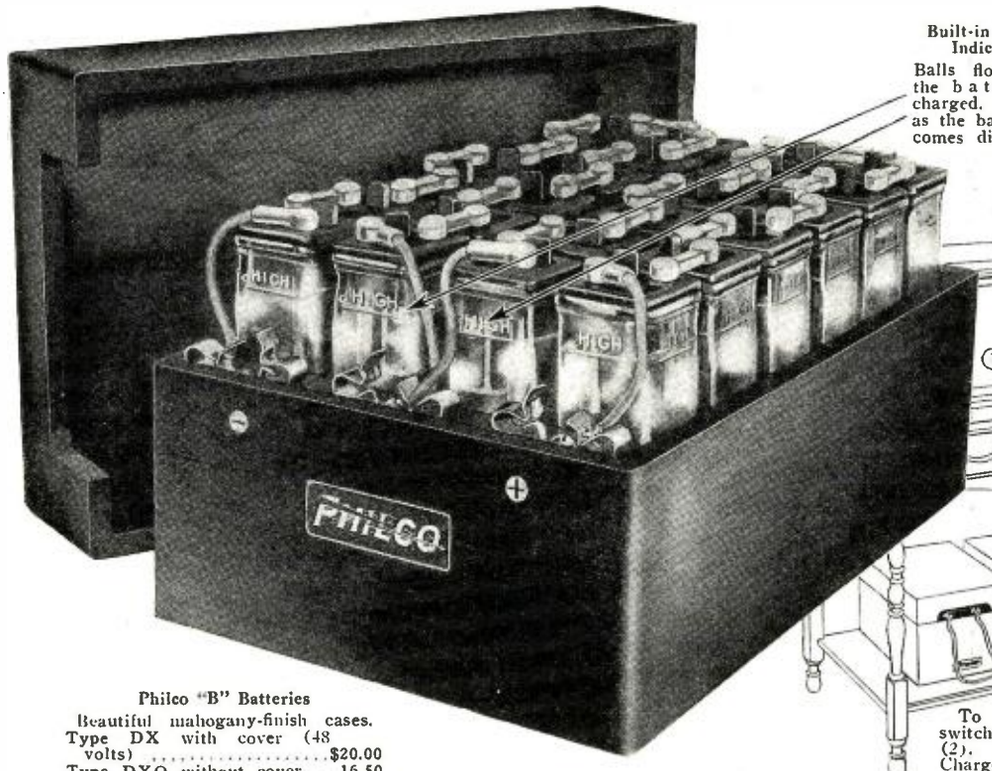
Answer: "Shake a little shimmie on the shores of Kakaako."

Minister: "Do you Clearance snap-snap-snap-buzz-click take this bedtime story by Kenneth Knee to be your lawfully wedded Sousa's band in new program?"

Answer: "Good-bye, Tootsie, good-bye."

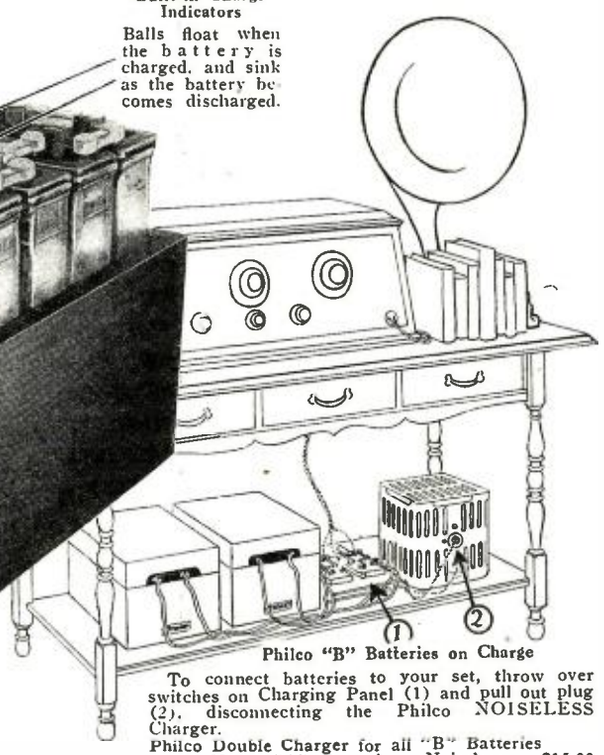
Minister: "I pronounce you McKinley high school glee club in songs and instrumental music."

Contributed by Billy Doll.



Built-in Charge Indicators
Balls float when the battery is charged, and sink as the battery becomes discharged.

Philco "B" Batteries
Beautiful mahogany-finish cases.
Type DX with cover (48 volts) $20.00
Type DXO without cover... 16.50
"B" Charging Panel, factory-wired and ready for use.... 2.75



Philco "B" Batteries on Charge
To connect batteries to your set, throw over switches on Charging Panel (1) and pull out plug (2), disconnecting the Philco NOISELESS Charger.
Philco Double Charger for all "B" Batteries and UD86 "A" Batteries. Noiseless.... $15.00
Philco Single Charger for all "B" Batteries and UD44 "A" Batteries. Noiseless.... 9.75
Charger prices include plugs and receptacles.

Philco Pressed-Glass Case "A" Batteries
Spray-proof. Stay dry and clean always. Built-in Charge Indicators.
Type UD86 for storage battery tubes $16.00
Type UD44 "a dry cell replacement" enabling you to get better results out of dry cell tubes. Occupies less space than three dry cells and may be installed permanently in the radio cabinet. Price $8.00

Philco Mahoganized-Case "A" Batteries
Types RAR and RW for storage battery tubes. In beautiful Adam-brown mahogany-finish cases harmonizing with your radio cabinet. Price..$14.50 up
Philco Charge Tester — permanently mounted in filler cap—avoids fussing with hydrometer— $1.00 extra

Recharge in your living room *without changing a wire!*

You need storage "B" batteries because clear and distant radio reception depends on steady, non-drooping voltage and strong, hum-free current.

Philco has made "B" storage batteries easy to operate. Also economical. One Philco "B" Storage Battery will outlast many dry-cell batteries.

To Recharge—just throw the Charging Panel switches and insert the plug in the built-in receptacle of the Philco NOISELESS Charger. Cost—five to ten cents.

You don't move the batteries or disconnect a wire. You avoid all danger of getting positive and negative mixed and burning out tubes.

Clean, Dry and Beautiful. The tightly-sealed glass cells are assembled in Adam-brown mahogany finish cases harmonizing with radio cabinets and furniture.

Built-in Charge Indicator. Tells you at a glance how much charge is in the battery at any time. Does away with the old-fashioned hydrometer.

Philco makes storage "A" batteries of similar convenience and economy. Also high-powered starting batteries for your automobile.

Philco Batteries are Drynamic—shipped DRY—but CHARGED. Being dry, they cannot deteriorate while in shipment or on the dealer's shelf. Their life doesn't start until the dealer pours in the acid when you get the battery. You are certain to get its full life.

Ask for a Philco Drynamic—see the acid poured in—and you cannot get a stale battery. See your nearest Philco Service Station, Radio or Music Dealer.

Philadelphia Storage Battery Company, *Philadelphia*

PHILCO DRYNAMIC RADIO BATTERIES

JOBBERS and DEALERS— Philco has brought radio batteries out of the cellar and put them in the living room. Our new Radio Manual tells how. Fill out coupon below and we will mail you a copy.

R.N.

Name_____

Street_____ City_____

State_____ Jobber ☐ Dealer ☐

Hotel Furnishes Radio for its Guests

(*Continued from page* 2068)

losses. By this process the battery is only floating across the line and, therefore, the water decomposition due to charging is very small, and requires replenishing only once in six months.

By the action of the relay closing 1, Fig. 1, switch 2, Fig. 1, is actuated. This changes the "B" batteries from a charging circuit to the operating circuit. It is possible in this manner of charging the "B" batteries to regulate the charging period and rate plus a 5 per cent. battery loss to equal the discharge rate when the set is in operation.

Since this charging rate is of such small value, the water decomposition is like that of the "A" battery.

At the completion of the concert which usually starts at 12 o'clock noon and ends at 12 o'clock midnight, the black button switch 3, Fig. 2, is closed. This in turn energizes the releasing solenoid of the relay, which opens the "A" battery and charging circuit, and throws the "B" batteries back on charge.

An entirely different phase of the work presented itself when it came to running the lines throughout 208 rooms on eight different floors and loud speaker lines through a pipe shaft 14 floors high. All of these lines had to be run in such a manner that the energy level would be the same in any part of the building, and yet should any circuit fail, it would not throw out any other circuit. These technical difficulties, which vary for different structures, are solved by mathematical calculation.

RADIO IN EDEN

First Radio Fan: "Adam must have been the first radio nut."

Second Radio Fan: "How so?"

First Radio Fan: "He gave up a rib to get a loud speaker, and passed the rest of his days listening in."

Contributed by H. S. Tillotson.

Specialize!

(*Continued from page* 2102)

ized branch of electrical engineering. And just as in purely electrical work we have hundreds of applications of the still mysterious force, so indispensable for transportation, lighting, heating, signaling, etc.—so in radio we have corresponding spokes radiating from the one central hub—radio.

You would hardly go to a skilled telephone engineer for information concerning electrical mine locomotives. You would go to a man who was in close touch with that particular field. Yet both are graduate electrical engineers.

No more reason, then, why you should approach an expert radio engineer specializing in the transmission of photographs by radio and expect expert advice on the construction of an "Umptydyne" broadcast receiver. Your obvious source of information would be the men who are in daily contact with radio broadcast receivers and circuits—freak and otherwise. While it is true, except in instances so rare as to be almost a novelty, you do not find in the radio stores men who are radio engineers in the slighest sense of the word; glaring signs—impressive titles, etc., notwithstanding—still you will come into contact with men who are daily building, testing and selling every conceivable type of broadcast receiver and who are accordingly much better prepared to assist you in choosing apparatus for your particular needs, than are the men of the radio telegraphic, or the engineering field, who as a general rule have but a mild interest in radio broadcasting.

SOME RESULTS

It is obvious, then, to the young person seriously considering entry into the radio profession, that he cannot rush blindly into the field with a determination to learn radio. He must weigh carefully the many varied branches of this most fascinating profession and once he has chosen—be it the marine radio telegraphic field, broadcasting, radio photography or other interest, whichever holds the greatest attraction for him—he must devote himself almost exclusively to his choice and become a specialist in that one particular line.

Often a young fellow will come to me and say, "I'd like to learn radio; how shall I go about it?" At my question as to what particular branch of radio work he is interested in, he will generally reply, "Oh, I don't know—just radio." I can then only suggest that he investigate the field and endeavor to determine which of the many branches of radio holds the most fascination for him and then come back and talk it over.

As an example of the need for specializing, I have my own case as an outstanding illustration. Radio has always, since my first attraction to the then new science, some 16 years back, held my deepest interest, and I have almost lived radio to the exclusion of everything else. My reading has been mostly confined to books and periodicals devoted to the subject and my interest has never waned. Nevertheless, I found that it took every spare moment that I could manage, plus much experimentation, to keep reasonably abreast of the development in the many varied branches of the science, up to a few years ago. Since then, progress has been even more rapid and my efforts became a hopeless task—I simply could not keep up and expect to have a fairly general knowledge of each development. It has accordingly become necessary for me to specialize, and having chosen marine radio communication as my particular field of endeavor, I find that it is increasingly difficult day by day to do more than merely read the more important articles and treatises on development and experimental work foreign to my specialty, in an effort to at least know along what lines work is being done. I freely confess that I should most certainly hesitate to enter into a broadcast receiver circuit discussion with any high school boy radio fan, for I know I would be hopelessly outclassed. Daily I come in contact, through the press or casual conversation with circuit names and parts, all allied with broadcast reception, which mean exactly nothing to me. I can perhaps dig down into them and find hidden beneath a maze of "low-loss" and "high mu" and such data the old familiar lines of a basic circuit, but the modern camouflage almost obliterates the familiar connections!

SPECIALIZE

The answer is—specialize! Just as an expert French pastry chef will be totally ignorant of the finer points of broiling a juicy porter-house, so will the radio telegrapher, engaged in the constant exchange of dots and dashes, stammer and become confused, or wisely remain silent if a party to a discussion of modulation methods with water-cooled tubes!

The fundamental idea he has grasped beyond a doubt, just as the pastry chef knows that to broil a steak, heat must be applied, but both are lost when delving into the actual details.

So, if you want to enter the greatest game

EVEREADY HOUR
EVERY TUESDAY AT 9 P.M.
(Eastern Standard Time)
For real radio enjoyment tune in the "Eveready Group." Broadcast through stations—

WEAF	New York	WFI	Philadelphia
WJAR	Providence	WCAE	Pittsburgh
WEEI	Boston	WGR	Buffalo
WEAR	Cleveland	WOC	Davenport
WWJ	Detroit	WCCO	Minneapolis, St. Paul

The proven Dry Cell for all Radio Dry Cell Tubes

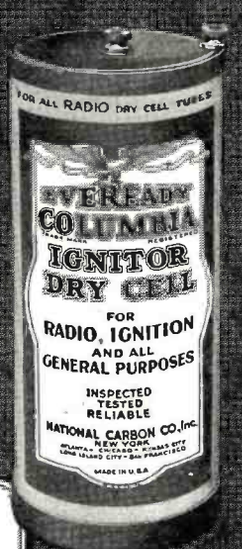
Recommend good batteries

IN AN effort to reduce the first cost of a radio set, a newcomer in radio often buys inferior batteries. *You* know such "saving" is really wasteful. Tell your friends who are about to buy receivers that the best batteries obtainable will prove to be the most economical. Tell them to buy Eveready Radio Batteries—they last longer and, because they are greatly superior, they give complete satisfaction.

There is an Eveready Radio Battery for every radio use.

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

EVEREADY
Radio Batteries
—they last longer



Eveready Columbia Ignitor Dry Cell "A" Battery for all Dry Cell Tubes 1½ volts

No. 770 45-volt Extra Large Vertical Price $4.75 For use on multi-tube sets

No. 767 45-volt Large Horizontal Price $3.75 With variable taps

in the world—choose carefully and then dig in and work—eat and sleep your stuff until you emerge a full fledged radio "specialist"—not a "generalist."

Fair-Sex Inventor

(*Continued from page* 2089)

and to show how even an amateur can turn his hand toward producing something of worth-while value in the industry just by looking ahead a little bit.

FUTURE

Though it would seem ridiculous at this stage to try to predict the future of radio, yet there are some developments which seem almost self-evident. It does not seem beyond the limits of common sense to feel that in the not very far distant future radio communication between the continents will be as ordinary a thing as the present-day local telephone. DX reception is improving and this can only mean that reception between the United States and Europe, for instance, will be a thing of everyday practice, but that even points as far apart as the United States and Australiasia will be within easy communication.

The guiding of ships and even airplanes by radio as a regular thing is not beyond present belief either, especially as everyone knows that this has already been demonstrated successfully. Radio some day may take the place of the telephone and for one individual to talk to another from Shanghai, China, to New York, U. S. A., is almost a fact. Then, again, the real difficulty to be surmounted there would not be in the radio reception, but in the trouble the New York man would have to distinguish the Chinaman's talk from static.

UNIVERSAL LANGUAGE

If a universal language does not progress any faster than it has thus far, the whole difficulty will be with this and not with the reception of radio in intercourse between the nations in the future.

I am not too optimistic, but I will take my stand with those who think that radio is to be the future leveler of all nations, the official medium through which disputes will be settled and amity will be won among all peoples. It does not seem too difficult to believe this, if for no other reason than that the people of the various nations will then be in direct verbal contact with one another and that this may bring about an understanding that will prevent future wars.

A question I am often asked is whether I intend to continue with my attempts to perfect radio inventions. My answer is that my interest grows constantly and that hardly a day goes by but that I add something in radio to the little laboratory that I have equipped and set up in my home. And this will apply to anybody. If the proper application is given to the work, there is plenty of opportunity for anyone interested in the business to try to turn his hand in an effort to develop something new for the radio fan that will be a boon in time saving or in perfecting the new science.

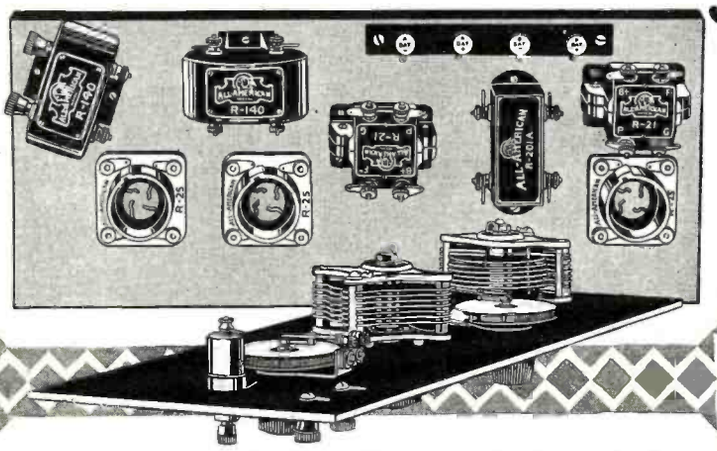
But to come back to the actual articles which I invented, I shall first describe in detail the construction of the loud speaker. This is made of well dried cedar wood, very hard, and is shaped, as I have said before, like a metronome, or a truncated pyramid. Some distance from the bottom of this box is a sort of scroll-work, which acts in a capacity similar to the action of the bridge in a violin.

This scroll-work, shown in the accompanying illustration, is glued onto the sides of the loud speaker and has in its center a hole large enough to accommodate a loud speaker unit.

Radio at its Finest — Now Within Your Reach

MEMBER RMA

This is Not a Kit!



Semi-Finished — Factory-Mounted

YOU buy this set with the ALL-AMERICAN parts properly mounted on the panel and baseboard. Without knowledge of blueprints, circuits or names of radio parts, you can wire up an ALL-AMAX SENIOR in *one delightful evening* and *know* that it is *right*. It was inevitable that sooner or later this *reliable*—and still *economical*—method of getting a high-grade radio set should be discovered. ALL-AMERICAN manufacturing ingenuity has found the solution and offers this completely mounted, highly efficient three-tube set at no more than you would pay for a kit of parts. Price, $42

Ten cents will bring you the new Radio Key Book, and upon request we will include, free, a complete wiring blueprint of either ALL-AMAX SENIOR or ALL-AMAX JUNIOR.

ALL-AMERICAN RADIO CORP.
E. N. Rauland, *President*
2646 Coyne Street, Chicago

ALL-AMAX JUNIOR

The same unique manufacturing methods that created ALL-AMAX SENIOR have brought forth ALL-AMAX JUNIOR—a one-tube set that brings in the local stations on the loud speaker, or tunes them out and gets real distance. All parts are mounted on panel and baseboard, and clear *photographic* wiring directions are included. Price . . $22

WIN AN ALL-AMAX RECEIVER

At your favorite Radio Store

Ask them about the great ALL-AMERICAN Slogan Contest

You can win a set by submitting a SLOGAN

Everybody can enter. It costs nothing

ALL-AMERICAN

The top of the truncated pyramid is covered with another piece of cedar wood, glued tightly, which is placed in mechanical connection with the diaphragm of the unit by means of the stem shown in the illustration. It can easily be seen, therefore, that the whole thing acts somewhat as the sounding-board of a piano.

There is no need to further describe the portable antenna, as everyone is acquainted with the idea of what an ordinary steel tape is like. It is also likely that everyone knows enough not to try to use a steel tape, for the reason that steel is magnetic and some things may happen in the reception of radio broadcast concerts which are not to be desired. Hence. the copper ribbon instead of the steel tape.

It is needless to say that these two inventions worked. If they did not, I would not be writing about them; neither would I suggest to others that they spend time and energy in trying to construct them.

A CORRECTION

In our first annual radio set directory a mistake was made in the descriptive specifications of two sets appearing on page 1656 of the March issue. The description should have read as below:

TRADE NAME: Grebe Synchrophase.
MODEL: MU-1.
TYPE: Two tuned and balanced radio, detector and two audio.
TUBES: Five 201-A.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: Three.
PRICE: $155.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with tubes of the UV-199 type (Model MU-2). Receiver shown with battery base.

TRADE NAME: Grebe Synchrophase.
MODEL: MU-2.
TYPE: Two tuned and balanced radio, detector and two audio, last stage paralleled.
TUBES: Six UV-199 type.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: Three.
PRICE: $155.00; with battery base, $170.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with five tubes, 201-A type (Model MU-1). Battery cabinet available with both models $15.00 additional.

With the Amateurs

(*Continued from page 2093*)

5AVH—Lanier Thompson, Box 317, Ruston, La. Pse QSL. All crds answered.

6CWN—Nathan H. Samuels, 1074 Ashmount Ave., Oakland, Calif. 5 Watts CW es Fone.

8ALZ—Elmer W. Stroachs, 7610 Redell Ave., Cleveland, Ohio. 50 Watts es CW, ICW es Fone. All crds QSL'ed.

9NE—Erland L. Olson, 272 Wilder St., Aurora, Ill. 5 Watts Fone es CW. Pse QSL.

9AYF—(Re-assigned) Chas. A. Hill, 1500 So. 12th St., St. Joseph, Mo. 5 Watts on 80 meters. QRK? A crd fr a crd.

Then you will say:
"This has the distinction of Genius"

In every industry there is some product that is incredibly fine—whose perfection beggars the comparison of price.

In radio, it is Rola. Not a "loud-speaker" or "reproducer"—but a *"Re-creator."* It actually *re-creates* every note, every shade of voice and instrument, as faithfully as a polished mirror reflects an image.

Rola was built with a full appreciation of the important part that a reproducing device plays in radio. With the knowledge that the finest set can be no better than its loud-speaker. Price, you will agree, is of little moment when you consider the many advantages to be gained by actually *re-creating* the beautiful radio programs.

There are many excellent loud-speakers—just as there are many excellent musicians. But the subtle distinction that we recognize as genius in some musicians is easy to recognize in the performance of Rola.

Rola's tone quality, its volume even—is self-adjusting . . . the mood of the musician himself. A wonderful new method of re-creation automatically eliminates the distortion of overloaded tubes—just as it amplifies the weakest sounds from your set.

A watch-like precision of manufacture assures you a lifetime of service. You will never care to replace your Rola—and that, in itself, makes it the wisest of investments.

When you hear a Rola—and we suggest that you hear it before you buy any loud-speaker . . . you will appreciate that with it comes the same satisfaction that you experience in owning a thoroughbred horse—a grand piano of some master make . . . or anything that is unmistakably the finest of its kind. At the better radio stores. Price complete with 14" horn and cord, $36.00. Phonograph unit with adapter, $22.50.

A product of the Rola Company, 4250 Hollis Street, Oakland, California. Marketed nationally through Baker-Smith Company, Inc., Head Office, Call Building, San Francisco, California. Branch offices in principal cities.

Rola

RE ★ CREATOR

9DXV—Rudy Mugerl, 3215 Ave "A," Kearney, Nebr. 5 Watts. All crds answered.

WHO CARES ANYHOW?

This curious communication came to the Signal Corps from a Chicago writer, who evidently believed receiving sets were taxed:

"In West Washington Boulevard, Nr. about 1452-54-56-58, is a lady which hav two Wireless Apparats and she not pay tax. she use it more in 10 year. This 2 wireless telegraphi can be easili found. She hav wire connected from rear hous thru windows.

Calls Heard

2CXY—BRADLEY BEACH, N. J.

(January 31 to February 19)

CANADIAN—4eo, (4io), 5bl. 5ct, 5dq, 5go, 5gf, 9dk.

BRITISH—(2cc), 2fu, 2gk, (2kf), (2kw), (2lz), (2nm), 2od, (2rb), 2sh, 2vc. 2wj. (2nb). (5ba), 5bv, 5ls, 5ma, (5mm), 5nn, 5pu, (5rz), 5uq, (6nf).

MEXICAN—1n. 1x, bx, 1aa, 1af.
BELGIUM—3ad.
HOLLAND—(0nl), 0re, (0ll), cpi.
DENMARK—7ec.
FRANCE—(8éé), 8ab. 8ct, 8gk, 8tk.
LUXEMBERG—8ao.
ITALIAN—(i1mt).
CUBA—2lc, 2mk.
SPAIN—ear6.
INDIA—ghh1.

Foreign and West Coast repts. appreciated. 35-watt input hr.

C3BL—1331 AVENUE ROAD, TORONTO, ONTARIO

1aam, 1afn. 1ajx, 1amf, 1are, 1avj, 1avp, 1awq, 1awy, 1ay, 1bdx. 1bhb, 1bub, 1cbb. 1cme. 1gh. 1vc, 1yd, 1zw. 2aan, 2agq, 2aod, 2aot, 2bgo, 2buy, 2cdh, 2cgs, 2chm, 2cjx, 2cqi, 2crp, 2cth, 2cyq, 2dg, 2eg, 2gy, 2kf, 3afq, 3ari, 3bbr, 3bct, 3bdm. 3bnu, 3buy, 3cah, 3cgc, 3cj, 3cjn. 3cu, 3du. 3ff, 3hh, 3kl, 3ly, 3me, 3na, 3zg, 4af, 4bnu, 4dv, 4mb. 5aat, 5adv, 5aen. 5agn, 5akh. 5aks. 5alz, 5anl, 5aom, 5aul, 5ck, 5ek. 5hv, 5ls, 5na, 5qh, 5qk, 5wi. 5xa, 5zr, 6aol, 6atf, 6avj, 6bcf, 6bwl, 6jj, 6ur, 7mb, 7ok, 8aam, 8acu, 8ahq, 8aig, 8alb, 8avt, 8avx, 8ayy, 8bba, 8bbw, 8bdw, 8bf, 8bga, 8biq, 8bko, 8bla, 8blr, 8bop, 8brb, 8brd, 8bsc, 8bsq. 8bvr, 8bxt, 8byt, 8bzl, 8cab, 8cas, 8cvb, 8cci, 8ccn, 8cej, 8chf. 8chg, 8cic, 8cl, 8coc, 8cqg. 8cqh, 8cui, 8cuk, 8cwl, 8cwp, 8cyt, 8czy. 8dc, 8ddc, 8dfm, 8dfo, 8dgl, 8dgo, 8die, 8djh, 8dlu, 8dmb, 8dmm, 8dnd, 8doo, 8doq, 8dqz, 8drs, 8ep, 8fu, 8gd, 8hn, 8jt, 8ki, 8mt, 8rv, 8rw, 8tt, 8tw, 8xe, 9aal, 9adk, 9aei. 9afq, 9ajv, 9ala, 9aoe, 9aot, 9aou, 9apd, 9apy, 9ato, 9atr, 9aux, 9avb, 9axs. 9ayq, 9bbj, 9bbx, 9bcb, 9bcd, 9bdz, 9beg, 9beq, 9bfp, 9bhi, 9bhp, 9biu, 9bk, 9bkq. 9bmh, 9bnk, 9bog, 9brs, 9bvk, 9cia, 9chy, 9ckh, 9cln, 9cnb, 9cni, 9coc, 9cro, 9cte, 9cui, 9cwk, 9dbg, 9dbj, 9dbw, 9dct, 9dfz, 9dga, 9dge, 9dgh, 9dhg, 9dhl, 9dln, 9dpc, 9drj, 9dry, 9duv, 9dwz, 9dyt, 9dyy, 9ebd, 9ee, 9eel, 9efv, 9ehi, 9ejr, 9ejy, 9eky, 9el, 9elq, 9ely, 9ep, 9ez, 9fj, 9gs, 9hp, 9il, 9lb, 9mr, 9ni, 9tw, 9vl, 9wo.

CANADA—1am, 1ar, 1ef. 2fi, 3ws, 4dq.

Complete log here—crd for all.

GEORGE EDWARDS, 159 A HILLINGDON STREET, LONDON, S. E. 17, ENGLAND

(Calls Heard From January 1 to 7, 1925)

1aad, 1aea. 1aid, 1ana, 1ary, 1atj, 1aur, 1avf, 1bal, 1bcl, 1bcr, 1bdx, 1bep, 1bgq, 1bhr, 1bie, 1blr, 1bnt, 1bsw, 1bvl. 1bwx, 1cab. 1cma, 1cme, 1cmx, 1fd, 1gs, 1hb, 1ii, 1kl, 1ml, 1nd, 1pl, 1py, 1sk, 1sw, 1xad, 1xam, 1xu, 1xz. 1yd, 1zad, 2aan, 2abt, 2axf, 2axu. 2bgi, 2bgg, 2bls, 2box, 2bqu, 2brc, 2bum, 2ccj, 2ce. 2cep, 2chj, 2cjb, 2cpo, 2cvf, 2cvj, 2cxw, 2mc. 3ava. 3bg, 3bnu, 3bw, 3bta, 3ca, 3cbl, 3cf, 3chc, 3chg, 3mf, 3oq, 4cc, 4fs, 4ku, 4sb, 4sx, 4tv, 4xe, 5atx, 8acy, 8cbp, 8cuk, 8pk, 9ejt.

CANADIAN—1ar, 1bf.

N. B.—A station either calling or signing SS KSP heard January 30-31, time here about 1 a.m. to 2 a.m., January 31. Not certain as to actual time. QRA?

Station sending test NR1, test NR2, test NR3 up to 4 then lost through jamming. QRA? This was on February 1 about 1 a.m. to 2 a.m. here.

JOHN H.-P. ANDREWS, COR. LAKE AND BELLONA AVENUES. GOVANS. BALTIMORE, MARYLAND

(About six nights—one tube, three circuit—tuned plate.)

(Calls Heard in January, 1925.)

6afg, 6agk, 6ahp, 6alw, 6ame, 6awt, 6bir, 6blh, 6boq, 6bph, 6bqr. 6bra, 6bur, 6cbb, 6cct, 6cej, 6chl, 6cmg. 6cmn. 6crx, 6css, 6cwi, 6czx, 6eb,

The Popular Windsor Radio Console With Its Own Loudspeaker—Concealed! Price, including unit and inbuilt horn, $40

Here is the contribution to Radio that MOTHER has so patiently awaited. And every prideful housekeeper. For it restores LAW and ORDER to the living room.

A stunning console that accommodates ALL your radio equipment. Your set goes on top. The rest of your outfit—is CONCEALED. No more clutter of equipment to clash with the surroundings.

Batteries need no longer scrape polished baseboards, nor endanger handsome rugs. There's a place INSIDE for the largest A and B wet batteries required for any home radio set, and plenty of room for a big charging outfit, too.

What about the HORN? Out of sight and out of mind! This clever console has its own loudspeaker horn, inbuilt, of resonant wood, which does not mutilate the tone as does any harsher material. With a unit selected without prejudice or preference from a score of makes. Phonographs no longer have unsightly horns. The horn is now retired in home radio reception. Equally welcome should be the news that artistic appointments of the drawing room need not be set at naught by a litter of apparatus.

Your dealer has this console, finished in mahogany or walnut. The 38 x 18 top takes any set—with elbow room in front—knee space beneath—room for all else inside. Substantially built and beautifully finished; the product of an old and respected furniture maker. And only $40, loudspeaker included! (West of Rockies, it's $42.50.) Full description and name of nearest dealer on request.

Dealers: This useful member of the furniture family has been joyfully received into thousands of homes—and a million homes still need its orderly aid. It was designed for *everyone's* use—for it accommodates *any* outfit. It appeals to *all* classes—for it is a real piece of furniture.

The diagram shows how the back provides ample space for the safe storage of any home outfit. Out of the way and out of view—but readily accessible when wanted. From the front you can see only an attractive piece of furniture—such as would be bought as quickly for its beauty as for its tremendous usefulness.

Not even the artistic grill that conceals the soundbox hints of utility. An altogether graceful exterior, designed and finished with the care which has characterized Windsor furniture *forty years*. Strong and sturdy, too. There is no wobble or waver to this console, though laden with heavy equipment. It is 38 in. long, 18 in. deep, 29 in. high. Finish, mahogany or walnut. Sales have been *phenomenal*. Write for proposition.

Windsor

Loudspeaker Console

Windsor Furniture Company
1428 Carroll Ave., *Chicago*

Pat. Nov. 18, 1924

6kb, 6pl, 6rv, 6zh, 6zp, 7afo, 7mf, 7mp.
CANADIAN—5ba.
FOREIGN—g2jf, g2kf, g2lz, g2nb, g2nl, g2nm, g2od, g2om, g2sh. g2sz, g5nn, g5uo, g6nf, g6vp, f8cz, f8gk, f8gl, f8sm, q2mk, (oreθre), sj.

P. H. BRIGSTOK TRASLER, 37 YORK ROAD, NORTHAMPTON, ENGLAND

1aac, 1aaj, 1aao, 1ae, 1aea, 1ajg, 1ana, 1anr, 1are, 1ary, 1auc, 1axz, 1bbe, 1bdt, 1bdx, 1bes, 1bgg, 1bgq, 1bhm, 1blx, 1bo, 1boa, 1ckp, 1cme, 1cmp, 1da, 1dd, 1eb, 1cf, 1er, 1fn, 1gv, 1ii, 1kc, 1pl, 1py, 1rd, 1sf, 1xav, 1xw, 1xz, 1zab, 1zt, 2aay, 2abt, 2afp, 2ag, 2all, 2awf, 2azy, 2be, 2bgg, 2big, 2bm, 2br, 2brb, 2brc, 2bsc, 2bw, 2by, 2cee, 2cei, 2cbg, 2cc, 2cqo, 2cvi, 2cyw, 2dx, 2gk, 2kx, 2pd, 2vk, 2wr, 2xi, 2xq, 3ab, 3adq, 3ajd, 3bco, 3bdi, 3bg, 3bng, 3bss, 3bta, 3bwt, 3cbg, 3cbl, 3cc, 3chg, 3cjn, 3lg, 3mue, 3ot, 3wb, 4bq, 4eq, 4fg, 4iz, 4jr, 4lu, 4sb, 4tw, 4xe, 5uk, 8abm, 8adg, 8avd, 8dea, 8nb, 9bpy, 9cap, 9cfi, 9ch, 9dbf.
NKF, NERKI WGH, WJS.
CANADIAN—1af, 1ar, 1dd, 1dm, 1dq.

R. F. DURRANT WIRELESS STATION, MOSUL, MESOPOTAMIA

U. S. A. STATIONS HEARD—1abs, 1er, 1zaf, 1kc, 1aw, 1cab, 1ez.
The above American experimenters may be interested to know that their signals are QSA out here on a wave band of 80 to 90 meters. Best time for reception being 0400 to 0500 hours GMT. As the distance is from 5,000 to 7,000 miles, it will give them an idea of their efficiency.
If this catches the eye of Australian 3BD he might send his address. 3BD has got me one occasion.

CARLOS BRAGGIO—CB8—CALLE ALSINA 412, BUENOS AIRES, ARGENTINE

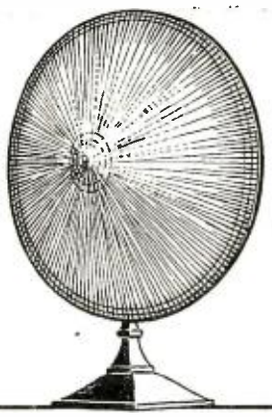
(January 24-25, 1925)
1rd, 1af, 1bkr, 1bdh, 1aki, 1bes, 1cme, 2af, 2afp, 3adq, 3bus, 3xm, 3ot, 4eq, 4xe, 4my (4tw), 4ua. 5cw, 5lu, 6rn, 6chx, 6bph, 6ux, 6bip, 7ls, 8doo. 8gz, 8lr, 8blc, 8ry, 9ktj, 9bm, 9dtk, 9rt.
CANADA—(1dd), (3xi).
ENGLAND—2od, 2sz, 5ls, 6ry.
HOLLAND—0nl.
We have very bad summer, awful QRN. Am transmitting on 65 meters.

JACK B. LYON, WOODROFFE, ONTARIO, CANADA

(Heard Since January 1, 1925, on 1 (Peanut) tube)
ALL FONE
1aaa, 1aah, 1aby, 1ady, 1afu, 1aje, 1bjm, 1cke, 1ea, 1kr, 1om. 1ud, 1vv, 2ad, 2aky, 2ald, 2bhy, 2bqa, 2cfc, 2cj, 2rb, 2iu, 3bhy, 3br, 3bwb, 3cgc, 5amf, 8ais, 8aux, 8beo, 8bhm, 8brc, 8bic, 8blz, 8hz, 8kb, 8ia, 8io, 8cmt, 8cld, 8bxq, 8dat, 8yv, 8yx, 8cdf, 9acm, 9ajw, 9bow, 9bsp, 9cow, 9caw, 9deq, 9em, 9ez, 9zl, 9ua, 9eji, 9xn, 9xj, (9crw).
CANADIAN—3afp, 3ap, 3gg, 3kr, 2bn, 9ce, 9bm, 9cy.
CANADIAN HAM B. C.—10vc, 10ap.
Plse send crd. Will QSL.

RADIO RESEARCH STATION—6NF ALFRED D. GAY,

49 Thornlaw Road, West Norwood, London, S. E. 27, England.
(November, 1924-February, 1925)
1awx, 1aqm, 1anr, 1aww, 1alj, 1afc, 1alg, 1apk, 1aug, 1aac, 1ajg, 1ax, 1alk, 1aea, 1aja, 1azr, 1aur, 1ary, 1atj, 1ana, 1aap, 1atj, 1aar, 1ajx, 1all, 1auc, 1aac, 1acb, 1aid, 1avx, 1axn, 1apf, 1af, 1bv, 1bi, 1bq, 1bfn, 1bcc, 1bgt, 1bgq, 1bip, 1bdt, 1bjo, 1bgy, 1bal, 1bhm, 1bg, 1boa, 1bdx, 1bis, 1biy, 1bhw, 1bpb, 1bsd, 1bau, 1blx, 1bep, 1bqs, 1bdh, 1bes, 1bcr, 1bwx, 1bbx, 1beo, 1cmp, 1ckd, 1cre, 1cme, 1cwe, 1cw, 1cbg, 1ck, 1clu, (1cqz), 1cau, 1ci, 1cab, 1cru, 1cri, 1cx, 1da, 1dm, 1ef, 1er, 1ez, 1gv, 1gs, 1hn, 1ii, 1jk, 1ka, 1kc, 1km, 1lw, 1mu, 1my, 1ml, 1nd, 1nu, 1ow, 1pa, 1pd, 1pl, 1py, 1se, 1sf, 1sw, 1sz, 1vj, 1xu, 1xz, 1xam, 1xap, 1xav, 1yb, 1yw, 1zt, 1zs, 1zv, 1zz, 2ana, 2act, 2awf, 2apy, 2awu, 2aft, 2afp, 2auy, 2aay, 2ax, 2anh, 2aar, 2agb, 2ag, 2abt, 2bg, 2bn, 2br, 2bo, 2bqm, 2bxm, 2bbn, 2bco, 2bic, 2bgg, 2brb, 2bgi, 2by, 2bum, 2brc, 2bqu, 2bw, 2cla, 2czr, 2cep, 2cvj, 2cft, 2cqu, 2cub, 2cjs, 2cbg, 2cqz, 2cvu, 2cee, 2cei, 2cuf, 2cjx, 2cxm, 2cjb, 2cxw, 2dd, 2dn, 2eb, 2gk, 2kg, 2key, 2kf, 2kx, 2ld, 2le, 2mc, 2mh, 2mu, 2pd, 2qh, 2rk, 2ud, 2wb, 2wr, 2xy, 3ajd, 3auv, 3ady, 3ape, 3alq, 3ab, 3auv, 3alx, 3adv, 3adq, 3bco, 3bdo, 3bsb, 3bsv, 3bgz, 3bss, 3btm, 3bof, 3bng, 3bob, 3bta, 3bva, 3bnu, 3cjn, 3cac, 3cdg, 3cdt, 3cbi, 3chc, 3chg, 3cc, 3cf, 3dh, 3hh, 3hg, 3iy, 3jr, 3mb, 3mf, 3mz, 3oq, 3og, 3ou, 3qs, 3qv, 3rr, 3sf, 3sg, 3tj, 3te, 3xf, 3xv, 3yo, 4aj, 4ao, 4bx, 4bs, 4do, 4du, 4eh, 4eq, 4fg, 4fz, 4fs, 4gw, 4io, 4jr, 4ke, 4km, 4kl, 4qf. 4rr, 4sa, 4uk, 4xe, 4xx, 5ajj, 5cn, 5go, 5gs, 5lh. 5ph, 5su, 5se, 5uk, 5hn, 5hl, 5sd, 8abn, 8ad, 8ada. 8aly, 8aol, 8amr, 8adz, 8abn, 8adg. 8bem, 8bau, 8bbw, 8bkh, 8bcp, 8ced, 8cko, 8cyi, 8ccq, 8cbp. 8cmt, 8ih, 8dme, 8dsw, 8ddo, 8dnf, 8ddo, 8pr. 8pl, 8tr, 8uf, 8nb, 8wk, 8gz, 8xb, 8uq, 9bcj, 9erd, 9bht, 9dun. 9ehy, 9dwx, 9vc, 9coc.
CANADIAN—1ar, 1dq, 1rn, 3ab, 3afp, 1dd, 1af. 2cg, 2be.
OTHERS—vdm, ch8, wgh, wjs, nkf, 9tc.
Plse QSL. All crds answered QRK. 6NF?



Hear the Formica band every Wednesday evening from 9 to 10 Central Standard Time over WLW.

They have re-designed but they still use Formica!

THERE has been a great deal of activity in the engineering departments of the set makers since the first of the year — new models, new prices, newly simplified sets. Every conceivable substitute for Formica panels, tubes and insulating parts has been examined, tried and thoroughly tested.

But Formica is as prominent as ever in the sets that have been O.K.'d for production. For there is no substitute — nothing that combines the beauty and permanence of Formica, its strength, freedom from warping and distortion.

The makers know that Formica in their sets *never gives trouble!* And trouble is the most expensive thing the set maker can have. No small saving in material cost can make it worth while.

Last year 125 leading makers used Formica — this year the percentage will be just as high.

Dealers and jobbers prefer Formica because it is the best known and most easily sold line of panel materials.

Write for booklet, "What Formica Is."

THE FORMICA INSULATION COMPANY

4618 Spring Grove Ave., Cincinnati, Ohio

Sales Offices

50 Church Street.....New York, N. Y.	289 Victoria St.....Toronto, Ontario, Canada
9 South Clinton St.....Chicago, Ill.	1026 Second Avenue.....Minneapolis, Minn.
516 Caxton Bldg.....Cleveland, Ohio	725 Bulletin Bldg.....Philadelphia, Pa.
1142 Granite Bldg.....Rochester, N. Y.	708 Title Building.....Baltimore, Md.
422 First Avenue.....Pittsburg, Pa.	585 Mission Street.....San Francisco, Cal.
6 Beacon Street.....Boston, Mass.	419 Ohio Building.....Toledo, Ohio
55 Calle Obispo.....Habana, Cuba	309 Plymouth Bldg.....New Haven, Conn.
	Whitney Central Bldg.....New Orleans, La.

Write for Booklet "What Formica Is"

1 Formica is used by 125 leading makers — and has for years been used by more makers than all other materials.

2 Formica will last forever.

3 Formica, in appearance, is the finest of all panel materials and always remains so.

4 Formica's electrical qualities of every kind far exceed any possible requirement.

5 Formica has high mechanical strength and will not break in use.

6 Formica will not sag from heat or cold flow under pressure. It retains its dimensions. Everything you fasten to it stays tight and precisely where you put it.

7 Formica panels are sold in neat craft paper envelopes which assure you that you are getting the genuine.

8 Formica is one of the most widely approved materials in radio.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

F. CHARMAN, 76 SALISBURY STREET, BEDFORD, ENGLAND

(Heard Between January 31, 5 p.m., and February 1, 3 a.m., E.S.T. Detector + IAF.)

AMERICAN—1aap, 1af, 1agg, 1ahp, 1aid, 1ana, 1arc, 1ary, 1atj, 1auc, 1aur, 1awy, 1axz, 1azi, 1bgg, 1bdw, 1bcr, 1bhm, 1bic, 1bip, 1blu, 1bnt, 1brc, 1bsd, 1bsk, 1bub, 1bz, 1bzp, 1cab, 1cak, 1cc, 1cme, 1cx, 1da, 1dcc, 1dl, 1fd, 1ga, 1gs, 1hn, 1hw, 1ii, 1js, 1kc, 1ku, 1ky, 1ml, 1my, 1pl, 1py, 1qm, 1rd, 1se, 1sz, 1uw, 1wl, 1xz, 1ym, 1unerk or u nerk1, 2ag, 2aja, 2au, 2axf, 2bd, 2be, 2bg, 2bgg, 2bjk, 2bjx, 2bm, 2bpc, 2bqu, 2br, 2brc, 2buy, 2bw, 2by, 2ch, 2cee, 2ceg, 2cep, 2cft, 2cg, 2chk, 2cj, 2cjx, 2cpd, 2cqz, 2cty, 2cub, 2cvf, 2cvj, 2cy, 2drs, 2eb, 2fk, 2gk, 2gl, 2ke, 2ku, 2kx, 2mu, 2nn, 2rd, 2rk, 2tp, 2tsw, 2wi, 2zb, 3ab, 3ad, 3adb, 3adw, 3afu, 3ahp, 3aih, 3aoj, 3apv, 3ash, 3awj, 3bei, 3bfg, 3bg, 3bta, 3bur, 3buy, 3ca, 3cb, 3cbl, 3cdq, 3cf, 3ch, 3chg, 3hg. 3hh, 3in, 3ju, 3jw, 3kq, 3ly, 3ms, 3mu, 3ou, 3sf, 3tf, 3wb, 3xv, 4ak, 4as, 4bq, 4cp, 4cr, 4do, 4eq, 4fg, 4fs, 4fz, 4jr, 4ku, 4qf, 4sa, 4sb, 4tw, 4uk, 5aiy, 5arj, 5bg, 5ck, 5lh, 5sd, 5uk, 6 bm, 8abg. 8adg, 8aic, 8aox, 8apa, 8apr, 8avl, 8avd, 8bii, 8ben, 8bky, 8bt, 8buk, 8cbp, 8cdt, 8ced, 8cyi, 8dgp, 8dmp, 8doh, 8doo, 8er, 8gz, 8jj, 8kc, 8lv, 8pk, 8pl, 8vq, 9aar, 9al, 9arr, 9bht, 9bhx, 9bjg, 9bk, 9cap, 9coc, 9dqm, 9ell, 9uc, 9zt.

CANADIAN—1ar, 1dq, 3ao, 3xi, 4pu, 9bj.

MEXICAN—hx. 9b, 1x.

(Other Calls Between December, 1924, and February, 1925.)

AMERICAN—1aac, 1aaj, 1aar, 1aav, 1aay, 1aba, 1abf, 1ad, 1adr, 1af, 1agc, 1ah, 1ahc, 1aid, 1air, 1aja, 1ajj, 1alk, 1am, 1apk, 1ar, 1arv, 1asu, 1at, 1aur, 1avf, 1aw, 1ax, 1axa, 1axn, 1bau, 1bbe, 1bcr, 1bcu, 1bdh, 1bop, 1bdx, 1bet, 1bes, 1bgo, 1bgq, 1bgt, 1bgy, 1bhm, 1bhw, 1biq, 1bjo, 1bkq, 1bky, 1blx, 1boo, 1bpb, 1bqq, 1bst, 1bv, 1bvl, 1bwj, 1bux, 1by, 1cbp, 1cg, 1cgi, 1cmp, 1cr, 1cri, 1dd, 1ef, 1er, 1fj, 1fn, 1gs, 1gv, 1hb, 1hn, 1kc, 1kx, 1kyw, 1lw, 1mkj, 1ml, 1my, 1nc, 1nlw, 1ou, 1pc, 1qk, 1rd, 1rhk, 1cf, 1sk, 1sw, 1tsw, 1vc, 1xak, 1xam, 1xm, 1xu, 1xv, 1xw, 1xwa, 1yd, 1zad, 1zq, 1zt, 2aay, 2abt, 2adm, 2adu, 2agb, 2agq, 2agw, 2agy, 2am, 2anm, 2apc, 2ars, 2arw, 2at, 2auu, 2avu, 2awv, 2aww, 2ax, 2axf, 2axj, 2be, 2bek, 2bgi, 2bgo, 2bhk, 2bi, 2big, 2bhm, 2bm, 2bnu, 2bqb, 2bqg, 2bqm, 2bqy, 2brb, 2brc, 2bsc, 2bu, 2buy, 2by, 2cak, 2cee, 2chk, 2cji, 2ck, 2cla, 2cot, 2cpk, 2cqo, 2cqu, 2cse, 2cty, 2cub, 2cuk, 2cxy, 2cyw, 2dd, 2eb, 2gc, 2kgb, 2kz, 2lc, 2le, 2mc, 2mk, 2mu, 2pd, 2ry, 2wy, 3aa, 3aau, 3abj, 3ach, 3adq, 3aew, 3agq, 3aha, 3aih, 3ajd, 3alq, 3alx, 3bco, 3bdo, 3bg, 3bgu, 3bgc, 3bh, 3bjg, 3bjp, 3blp, 3bnu, 3bop, 3bp, 3bu, 3bwt, 3cbl, 3cc, 3ccs, 3cdg, 3chc, 3chg, 3chh, 3chp, 3cjn, 3ck, 3ckj, 3dyk, 3ehz, 3fs, 3hh, 3hj, 3is, 3mb, 3mf, 3mk, 3ot, 3qo, 3sf, 3te, 3xp, 3xv, 3zv, 3zw, 4by, 4cs, 4fs, 4gw, 4hw, 4io, 4je, 4jr, 4js, 4ke, 4ku, 4ls, 4qf, 4si, 4tj, 4to, 4tu, 4xe, 5ah, 5aex, 5agl, 5bg, 5cx, 5fz, 5hl, 5lh, 8ack, 8ado, 8adg, 8ago, 8ahi, 8ahm, 8alo, 8atp, 8atz, 8avl, 8ay, 8bal, 8bau, 8bch, 8bfk, 8bgg, 8bhg, 8bk, 8bkh, 8bnh, 8boh, 8by, 8ck, 8cko, 8coi, 8cuk, 8cw, 8cyk, 8dgv, 8ekc, 8fm, 8gz, 8hv, 8jq, 8kc, 8pl, 8rg, 8ta, 8tk, 8tr, 8tt, 8uuu, 8wu, 8zc, 8ze, 8zy, 8zz, 9amj, 9baq, 9bcn 9bf, 9bkc, 9bmw, 9bna, 9bqe, 9cap, 9cbz, 9cvo, 9dbf, 9dfq, 9dji, 9dlw, 9dmj, 9dmn, 9dqn, 9dqv, 9dy, 9ep, 9epc, 9gb, 9ly, 9wv, 9zt.

AMAZON*
ntv, nkf, ivpl, wgh, yjs.*

CANADIAN—1af, 1ar, 1ax, 1az, 1dd, 1dq, 1dy, 1ef. 2bn, 2bv, 3ad, 3xi, 4pu, 9bj.

ANTIPODES—a2ds, a3bd, a3bq, nz4ar.

Unknown QRA. CP2HV. (Hrd on Dec. 28.)

If our call is HR. OM, pse snd me a crd. Wl QSL, QRH, QSB, QSL, QRK, etc.

8LV—HOWARD MacGUIRE, 4222 ALLENDALE AVENUE, DETROIT, MICH.

(None Listed Under 2,000 Miles.)

U. S.—6abh, 6ac, 6afg, 6agk, 6ahy, 6ajh, 6akw, 6alw, 6apw, 6ask, 6asv, 6ban, 6bir, 6bjj, 6bka, 6bmm, 6bpt, 6bql, 6bur, 6ccy, 6cdn, 6cgc, 6chl. 6cix, 6cnl, 6cmu, 6cso, 6css, 6cto, 6eb, 6ew, 6gi, 6ie, 6im, 6of, 6pl, 6uc, 6ut, 6vc, 6vk, 6xa, 6xby, 6xi, 6zh, 7ahi, 7aij, 7ajv, 7dd, 7df, 7dj, 7fq, 7gh, 7ij, 7jx, 7jy, 7lh, 7mx, 7qd, 7ub, 7um, 7zq, 7zt.

CANADIAN—4eo, 4fn, 4io, 5ef, 5go.

PORTO RICO—4sa.

BRITISH—1aa.

NETHERLANDS—2lc.

SPECIAL S.J.—(QRA?)

I would appreciate cards from any of the above.

I. GOLDSBOROUGH, SHAFTESBURY HOUSE

Received at Fethard Co. Tp., Irish Free State. (February 14 and 15.)

1ary, 1bcc, 1bwx, 1fn, 1hn, 1pl, 1sw, 1vc, 2bgi, 2bqb, 2bw, 2cep, 2cub, 2cvj, 2cxy, 3chk, 3mf, 3jo, 3wn, 8bit.

QSL QRA pse.

JOHN H. DIXON, APIA, SAMOA

Whb, wbap, wqj, wóc, kfon, wjjd, wsai, woi, cfcn, itlx, wgn, webh, wdaf, ckac, kdyv, kgu, kpo, kgo, khj, kwy, woai, kfi, knx, kfsg, kgw, wcal, kfkx.

73s to all.

The two outstanding parts in radio!

Give low losses and amplification without distortion to any set

QUALITY and distance are what a radio set must give. To insure Quality, amplification without distortion is essential. And to insure Distance, low losses are essential. That is radio in a nutshell.

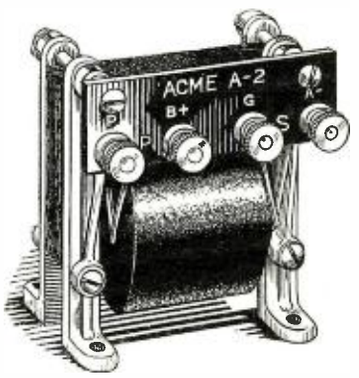
People in whose sets Acme Transformers are used, are sure of hearing concerts "loud and clear" so a whole roomful of people can enjoy them.

The Acme A-2 Audio Amplifying Transformer is the part that gives quality. It is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, super-heterodyne, regenerative or reflex the addition of the Acme A-2 will make it better.

To get the thrill of hearing distant stations loud and clear, your set must have low losses, for it is low losses that give sharp tuning to cut through the locals, and it is low losses that allow the little energy in your antenna to come to the amplifier undiminished. That's what the Acme condenser will do for any set. And it will do it for years because the ends can't warp, the bearings can't stick and the dust can't get in and drive up the losses several hundred per cent.

The Acme Reflex (trade mark) owes its success and its continued popularity to these two outstanding parts in the radio industry, for low losses and amplification go hand in hand.

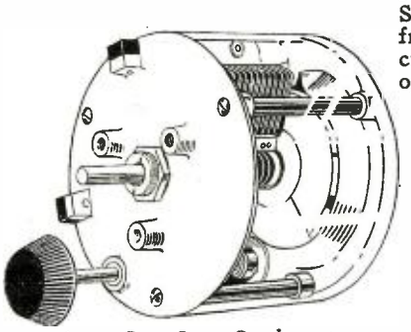
Use these two parts in the set you build. Insist on them in the set you buy.



Acme A-2 Audio Frequency Amplifying Transformer

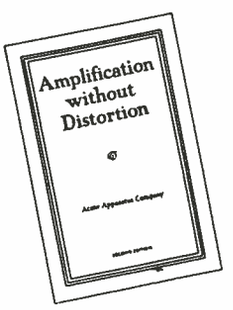
Send 10 cents for 40-page book, "Amplification without Distortion"

We have prepared a 40-page book called "Amplification without Distortion." It contains 19 valuable wiring diagrams. In clear non-technical language it discusses such subjects as, Radio Essentials and Set-building; How to make a loop; Audio frequency amplifying apparatus and circuits; Instructions for constructing and operating Reflex amplifiers; How to operate Reflex receivers; Antenna tuning circuits for Reflex sets; "D" Coil added to Acme four tube reflex; "D" coil tuned R. F. and Reflex diagrams; and several more besides. It will help you build a set or make your present set better. Send us 10 cents with coupon below and we will mail you a copy at once.



Acme Low-Loss Condenser

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. K-3, Cambridge, Mass.



SEND THIS COUPON

ACME APPARATUS COMPANY,
Dept. K-3, Cambridge, Mass.
Gentlemen:
I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book, "Amplification Without Distortion."

Name .....
Street .....
City ..... *State* .....

ACME ~for amplification

Don't Believe It!

(*Continued from page 2047*)

sets scattered along the right of way of the world's railroads will once and for all settle the problem of wrecks. And a lot of people believe it. Who could doubt the efficiency of the scheme when they see two toy trains headed toward each other at full tilt and then see them stop abruptly when they pass a couple of wires attached to a small radio set?

Then, after the demonstration, the onlookers are invited to get in on the ground floor. This company also owns the complete and total rights to the use for manufacture and sale of a Radio Railroad Block Control.

And the funny part of the whole business is that the thing might work—that is, if any company wished to install a 500-watt transmitter (about the size of the larger broadcast stations) every couple of miles along their right of way, and if the present block system were not much more efficient, simple and less costly to install and operate. But, then, it's science and it's new and the salesmen know their stuff, so to speak.

But the most effective field of all in which these mountebanks hold forth is the healing of ills. It is human nature, of course, to be more affected by bodily pain than any other situation. They desire health, when they do not have it, more than they desire wealth or anything else.

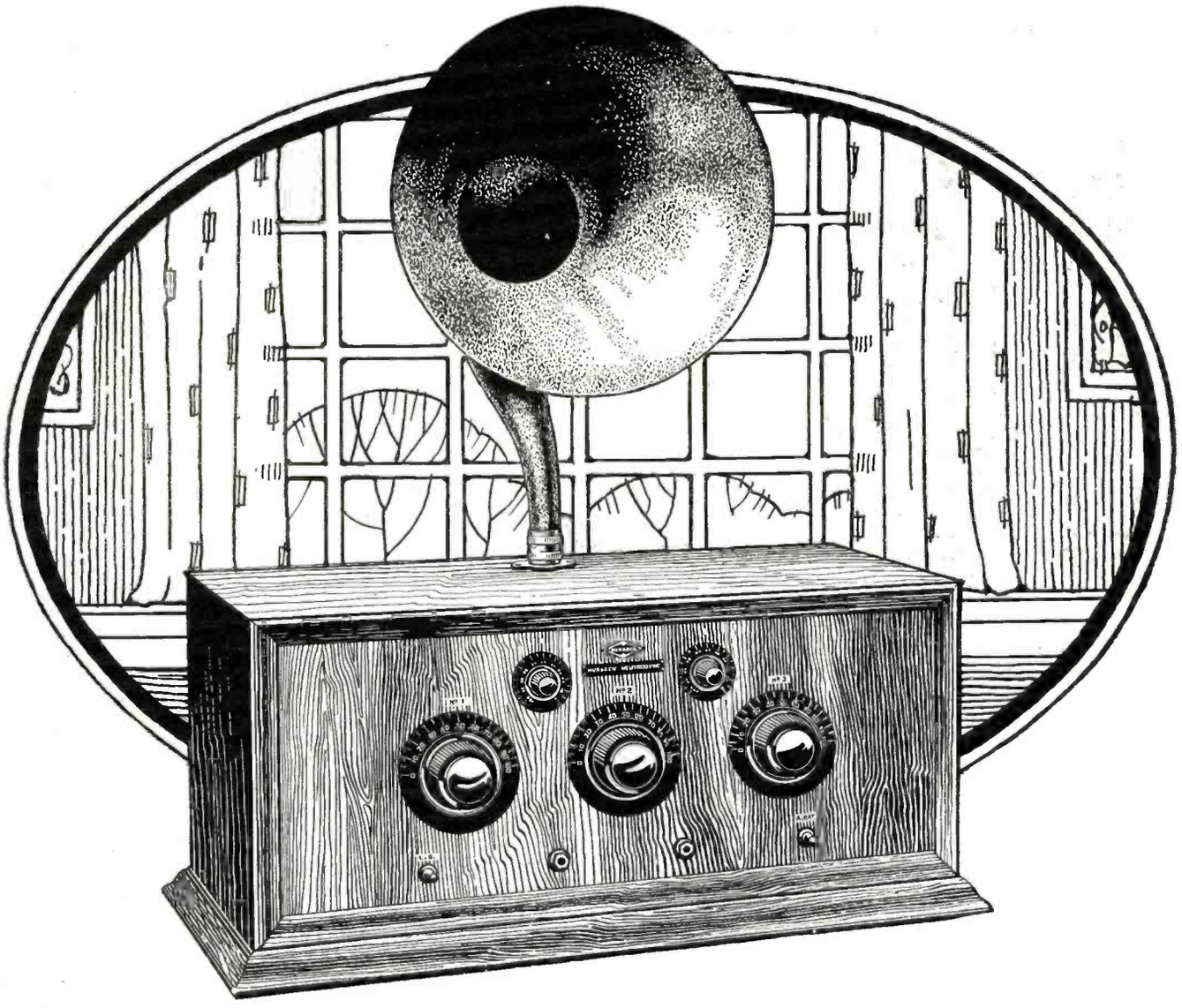
So, when an individual has suffered for years with some malady which the regularly constituted physicians fail to cure or pronounce as a chronic condition, they become easy prey to quacks with some new device for which wonders are claimed.

A recent illustration of this is the far-famed Neurophonometer, which was claimed to be indeed the eighth wonder of the world. RADIO NEWS offered a large prize, $1,000, the writer believes, for proof that the device would function as advertised, *i. e.*, that it was really a *bona fide* medical discovery. At the last notice, the apparatus had not been offered for test in order to claim the reward posted.

Being advertised only—the machines were not sold promiscuously—it has been impossible, so far, to obtain an actual hook-up and plan of the set. But from what the writer considers reliable sources, he has learned that the device is nothing more nor less than a single-tube regenerative set with an adaptation which changes the current reading in the plate circuit. An electrode is attached for going over the patient's body, presumably—according to the advertisement—for measuring the resistance of the nerve. A very efficient meter is installed in the face of the cabinet which changes its readings according to the position of the electrode on the patient's body. The multiplicity of controls helps to awe the person treated and to lead him to believe that he is obtaining real worth for his money.

Any engineer immediately guffaws when shown the thing. But, then, the engineer has technical knowledge and knows what he is about in the engineering field. None of the sharpers attempt to sell such stuff to men who know. It is the fellow who has no knowledge, but hopes—oh, how he hopes—to be cured and is willing, therefore, to spend his savings and put his watch in hock for the necessary money to try every new thing which puts in an appearance.

Now and then there is an altogether different plan pursued. And here is where the technical man is handed a gratuitous laugh which, at the same time, is harmless. One such instance came to light recently when



Hear the Murdock Neutrodyne

SEE the beauty of its cabinet. Hear its pure, sweet tone. Notice how easy it is to operate. Compare these things with any other hundred dollars' worth in radio. It is the Murdock Five Tube Neutrodyne. There is space in the cabinet for the "B" Batteries. The only accessories necessary are batteries and tubes. A "Murdock" set is backed by twenty years of successful experience in making radio apparatus.

$100
with built-in Loudspeaker

$92.50
without

WM. J. MURDOCK COMPANY
Dept. A3, Washington Ave., Chelsea, Mass.

Branch Offices: New York, Washington, Chicago, Los Angeles, San Francisco, Seattle

RADIO MURDOCK

MURDOCK RADIO PRODUCTS

Licensed by Independent Radio Manufacturers, Inc. Reg. U.S. Pat. Off. NEUTRODYNE Pat. March 27 1923 and April 1, 1924. Hazeltine Pats. Nos. 1,450,080 and 1,489,228. Other Patents Pending. Reg. U.S. Pat. Off.

Standard since 1904

the writer received in his mail a circular from the M—— Radio Research Laboratory.

There are theories in this prospectus, set forth in the most scientific terms, which are, to say the least, surprising.

It is claimed that hypnotism may be perpetrated by radio. But this is only the beginning. From this point, the gentleman proves, seemingly, that the "Powers of Evil" have set up great broadcast stations in all parts of the world, from which they send out hypnotic waves directed against the great leaders who are factors for law and order and civilization.

He goes into all sorts of technical explanations as to how the waves are generated and transmitted. He even publishes an "experiment"—which uses a special tube—carried on in a copper-lined room, in which these thought waves are detected and their effects noted.

Sandwiched in all this he gives his own theory as to the laws of gravitation and maintains stoutly that the earth and other planets are held to the sun by some sort of "waves."

Then he tells how one may make a success of life by cultivating certain powers for the detection of "thought waves," which seem to hold something in common with radio waves. The connection, to the engineering mind, is rather sketchy. He maintains that all life is made possible through waves and that every living thing gives them off. He has a method for detecting these waves, making it possible for every man to have the infinite omnipresence of God. Quite a little system, no?

Then, as usual, at the end of the pamphlet—profusely illustrated—there is the usual plea for help. It seems the director of the laboratory, whose views are set out in the text, needs money, lots of it, to continue his work as savior of civilization and law and order. And every now and then he gets the money.

The best laugh of it all is that he claims to have learned of a revolution which is to take place this year—engineered by the "Powers of Evil" of course—and which he needs money to combat. Since he is about the only man holding the secret to the method of fighting this terrible power, all contributions must be sent to him. They will be gratefully received.

The writer recently came across a religion based along the same lines. It, too, is seeking the financial aid of converts. The founder of this cult has found a book on radiation and waves in the Public Library and has, evidently, attempted to digest it. But the result seems to be the outcome of his dreams more than his scientific researches. There are some undiscovered octaves, as all scientists know, in the vibrations known to man, and this worthy has found them, he claims. And they, too, do great things like giving one power over his fellow-man, etc.

These are just a few of the more obvious and well-known schemes to separate the well-known public from their money through the cloak of science.

The stock method is, to the shame of the nation, more or less well known. Some company without a backing or established reputation goes into the field with a lot of promises and little tangible assets and gets all sorts of money. This is a field for an investigation in itself. It is principally financial and is in the province of the attorney rather than the engineer.

A good point for all to follow when confronted with such schemes is to get into immediate communication with some reputable authority and obtain the best possible advice. To the uninitiated it is extremely hard to tell the difference between the good and the bad. And sometimes there is a

CIR-KIT

More Power per Tube brings Greater Radio Most Economically

SEE ERLA RECEIVERS

Inherent Erla advantages in power, tone and selectivity are now available in beauteous complete Erla receivers. Retail prices range from $67.50 to $225. Both price and performance place Erla receivers among the sensations of radio history.

Triple power is the basis of Erla Supereflex records. Tubes, as used in Supereflex, simultaneously amplify received radio frequency currents, reflexed radio and reflexed audio frequency currents. So 1-tube Supereflex rivals the power of conventional 3-tube circuits. And 3-tube Supereflex readily outclasses the ordinary five!

Only such power can give you the thrill of Supereflex distance and volume; always with Erla crystal-pure tone—and with uncanny selectivity that gets what you want when you want it.

This finer radio is brought within the reach of all by Erla Supereflex CIR-KIT, the factory-sealed carton of genuine Erla apparatus for building Supereflex yourself. Anyone can follow the CIR-KIT assembly plan perfectly, using only screwdriver and pliers, without drilling or soldering.

Pride of workmanship, extreme economy, priceless radio performance, are yours in Erla Supereflex CIR-KIT. Select your model at the Erla store. 1 to 5 tubes, antenna and loop types.

Electrical Research Laboratories
Department C, 2500 Cottage Grove Avenue, Chicago

ERLA

chance for improvement through the use of some new scientific machine. It was only six months ago when a professor at Columbia University perfected a new type of Röentgen ray tube, which proved to be five times as effective in treating cancerous growths as those which were in use previously. It was soon put into operation in the chief hospitals of the country and proved exceedingly efficient. It is obvious in this case that the patient had everything to gain by submitting to such treatment, but if he had had an experience with the short wave oscillator which was good for creating radio interference but worse than useless as a treatment for cancer, he would undoubtedly question its efficacy to his ill.

Here is the making of a good dilemma. The patient who knows nothing of the technique involved does not know which is good and which is charlatinism. Obviously, the solution, for those interested, is to keep up with the times by reading the pertinent periodicals or, if that is impossible, by writing to some authority who is conversant with the facts.

The whole point is: Don't believe it unless you get unbiased and expert judgment on the claims made by those financially interested in it. There are any number of magazines and periodicals which will be more than willing to help you in this regard and for little or no expense. And the necessary trouble in asking them may be repaid a thousand times in the actual saving of time and money.

Thus far in radio practice and design we have had many kinds of "plexes" and "dynes," but we have never had, and may never have, an "anodyne."

KFI, Super-Power Station of the West

(*Continued from page* 2064)

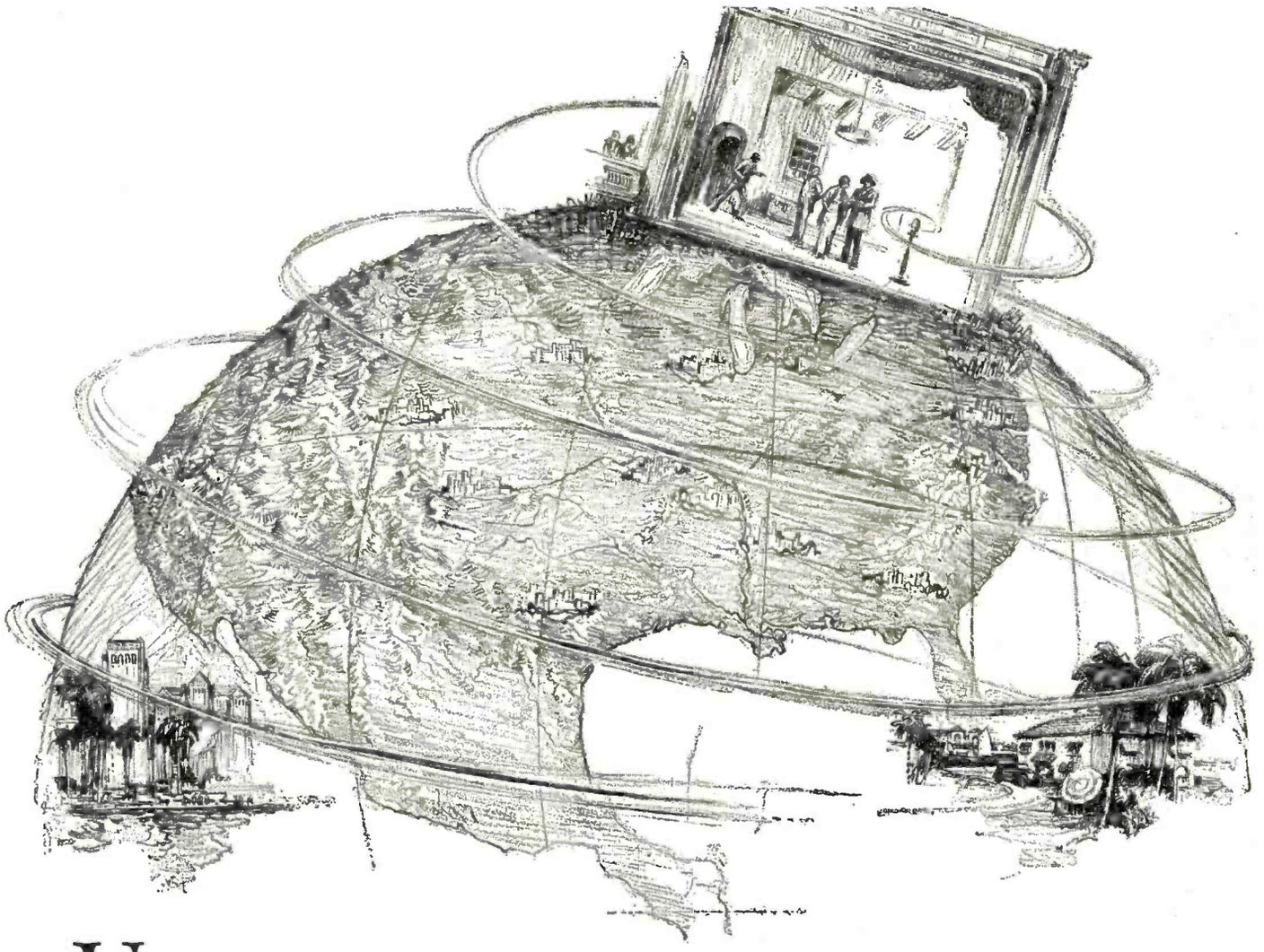
three additional rooms have been built. To care for the radio personnel a suite of offices have been constructed adjoining the new reception room and photographic studio. In all, seven new rooms have been added to the radio division.

THE APPARATUS

The present transmission panel of the 500-watt set occupies 30 square inches of floor space, is five feet in height, and is located in the control room. The dimensions of the new 5,000-watt transmission panel, which fills a separate room, are 16 feet long. seven feet high and nine feet deep. A wire cage is erected about it. The power, which is furnished by a commercial power circuit, is changed from A.C. to D.C. by large water-cooled rectifier tubes, the voltage being increased by a special step-up transformer.

The water cooling is a unique feature, as any great variation in temperature would interfere seriously with proper transmission. A certain flow is attained and held by means of an electrically driven circulating pump. A thermostatic control governs the flow of water around the tubes, and the temperature and cubic inches of water-flow are registered on two dials set in the panel. The compensation of the cooling system to meet an increased temperature is automatic, and should the temperature increase beyond a given safety point, the current will be automatically shut off to save any possible damage to the set. The speech input equipment and the incoming telephone lines from distant KFI studios are located in the control room.

One motor generator and one spare take care of the needs of the present set, but three generators and three spares are installed in the new generator room. Between this room and the transmitter room is built into the



Unseen actors

that thrill an audience of *millions*

OUT upon the still night come the sounds of a desperate struggle. Heavy blows splinter a door—there's a crash. A shot is fired—a woman screams!

And millions of radio listeners thrill as delightful gooseflesh creeps up their backs. For it is not real bloodshed but WGY, the General Electric Company's broadcasting station at Schenectady, N. Y., giving a radio drama. On a single evening WGY has been heard and reported from every state in the Union, Hawaii, Canada, South America, and England.

In the broadcasting of this famous station, Exide Batteries are employed. All batteries in the equipment are Exides. A great many of the most important government and commercial radio plants use Exide Batteries.

They were selected for the navy airship Shenandoah and the great liner Leviathan. Exides went to the Arctic with MacMillan and helped the American airmen circle the globe.

Exide 6-volt "A" battery in one-piece case

There are also Exide "A" batteries for 2-volt and 4-volt tubes and "B" batteries, 24 and 48 volt, of 6000 milliampere hour capacity. The Exide line includes a most economical "B" battery Rectifier.

When you tune in

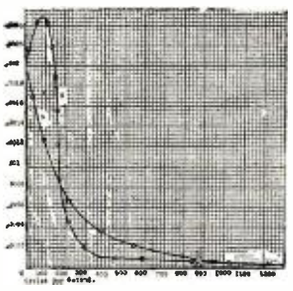
There is a complete line of Exide Radio Batteries made for home receiving sets. They give uniform current through a long period of discharge and assure you the clearest reception. You will find them not only a great satisfaction, but a genuine economy.

You can get Exide Radio Batteries at every Exide Service Station and at radio dealers. There is a type for every tube and a size for every set.

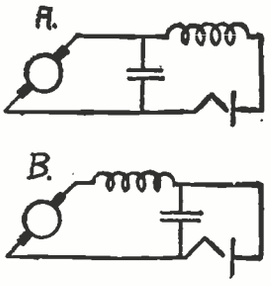
THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

In Canada, Exide Batteries of Canada, Limited
153 Dufferin Street, Toronto

Exide
RADIO BATTERIES
FOR BETTER RADIO RECEPTION USE STORAGE BATTERIES



No 5 of a series of 10 "FILTER FACTS" follow them thru monthly



In a circuit containing constant values of inductance and capacity in series the distribution of the voltage across the various elements will be dependent upon the impressed frequency i. e. in B for a constant ripple voltage the voltage across the condenser will vary for various frequencies. The ripple voltage across the condenser is the ripple voltage across the tube. For high impedance loads across the condenser, such as a tube, this voltage rises to several times the value of the initial voltage. The peak of this rise is reached at a frequency slightly less than resonance. With increased frequency beyond resonance this voltage decreases rapidly soon becoming but a small fraction of the impressed voltage. The amplitude of the fluctuation of the current thru the plate circuit will vary with this voltage. Curve "B" shows the value of this current with the very excessive ripple voltage of 10 volts, a choke of approximately 10 henries and a one microfarad condenser, used with a "5 watter".

Fig. A shows the "cart before the horse" i. e., the voltage across the condenser will be full ripple voltage. The voltage across the plate will vary only as the impedance of the coil in series with it varies. This our curves tend to show is a better filter at frequencies below resonance than "B" but not as good above resonance. "B" seems to be the most practical of the two. Roughly speaking it will magnify frequencies below resonance and greatly decrease those above. This means that its effectiveness depends upon designing it with as low a resonant frequency as possible, i. e., both inductance and capacity as large as possible.

These curves are plotted to an exaggerated scale. The maximum value is .0024 amperes and the minimum .0000025 amperes.

ELECTRIC SPECIALTY COMPANY
TRADE "ESCO" MARK
211 South Street Stamford, Conn., U. S. A.
ESCO POWER BEHIND YOUR TUBES MEANS MAXIMUM MILES PER WATT

wall a white marble switchboard, approximately five feet by six feet, which controls the motor generators, electric lights, signs on the towers and transformers for the rectifier tubes. A plate glass partition in the wall is a feature of the transmission room so that the general public may see the set in operation. This partition is 10 feet long and six feet high. All metal structure, such as beams, lath and conduits, have been bonded together by brazing to prevent any absorption of radio frequencies back into the building. A new ventilation system is in process of installation that will insure a constant circulation of fresh air throughout the studio and reception room. The ceilings are false, or drop ceilings, and the space between the roof and the lower ceiling is converted into channels for the incoming air currents.

"Distance transmission is, after all, only a stunt," said Earle C. Anthony recently, "and, although important as a method of extending the scope of broadcasting, it is not as important as perfecting the quality of local transmission. And when I say local, I do not mean merely the surrounding hundred miles or so, but the Southwestern part of the United States. I look to the time in the near future when every State in the Union will be 'local' for KFI. We have installed the finest equipment procurable and will continue our policy of being in the forefront of radio broadcasters. The new KFI radio central super-station is as perfect as radio engineering can make it, but we mean to advance with any new departures, so as to insure our constantly growing audience the very finest reception.

"The development of radio is not yet brought to a close, although the Western Electric Company's latest development, a 5,000-watt transmitting set, would seem to allow little room for improvement.

"The new set handles a much wider band of frequencies or, in untechnical language, higher and lower tones, and their finer graduation may be picked up by the public. The vast reservoir of power will allow not only a greater range of audibility, but will insure better quality during all times. Heretofore, during the day and especially during the summer months, atmospheric conditions, heat and static have caused such interference that broadcasting has not proved itself entirely satisfactory, except under the most favorable conditions. With KFI's new equipment, perfect reception at all times is foreseen. The public at large is assured of the best programs given under ideal conditions and, although no particular stress is being laid on distance transmission, the radio public in the Far East will hear KFI more easily than before."

The Most Novel Super-Heterodyne

(*Continued from page* 2077)

side can only be accomplished by continued changes, and cut-and-try methods.

Zincite as a crystal is subject to widely fluctuating conditions. One piece will respond without any battery excitation at all. Another will be sluggish until it is jolted by a short circuiting across an "A" battery. Some will have to be baked in an oven and the blackish impurities scraped off, such as zinc sulphide. Zincite itself is ZnO, or zinc oxide, an orange-red colored mineral in a granular form, sometimes showing layers and strata.

Thus far there has been no time for obtaining reception results with this novel Super-Heterodyne receiver. All of the time available in the laboratory of the writer has been spent in getting together the necessary parts, testing them out, and making up a

good, feasible diagram which will stand up under both theory and actual test.

The theory of the Super-Heterodyne, as we know it today, supports this effort to produce a new, *radiationless* Super-Heterodyne which will not only *work*, but also which will *work under standard conditions!*

There are now too many controls, too many separate batteries, and a lot of needless parts in the diagram of this new type of receiver. It will require a considerable amount of time and effort to weed out the "bugs" in this circuit, but we hope to be able to show photographs and improved diagram and circuit constant data in a near future issue of RADIO NEWS. If we are successful in making this circuit work, we will publish the details of the distances covered, the types and values of the equipment used—and will show a simplified hook-up which will enable every home builder of a radio set to try his hand at this type of Super-Heterodyne receiver.

This may be the first step toward the elimination of the vacuum tube as a radio standard. The vacuum tube itself is not a perfect piece of equipment and it is subject to improvements and changes for the better, as the radio art progresses. The lowly crystal and the long-forgotten electrolytic detector may yet enjoy a renaissance which, when it comes, will greatly reduce the cost of radio to the average fan.

Some Effects of Resistance in Radio Circuits

(*Continued from page* 2081)

There is an interesting lesson to learn from this discussion, as it will illustrate that although, theoretically, certain benefits may arise from doing certain things, practically and economically it does not pay to do them. For instance, it will be shown in connection with Fig. 6 that whether the leakage path in a condenser is a quarter of an inch longer or shorter will not make any appreciable difference in its operation, despite the fact that many designers of condensers have wracked their brains trying to devise ingenious methods of mounting the plates in the condensers.

Fig. 6 shows a condenser which is supposed to have no series resistance, but has a leakage path for the current across its terminals. This is represented by r in the diagram. If this circuit be analyzed by the ordinary circuital laws of A.C. circuits, it will be found that the apparent resistance and capacity of the leaky condenser (across its terminals) are given by the formulae:

$$R^1 = \frac{r}{1 + 0.0000\ 39 r^2 f^2 C^2} \quad (4)$$

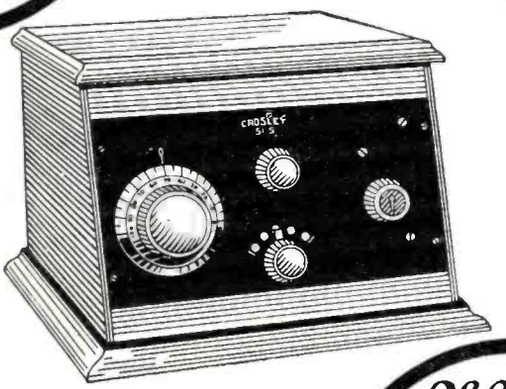
$$C^1 = C + \frac{1}{39.48\ f^2 r^2 C} \quad (5)$$

in which r is the resistance of the leakage path in ohms, f is the frequency in kilocycles, C, the capacity in microfarads, R^1, the apparent resistance in ohms, and C^1, the apparent capacity in microfarads.

If we assume a certain condenser having a capacity of 0.001 microfarad, and assume also that its insulation is so poor as to offer to the current a leakage path of only 1 megohm (1,000,000 ohms), the apparent resistance of the condenser would be only 0.025 ohm at 1,000 kilocycles (300 meters) and its apparent capacity would differ from its true capacity by only 0.000025 micromicrofarad. It is ridiculous to suppose that even a poorly constructed condenser could have as low a leakage resistance as 1 megohm in fact, it may run into hundreds of megohms. Besides this, what difference would the

THE NEW CROSLEY 51-SPECIAL

$23.50



Of Course the Famous Crosley 51 Regular at **$18.50** *Will be Continued*

Here is the popular Crosley 51 dressed up in new clothes. It is known as the Crosley 51-Special. This two tube, genuine Armstrong regenerative receiver is exactly the same as the nationally known Crosley 51, except it is installed in a larger cabinet in which there is room for dry cell batteries. Also there is the slanting panel, a feature that adds to the appearance of the set and makes operation more comfortable. This radio is as artistic as it is efficient, appealing to the housewife who demands beautiful appearance and elimination of visible batteries. All Crosley radios are licensed under Armstrong Regenerative U. S. Pat. 1,113,149. Other models priced from one tube 50, at $14.50 to the Trirdyn Special with sloping panel, at $65. For sale by good dealers everywhere. Write for catalog.

Prices quoted without accessories. West of Rockies add 10%.

THE CROSLEY RADIO CORPORATION

Powel Crosley, Jr., President

522 Sassafras St. Cincinnati, Ohio

Crosley owns and operates Broadcasting Station WLW

0.000025 mmf. make to anybody? The point is that the leakage path has not much to do with the efficiency of the condenser, provided its resistance is not too low.

SHUNT RESISTANCE OF CONDENSERS

In the above discussion we have neglected the series resistance in the condenser. The plates of the condenser have resistance, and there may also be resistance at points of contact, soldered joints, etc., inside the condenser. Fig. 7 represents the equivalent state of affairs in which the internal resistance of the condenser is represented by R and the leakage path by r. The formulae for this case are rather complicated, but they can be simplified if we assume that the series resistance is small compared with the leakage resistance. The relation then becomes

$$R^1 = R + \frac{1}{0.0000\ f^2C^2r} \qquad (6)$$

If we now assume the same 0.001 microfarad condenser, operating at 1,000 kilocycles, increases the apparent resistance of the condenser by only 0.01 (one hundredth) of an ohm, the leak resistance, r, would have to be as low as 2.5 megohms. The apparent capacity is not affected appreciably.

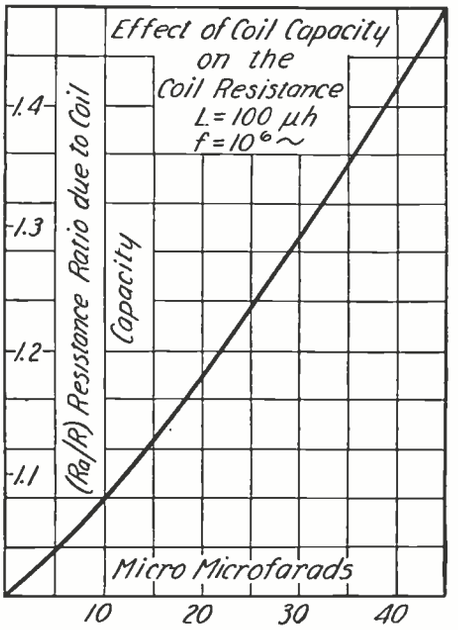


FIG. 5-A

Curve showing how small the effect of coil capacity on the resistance of single layer coils is, even for abnormally high capacities.

To further emphasize this fact, formula No. 6 has been plotted, as shown in Fig. 8. The apparent resistance of the condenser remains practically unchanged for leak resistances greater than about 3 megohms, but even for leak resistances as low as 1 megohm, the apparent resistance does not change more than about 0.02 of an ohm. This is very small compared with the series resistances of condensers which are in the neighborhood of 1 ohm, so that it seems that more would be gained by directing the attention of designers toward reducing the series resistance than by concentrating their efforts toward reducing the leakage currents.

LOSSES IN COILS

We will next consider a coil which has both resistance in its wire and resistance which is equivalent to faulty or leaky insulation. This is a case in which R, the resistance of the wire, is in series with the inductance, L, of the coil, and the pair shunted by the leakage path, r.

The condition represented by this circuit is a very common one in ordinary radio practice and is one of the causes of the relatively high resistance of the coils used in so

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Zenith—

the exclusive choice of MacMillan for his North Polar Expedition

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This message brings to radio enthusiasts the announcement of an ***advance in Zenith prices*** on all models. The new prices are shown in the panel at the right.

Radio sets—like motor cars and pianos—gravitate to their correct price level. There is more to a radio receiving set than merely a beautiful cabinet backed by extravagant claims. It must meet exacting requirements. The novelty has worn off. The public is becoming educated. It knows what to expect and can now distinguish merit in radio.

An imposing name and an intensive advertising campaign—when they back a radio product which does not deliver equally impressive results—soon lose their fictitious values.

By that same token, performance which is literally ***outstanding*** fixes for the makers of that product a standard of supremacy which, in duty to the public, they are obligated to maintain.

Throughout the radio world the name ZENITH has come to be the very symbol of results—in quality of tone, in simplicity, in selectivity, in volume without distortion, and in long-distance reception. The artistry of design for which it stands is too well known for comment.

The fact that ZENITH has ***advanced*** its prices is of more than passing moment. For it registers the determination on the part of the builders of ZENITH to maintain the acknowledged supremacy of ZENITH receiving sets—both in beauty and performance.

All present models are guaranteed against price reduction.

The complete Zenith line ranges in price from $100 to $475.

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. They are NON-RADIATING.

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Zenith 3R - - $175

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—44⅞ inches long. 16¾ inches wide, 10⅝ inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries) $240

SUPER-ZENITH VIII—Same as VII except—console type. Price (exclusive of tubes and batteries) $260

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) $355

SUPER-ZENITH X—Contains 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. Price (exclusive of tubes and batteries) $475

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many hook-ups. The leakage resistance, however, must not be confused with the losses due to the capacity of the coil. Coil capacity is another of these causes which should be reduced as much as possible. But the point that must not be forgotten, and which has been elaborated upon in the writer's article in the January issue of RADIO NEWS is that both the losses due to leakage paths and coil capacity are small as compared with the actual losses in the wire, due to its ordinary resistance, which has been considerably increased by the skin effect. Good engineering practice reduces the more serious causes or losses first, and considers the other refinements afterwards. The mere fact that a coil is wound "on air" or has its turns zig-zagged does not mean that it is a low-loss coil. There are points of more importance to consider, which have been described in the above-mentioned article.

The analysis of the circuit of Fig. 9 results in the following expressions for the apparent resistance and the apparent inductance:

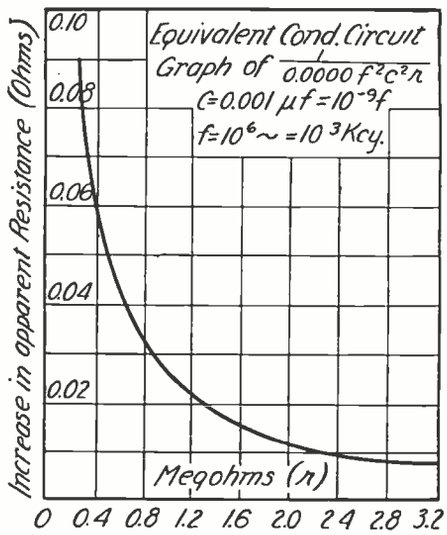


FIG. 8

Showing the change in equivalent resistance of a condenser due to shunt resistance.

$$R^1 = R + \frac{0.000039\ f^2L^2}{r} \qquad (7)$$

$$L^1 = \frac{L}{1 + \frac{0.000039\ f^2L^2}{r}} \qquad (8)$$

in which the symbols have the same meanings as before. It will be remembered that in the case of a leaky condenser considerable reduction of the resistance of the leakage path did not increase the apparent resistance of the condenser appreciably. In fact, for a leakage path as low as 1 megohm, the apparent resistance did not change more than about 0.02 ohm. The leakage path has a greater effect in the case of coils, however, as will be seen from Fig. 10, which has been plotted from Equation 7. A leakage path of 1 megohm in this case causes an increase in the coil resistance of about 0.4 ohm, or nearly half an ohm. This leakage path might easily be furnished by moisture in the insulation of the wire on the coil or dust.

CONCLUSION

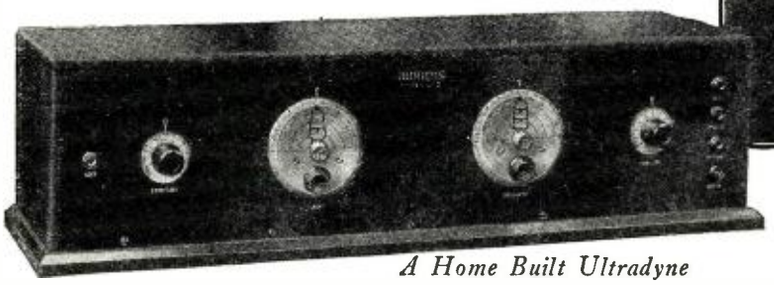
The effect of the leakage path on the inductance of the coil is to lower it. In this particular case of a 1 megohm leakage path, the apparent inductance of the coil will be reduced about 30 per cent. This will make no difference in operation, excepting that more of the tuning condenser will have to be used to tune to a given wave-length.

How to Build The Ultradyne (Model L-2)

by R. E. Lacault, E.E., A.M.I.R.E.
formerly Associate Editor, Radio News

How You Can Build This Remarkable Super-Heterodyne In Your Own Home

R. E. LACAULT
Designer of the Ultradyne Receivers and formerly Associate Editor of Radio News, is now Chief Engineer of the Phenix Radio Corporation.



A Home Built Ultradyne

THE Ultradyne Model L-2 is an improved Super - Heterodyne designed to so simplify its assembly that anyone can successfully build it at nominal cost and enjoy even greater performance than with any other type of Super-Heterodynes.

Every step is explained in an illustrated thirty-two page book, "How to Build and Operate the Model L-2 Ultradyne," in a non-technical way that one knowing nothing of radio finds easy to follow. Thousands have built the Ultradyne Model L-2 from instructions in this book, and thousands like Arthur Bender of 116 East Second Street, Covington, Ky., say it's the most wonderful receiver they have ever known.

The "Modulation System" of radio reception and the successful application of regeneration are vital features incorporated exclusively in the Model L-2 Ultradyne that give it greater sensitivity, greater range on the loud speaker and greater selectivity, than any other Super-Heterodyne. The Ultradyne Model L-2 detects the faintest broadcast signals—signals that other receivers fail to get, regenerates and makes them audible on the loud speaker. The Ultradyne easily tunes out powerful local broadcasting completely and brings in distant stations clearly on the loud speaker. No other Super-Heterodyne can give you such performance.

The Ultradyne Kit furnishes all special parts, required to build the Ultradyne, with these superior Super-Heterodyne features. The kit contains 1 low loss Tuning Coil, 1 low loss Oscillator Coil, 1 special Type A Ultraformer, 3 Type B Ultraformers, 4 matched fixed Condensers. The complete kit can be bought for $30 from any reliable dealer. The Ultraformers are new, improved long wave radio frequency transformers, specially designed for the Ultradyne Model L-2 and are vital to the unusual efficiency of the receiver. To protect the public against imitation, every Ultraformer carries the Lacault monogram seal (R. E. L.) and is guaranted so long as this seal remains unbroken.

The Ultradyne Model L-2 has met with phenomenal success—success built purely on performance alone—its system of radio reception has been the envy of the largest radio manufacturers in the country. Now anyone who uses the Ultradyne Kit and follows instructions can build the Ultradyne Model L-2, the improved Super-Heterodyne, with positive assurance of getting better results than with any other super radio receiver.

ULTRADYNE
MODEL L-2

This trademark (Ultradyne) is a guarantee of perfection and satisfaction in a radio receiver, and applies to all receivers designed and built under the personal supervision of R. E. Lacault.

It would be possible to thus go on forever, analyzing every form of circuit known. It is needless to do this, because all circuits are combinations of these elementary ones which have been described. Thus, the secondary or closed circuit coupled to the antenna or open circuit, and connected to the input of an electron tube, may be considered as a condenser shunted by a leakage path (the grid leak resistance) and the combination connected in series with the inductance and resistance of the tuning coil.

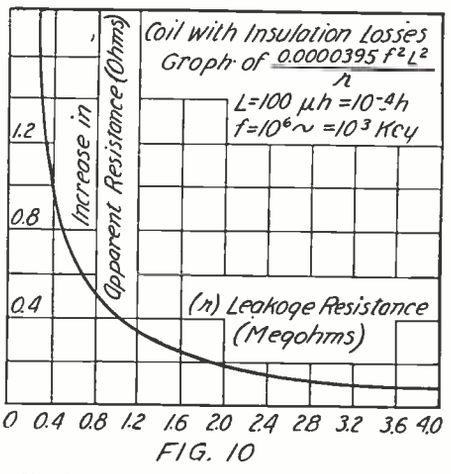


FIG. 10

Showing the change of resistance of a coil due to shunt leakage paths.

A knowledge of these facts is necessary to the designer of radio apparatus and circuits, for as much depends on the proper proportioning of the various pieces of apparatus, as upon the proper use of these.

I Want to Know

(*Continued from page* 2110)

A. 1. You should have no difficulty in constructing a very satisfactory instrument from the circuit shown and the following data.

The latest model of this unit has a push button connected to the grid binding post of the socket and to the "A" battery in such a way that the grid connects directly to negative "A" when the button is normally out. When depressed, the grid is connected dircetly to the rheostat (which is connected in the positive lead of the "A" battery). The rheostat is a special one having three sections of three different resistances. When the switch arm is turned one-third of the way, the resistance is 1.5 ohms; when turned two-thirds of the way, the resistance is 5.5 ohms; when all of the resistance is in circuit, the total resistance is 60 ohms with a carrying capacity of .25 ampere.

The resistance "R" may be wound on a wood spool about ¾ inch long and ½ inch in diameter. For the unit mentioned this spool is wound to a resistance of about 1,000 ohms with a wire having a zero temperature coefficient of resistance, such as manganin, constantan or advance. The model without the grid bias polarity button has a coil wound to only 300 ohms. The value of this resistance lies in its largely preventing burning out of the plate milliameter accidentally.

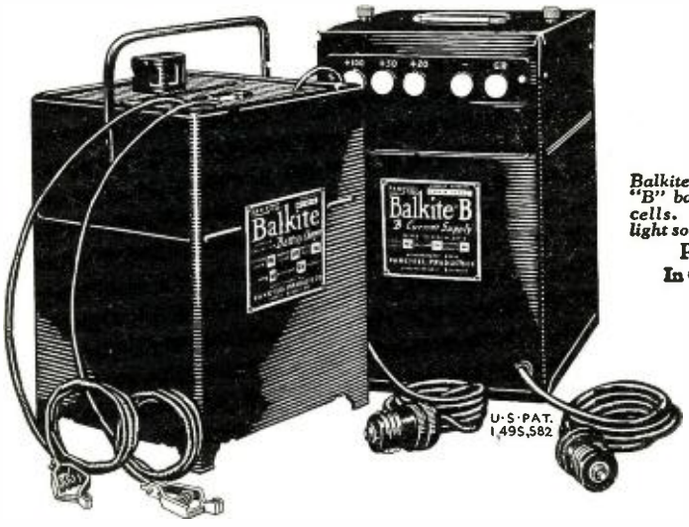
Use a single storage cell or a single dry cell for tubes having a terminal voltage of 1.1 volts, such as the C-11 and WD-11 tubes. Use two cells of a storage battery or three dry cells, in series, for tubes having a terminal voltage of three volts, such as the 399 and UV-199 tubes. Use a regular three-cell storage battery or four dry cells in series when testing tubes having a terminal voltage of five volts such as the C-301A and UV-201A tubes.

The value of a vacuum tube as an amplifier may be said to be, roughly, proportional to the plate current change for a given grid voltage change.

The application of this in the instrument under consideration is given below.

With normal tubes, a definite current will flow in the plate circuit of the tube when the filament is operated at the rated terminal voltage. This direct current will be indicated by the plate milliammeter. Now, reversing the grid polarity should result in a considerable change in the milliammeter reading. The amount of this change will indicate the value of the tube; a relatively large change occurring, if the tube is a very good

Balkite Battery Charger. Charges 6-volt "A" storage batteries.
Price $19.50
West of Rockies, $20
In Canada, $27.50



Balkite "B"—replaces "B" batteries and dry cells. Operates from light socket.
Price $55
In Canada, $75

Balkite Radio Power Units

give your set greater clarity, distance and volume

Your radio set will perform consistently only if your power supply is unfailing. Balkite Radio Power Units provide a convenient power supply that furnishes a constant, uniform voltage to both "A" and "B" circuits. The Balkite Charger keeps your "A" storage battery charged and operating at full efficiency. Balkite "B" replaces both "B" storage batteries and dry cells, and supplies plate current from the light socket.

The Balkite Battery Charger and Balkite "B" are based on the same principle. Both are entirely noiseless in operation, have no moving parts or bulbs, have nothing to adjust, break or get out of order. They do not create disturbances in either your set or your neighbor's, require practically no attention, and can be put in operation at any time by merely connecting to the light socket. Their current consumption is very low. Both are guaranteed to give satisfaction.

Sold by leading radio dealers everywhere

FANSTEEL
Balkite *Radio Power Units*

BALKITE BATTERY CHARGER— BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS COMPANY, *Inc., North Chicago, Ill.*

amplifier. The most important point to observe is the rise in plate current value when the tube grid polarity is made positive by depressing the push button. This ratio, which should be high, is of more importance than the exact values indicated.

Q. 3. What is the resistance range of the Turn-It variable grid leak?

A. 3. Rated approximately from ½ to 5 megohms.

DUCON ANTENNA PLUG

(2114) Mr. Thomas D. Burnett, Riderwood, Md., asks:

Q. 1. What are the capacities of the two fixed condensers used in the Ducon antenna plug, using the lighting circuit as aerial?

A. 1. One condenser is about .0003 mfd. capacity and the other is approximately .003 mfd. capacity.

Q. 2. A push-pull amplifier of the type described on Hook-Up Sheet No. 14 (circuit No. 66) appearing in the December, 1924, issue of RADIO NEWS seems to be connected up exactly as shown in the diagram, but signals are made weaker rather than stronger. What could cause this?

A. 2. This is probably explained by the fact that the "B" battery should have been reversed so that "B" minus connects to the "A" battery instead of "B" plus, as shown.

Q. 3. I have been asked what "R3" means, referring to code signal audibility. Can you advise me of the interpretation?

A. 3. The audibility table from which this is taken is not generally used by United States amateurs, which is to be regretted. The audibility table in regular use overseas is as follows:

CODE SIGNAL AUDIBILITY AT RECEIVING STATION

R1—Almost inaudible.
R2—Perceptible.
R3—Extremely feeble.
R4—Very feeble.
R5—Very weak.
R6—Weak.
R7—Fair.
R8—Loud.
R9—Loud speaker volume.

PHONE AUDIBILITY AND QUALITY

M1—Speech garbled.
M2—"Hashed" speech.
M3—Uneven modulation.
M4—Clear voice.
M5—Very clear, modulation perfect.

SECOND HARMONIC SUPER-HETERODYNE

(2115) Mr. O. Leslie, Argonia, Kansas, asks:

Q. 1. Will you please show the diagram of connections employed in the R. C. A. second harmonic Super-Heterodyne, together with construction data and an explanation of the principle of operation?

A. 1. In Fig. Q-2115-A we are illustrating in a general way the principle involved in the second harmonic Super-Heterodyne. This picture is to be compared with Fig. Q.2115-B.

In the circle A of the picture diagram is a representation of the weak incoming broadcast signal. Circle A-1 represents this same signal made stronger by the amplified action of the first vacuum tube. This tube does nothing but amplify signals. It is reflexed in a manner to be described later.

The amplified plate current of the first tube is transferred by induction to the grid circuit of the second tube. This grid current is shown in circle A-2.

This second tube acts as the first detector and also as the frequency changer.

If you will count the number of cycles represented in A, A-1 and A-2, you will see that there are nine complete cycles.

You will note that in B-1 we have only four cycles. This is the strong fundamental oscillator frequency produced by the second tube, which must act as an oscillator as well as the second detector.

Heterodyning is the next operation to be considered. When one frequency is added to a different frequency the combination of the two produces beats which may be considered as another frequency. This "beat" frequency is the difference in frequency between the first two. For instance, if an audible note of 1,000 cycles is sounded at the same time that an audible note of 400 cycles is sounded, a listener will hear these two and still a third note having a frequency which is the difference between the two, or 600 cycles. This, the production of a third frequency by adding one frequency to another, is "heterodyning." In our example of audio sounds, the third frequency of 600 cycles is called the "beat," or "beat frequency." In a Super-Heterodyne this beat frequency is ordinarily termed the "intermediate frequency."

Our fundamental oscillator frequency B-1, of 4 cycles, heterodynes the A-2 frequency, producing a beat note or intermediate frequency of 5 cycles. However, let us suppose our intermediate frequency C-1 to be 1 cycle. Consequently, a beat frequency of 5 cycles does not affect the filter coupler in the second tube plate circuit, tuned to the frequency C-1 of 1 cycle.

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Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect and in original carton. We will ship brand in stock unless you specify otherwise.

T105 Detector, UV200, C300. Each $2.69
T112 Amplifier, UV201A, C301A. Each 2.69
T118 5-Watt Transmitter. 7.70
T107 WD11, C11. Each.. 2.69
T101 WD12, C12. Each.. 2.69
T102 UV199, C299. Each. 2.69

ADAPTERS

To use dry cell tubes in standard base sockets simply insert one of these adapters in the socket.
T104 For 199 or 299 tubes....40c
T109 For WD11 or C11 tubes 40c

BAKELITE SOCKET

T140 Standard base..30c
T141 UV199 base....30c
T136 C11 .....39c
Moulded of genuine red brown bakelite. Binding post conections. Strong contacts. Real values.

METAL TUBE SOCKET

T134 Each 25c
Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET

T150 Single Gang...$.76
T153 Three Gang....2.25
Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

SUPERIOR RHEOSTATS

T147 6 ohm. Each.....62c
T148 20 ohm. Each.....66c
T149 30 ohm. Each.....70c
One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.
T156 400 ohm Potentiometer. Matches above rheostats. Each 89c

FILAMENT CONTROL RHEOSTATS

T132 6 ohm. Each...34c
T129 20 ohm. Each...36c
T131 30 ohm. Each....38c
T135 6 ohm Vernier..78c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob, 1¾" diam.
Potentiometers. Match above rheostats. Same high grade construction.
T151 200 ohm. Ea. 52c T152 400 ohm. Ea. 58c

RADIO "BAKELITE" PANELS

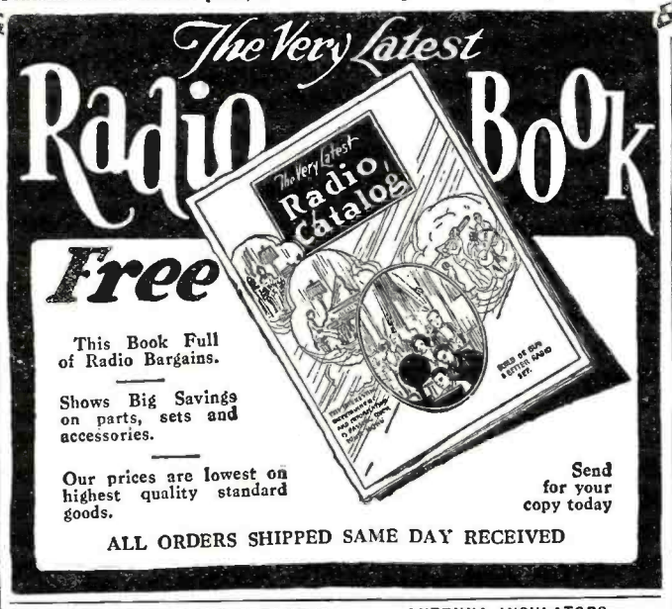
We supply genuine Bakelite, Condensite, Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as front. Postage 10c each extra.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	T450	$.55	T460	$.89	T470	$1.15
6x10½	T451	.86	T461	1.10	T471	1.60
7x10			T455	1.28		
7x12			T456	1.64		
7x14	T458	1.38	T468	1.73	T478	2.35
7x18	T453	1.78	T463	2.27	T473	3.15
7x21	T457	2.05	T467	2.65	T477	4.10
7x24	T459	2.42	T469	2.97		
7x26			T462	3.25		
9x14			T464	2.35	T474	3.15
12x14			T465	2.97	T475	3.98
12x21			T466	4.25	T476	5.70

COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch size have 180° scale marked 0 to 100.

Black No.	Price	Diam	Shaft Size	Mahogany No.	Price
T921	16c	2"	3/16	T926	19c
T922	16c	2"	1/4	T927	19c
T923	22c	3"	3/16	T928	26c
T924	22c	3"	1/4	T929	26c
T925	29c	4"	1/4	T930	34c



STANDARD BRAND LOUD SPEAKERS AND UNITS

T618 Brandes Table Talker.....$8.45
T616 Atlas Loudspeaker 21.95
T620 Baldwin Loud Speaker.....19.50
T603 Magnavox M4 Loudspeaker....21.00
T612 Magnavox R3 Loudspeaker....31.75
T614 Magnavox M1 Loudspeaker....26.50
T757 Morrison Adjustable Unit.... 4.35
T755 Genuine Baldwin Type C unit 4.85
T608 Atlas Unit. Each 10.80

STANDARD BRAND HEADSETS

T754 Baldwin Type C.....$9.80
T764 Frost, 2000 ohm 3.50
T766 Frost, 3000 ohm 4.35
T751 Murdock 56, 2000 ohm 3.25
T752 Murdock 56, 3000 ohm 3.60
T768 Brandes Superior, 2000 ohm.. 4.85
T769 Brandes Navy, 3000 ohm..... 6.85

DUBILIER MICADON TYPE 601

T502 .0001..29c T507 .0025.33c
T503 .00025.29c T508 .003..40c
T504 .0005..29c T509 .001..40c
T505 .001...33c T510 .005..48c
T506 .002...33c T511 .006..60c

DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
T581 .00025. Ea. 38c
T582 .0005. Ea. 38c

ANTENNA INSULATORS

T263 Ribbed Porcelain insulator, 2½ in. long. Ea...6c
Dozen 55c
T265 Ribbed Porcelain insulator—5 inches long. Ea...15c

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
T248 100 ft. coil 56c T249 500 ft. coil $2.60

SUPERIOR RADIO SWITCH

T283 Each 29c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

SUPERIOR RADIO JACKS

Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
T390 Open circuit. Each.....32c
T391 Closed circuit. Each.....39c
T392 Two circuit. Each 49c
T393 Single circuit filament control..46c
T394 Two circuit filament control.....59c

The greatest radio value ever offered

A five-tube radio frequency set that brings in the distant stations on the loud speaker. All the volume you could want with the finest tone quality, clear and sweet. Careful designing with big quantity production make our low price possible. Only the finest quality materials used throughout. New style efficient low loss condensers and transformers. Bakelite panel size 7x18 in. Handsome mahogany finish cabinet. Neat convenient dials. We can recommend this set for either city or country use. Will not reradiate and will bring in stations from coast to coast. No set approaches this for value. Equals many sets selling at double and triple our price. Try it for ten days. If you are not satisfied return it and we will refund your money.

T867 Set, only $47.50
T868 Set complete with five 201A tubes, 90 volts B battery, 100 ampere storage battery, one T613 Special Speaker, and complete antenna equipment. Nothing extra to buy. Price $88.00

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

No. Plates	Max. Cap.	Plain Type No.	Price	Vernier Type No.	Price
3		T815	$.79		
5		T816	.89		
11	.00025	T814	1.00	T825	$1.85
17	.00035	T817	1.20		
23	.0005	T813	1.30	T824	2.25
43	.001	T812	1.45	T826	2.46

GROUNDED ROTOR LOW LOSS VARIABLE CONDENSERS

T797 .0003 .....$2.75
T798 .0005 ..... 3.25
T799 .001 ..... 3.95
The most efficient type condenser made. Low losses, grounded rotor, straight wave line. Made of the best grade materials throughout. Heavy aluminum plates. Well insulated.

STANDARD BRAND VARIABLE CONDENSERS

T810 Acme .0005 Vernier.....$5.65
T784 Coto .00025 Vernier 3.95
T785 Coto .0005 Vernier 4.25
T786 Coto .001 Vernier 4.95
T787 Cardwell .00025 ..... 3.95
T788 Cardwell .00035 ..... 4.35
T789 Cardwell .0005 ..... 4.60
T790 Cardwell .001 ..... 5.55
T791 Marco .00025 ..... 3.95
T792 Marco .00035 ..... 4.45
T793 Marco .0005 ..... 4.95
T794 Marco .001 ..... 5.85
T795 Flewelling .00025 Vernier.... 4.50
T796 Flewelling .0005 Vernier.... 4.95

OUR SPECIAL A. F. TRANSFORMER

T549 3 to 1 ratio..$2.25
T550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.
T587 Thordarson Ratio 3½ to 1....$3.30
T588 Thordarson Ratio 6 to 1 ..... 3.70
T589 Thordarson Ratio 2 to 1 ..... 3.95
T590 Thordarson Push Pull. Pair..11.20
T531 All American 10 to 1. Each 4.25
T532 All American 5 to 1. Each 4.25
T533 All American 3 to 1. Each 4.05
T534 All American Push Pull. Pair 10.80
T535 Rauland Lyric 8.10
T553 Acme 3.95
T597 Erla 6 to 1..... 4.05
T598 Erla 3½ to 1..... 3.60
T591 Modern 10 to 1. Each..... 4.50
T592 Modern Push Pull. Pair.... 9.90
T555 Federal No. 226. Each..... 4.45
T556 Federal No. 65. Each..... 6.35
T712 Radio Corp. Each 5.70

STANDARD BRAND RADIO FREQUENCY TRANSFORMERS

T562 Dubilier Duratran $3.45
T565 Acme R2 ..... 3.95
T566 Acme R3 ..... 3.95
T567 Acme R4 ..... 3.95
T568 Erla Reflex No. 1..... 4.45
T579 Erla Reflex No. 2..... 4.45

RESISTANCE COUPLED AMPLIFICATION

T570 1st Stage Unit $2.30
T571 2nd Stage Unit 2.30
T572 3rd Stage Unit 2.49
Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

The Barawik Co.
102 So. Canal St. Chicago, Ill.

Due to what is termed "asymmetrical action" in the tube, the oscillator tube is capable of producing a "second harmonic," or second frequency B-2, which is very much weaker than the fundamental. (The need for utilizing the 8-cycle harmonic of 4 cycles rather than producing a fundamental of 8 cycles will be stated below.)

The second harmonic of any frequency is just double that number of vibrations (½ the wave-length) in a given time.

B-2, the second harmonic, consists of 8 cycles (*i. e.*, twice x 4). When these 8 cycles are caused to heterodyne (to be added to) the A-2 frequency of 9 cycles, the difference is only 1 cycle. This beat frequency of 1 cycle is the same as the adjustment of the filter coupler which is designed for 1 cycle.

C-2 is the beat frequency or intermediate frequency which has been reflexed into the grid circuit of the first tube, which now amplifies once more. The output, C-3, of this tube is stronger than C-2 and considerably more powerful than the original incoming signal A.

The output, C-3, continues on to other tubes which act consecutively to further amplify at the intermediate frequency, detect, then amplify at audio frequency.

Explanatory Circuit.

Q-2115-B is a schematic circuit illustrating the system. The 50-turn coil may be the secondary of a standard aerial tuning coil wound with No. 22 or 24 D.C.C. wire on a 3-inch tube. The primary may be wound directly over the filament end.

The two honeycombs are in variable inductive relation and must not be in inductive relation to other coils in the set.

The 500-turn honeycomb coils and the two variable condensers comprise the standard filter coupler which, when Giblin-Remler coils are used, will respond to wave-lengths between approximately 1,730 and 7,900 meters. If intermediate frequency transformers are used having a higher wave-length, it will be necessary to connect two fixed condensers, each of .001 mfd. capacity, in parallel to each of the .001 mfd. variable condensers.

If we consider an actual example of an incoming signal having a frequency of 500,000 cycles (600 meters), to which the 50-turn coil and its variable condenser are tuned, and an intermediate frequency amplifier and filter coupler tuned to 50,000 cycles (6,000 meters), it becomes necessary to heterodyne some frequency with the incoming signal frequency in order to produce a difference of 50,000 cycles.

Adding 50,000 cycles to 500,000 cycles we derive a total of 550,000 cycles (554 meters), the frequency required of our oscillator.

If the oscillatory circuit now including the 125-turn honeycomb coil were to include a much smaller honeycomb coil instead, so as to cover practically the same wave-length range as the broadcast stations, in the same manner as the regular oscillator system of a Super-Heterodyne, a peculiar effect would be noted; it would not be possible to adjust this circuit so as to heterodyne with the incoming signal without de-tuning the input circuit. Inversely, it would not be possible to tune the input circuit without de-tuning the oscillator circuit.

It is an entirely different matter when the wave-length range of the oscillator circuit is placed considerably outside the operating range of the input tuning circuit, which is accomplished by doubling the wave-length; tuning the 125-turn honeycomb circuit designed for this new wave-length range no longer has any appreciable de-tuning effect on the input circuit.

Our beat frequency, we have decided, is to be about 50,000 cycles. The asymmetrical tube action mentioned above causes our oscillator to produce the desired frequency, which will result in a beat of 50,000 cycles. Granting an arbitrary incoming signal frequency of 500,000 cycles (600 meters) and the requirement of an oscillator frequency of 550,000 cycles (545 meters) the 125-turn honeycomb coil circuit is tuned to 275,000 cycles (1,090 meters). Tuning this circuit does not appreciably affect the input tuning, while the second harmonic of 1,090 meters occurs at the required 545 meters (550,000 cycles).

Remember that these figures are used only for illustrating the principle. They will be different for every wave-length received and for the different intermediate frequencies for which the set may be designed.

Experimental Circuit

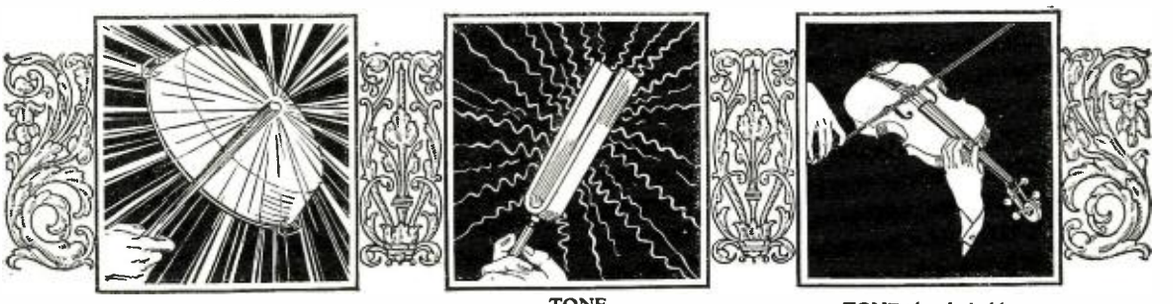
Circuit Q-2115-C shows a complete set having one stage of short-wave amplification (tube No. 1), first detector (tube No. 2), oscillator (tube No. 2), first intermediate frequency amplifier (tube No. 1), second stage of intermediate frequency amplification (tube No. 3), second detector (tube No. 4), and one stage of audio frequency amplification (tube No. 5)—seven operations being performed with five tubes.

In this circuit the instrument marked R.F.T. (B.W.) can probably be a regular radio frequency transformer, air core, designed to cover the broadcast wave-lengths.

We are showing a "C" battery in the oscillator tube circuit. This tube must act as detector as

Does Your Radio Make Music Sound like—

this— *or this—* *or this*



NOISE
(Non-periodic vibrations; unpleasant sounds)

TONE
(Periodic vibrations, without overtones; sounds which have mere musical pitch)

TONE plus desirable OVERTONES
(Tone color—REAL music)

In Radio, people want Distance—but they want TONE even MORE

Without Desirable Overtones You Get no Rich, Resonant Voice nor Tonal Beauty

How Pfanstiehl Reproduces Most Delicate Overtones

ANY good radio set can get distance, simply by amplification. There is no distinction about that. To get tone quality is quite another matter. And tone quality is the real measure of radio reception. Radios differ in this respect just as pianos differ. You judge a piano by its ability to produce a beautiful tone. You judge a radio by its ability to *reproduce* a beautiful tone, from a distance.

In a piano, quality of tone depends upon the manner in which the overtones are produced and controlled. Without them you could have no richness or beauty of tone. You would have a colorless, uninteresting sound. You can get beautiful piano music only from a fine piano in the hands of a good performer. Paderewski himself could not get tonal beauty out of a poor piano.

Overtones Perfectly Reproduced

In radio you have a similar situation. It cannot receive a lovely voice or beautiful music unless it reproduces the overtones which make it beautiful, exactly as they are sent out in delicate vibrations from the transmitting station.

That has been an extremely difficult thing to do in radio reception, simply because radio engineers have not known how to control the forward stream of radio energy as it passes from circuit to circuit in the set. Some of the energy strays off and feeds back. That is what causes the uncanny noises you hear, noises which have to be choked down or neutralized by a lot of complicated devices, and these distort and spoil the delicate super-vibrations which make overtones in your reception. Your tonal beauty is gone, in exactly the degree that your overtones are distorted or suppressed.

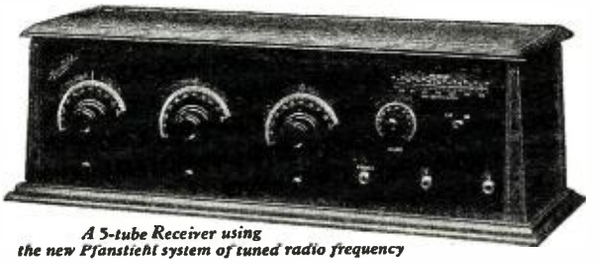
The matchless beauty of Pfanstiehl tone lies in the utter absence of feedback to disturb the delicate super-vibrations which make the overtones. These come through INTACT. There is no distortion whatever. The tone is full, rich and clear. You can enjoy exactly as transmitted the vocal charm of a beautiful singer or the tone color of a great violinist.

What an immeasurable advantage that is!

Distance, selectivity, volume, portability, are all values in radio which people want and can have to the extent that the maker chooses to afford them. There is no special problem about that. Radio science knows *how.*

The Big Problem in Radio Is Tone Beauty

The big problem in radio is tone beauty, a full and true reproduction of voice or music EXACTLY AS TRANSMITTED. This problem has been fundamentally solved in the Pfanstiehl. It gets the same distance, selectivity and volume as other high-grade 5-tube receivers; but in tone it is matchless, for the reasons above given.



A 5-tube Receiver using the new Pfanstiehl system of tuned radio frequency

Hear the new Pfanstiehl Overtone Receiver at your radio or music dealer's. If he does not have one we can quickly get it to him.

Pfanstiehl Radio Co.
Sales Offices:
Dept. C, 11 S. La Salle St.
CHICAGO, ILL.

Pfanstiehl

OVERTONE RECEIVER

well, and, therefore, it may be advisable to try connecting a grid condenser and leak, or a crystal detector, at "X."

Although iron core intermediate frequency transformers I.F.T. 1, I.F.T. 2 and I.F.T. 3 are shown (if the experimenter has a set of Tropaformers, they will readily adapt themselves to many experiments with this circuit), it is possible that air core transformers which amplify best at about 6,000 to 8,000 meters could be used.

It will be noticed that the primary I.F.T. 1 is connected into the circuit in a different manner than usual. It is a particularly efficient method of connection in this circuit.

The second harmonic Super-Heterodyne is generally conceded to be the most difficult type of receiver to construct outside of the laboratory. Only a skilled engineer can hope to successfully build a set incorporating this particular principle.

For further information on the second harmonic Super-Heterodyne, we refer the experimenter to the May, 1924, issue of RADIO NEWS, page 1576, the "Proceedings of the Institute of Radio Engineers" of October, 1924, page 539, and "Wireless Age" magazine of April, 1924, page 30.

Lessons in Esperanto

(*Continued from page 2056*)

the material indicated in the root. It gives a definite quality to the root. **Bovo**, a bull, or ox; **bovaĵo**, beef. **Ovo**, egg; **ovaĵo**, omelet. **Manĝo**, a meal; **manĝaĵo**, the food for a meal. **Bono**, good; **bonaĵo**, a good action. **Li faris al mi bonaĵon**, He did me a good act. **Heroa**, heroic; **heroaĵo**, a heroic exploit.

-An-, -ist-, -estr-, -ul-. These four suffixes relate to individuals. When combined with a root, one or other of them serves to show a person's country, religion, profession, occupation, character, etc. Each has its distinct meaning, and care must be taken not to confuse them. The feminine suffix **-IN-** is added to denote females. **-An-** indicates a member of something, such as a club, society, etc.; an inhabitant of a place or country; a partisan, or adherent to some party, faction, religion, etc. **Klubo**, a club; **Klubano**, a club member; **Senato**, senate; **senatano**, senator. **Ameriko**, America; **amerikano**, an American (words indicating people of a country are generally written with small letter). **Kristano**, a Christian.

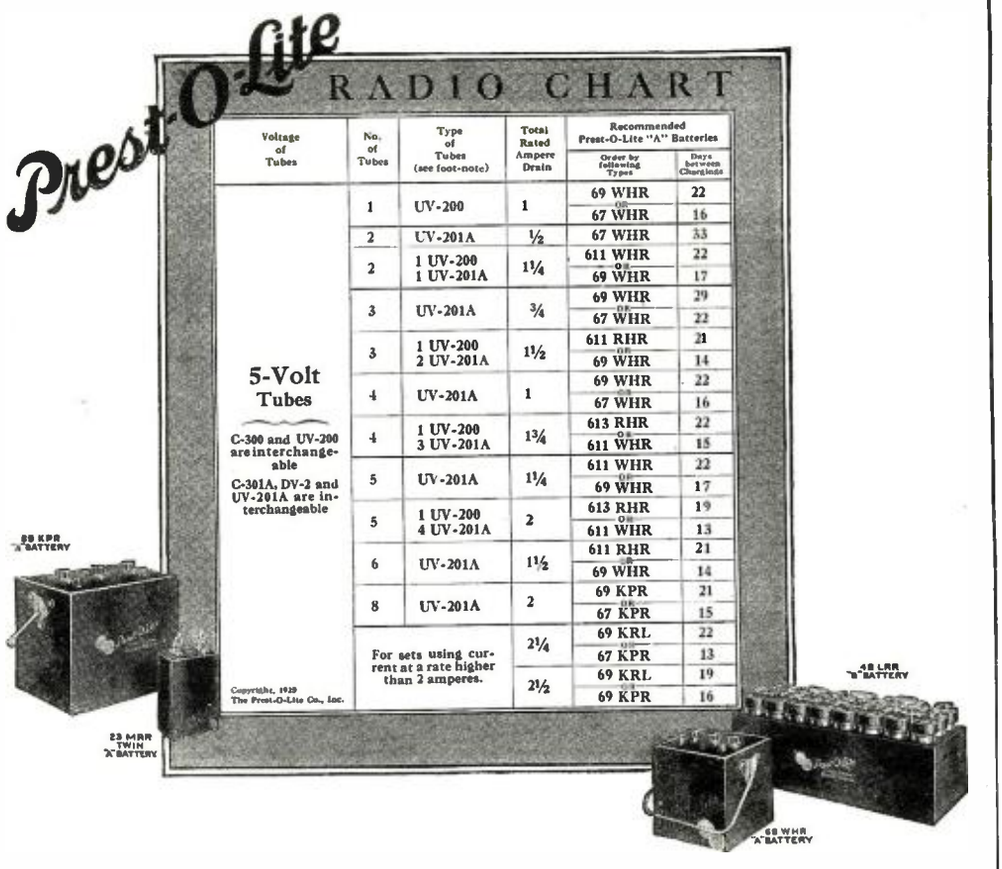
-Ist-, like the English affix -ist, denotes a person following a profession or trade, or some occupation by which he gains his livelihood, or who is habitually engaged in science, art, etc. It denotes a person's occupation, not something they do occasionally. **Instruisto**, a professional teacher; **instruanto**, one who teaches occasionally, but not as a profession. **Ŝuo**, shoe; **ŝuisto**, shoemaker.

The person doing a thing occasionally, as an amateur, such as **instruanto**, is indicated by the participle. **Juĝanto**, a person judging something; **juĝisto**, a judge by profession. **Rajdanto**, a rider; **rajdisto**, a jockey.

-Estr- denotes a person who is a chief, leader, ruler, head of a state, party, any organized body, etc. As **-an-** denotes a member, partisan, etc., of some body, profession, etc., so **-estr-** designates the head, or leader: **Urbo**, a city; **urbano**, a city inhabitant; **urbestro**, mayor. **Lernejo**, school; **lernejestro**, principal of a school. **Imperio**, empire; **imperiestro**, emperor; **imperiestrino**, empress. **Ŝipo**, ship; **ŝipestro**, captain of a ship. (For naval or military captain use **Kapitano.**)

Cefo, chief, is used in a few words as a prefix with a similar meaning to **-estr-**: **Episkopo**, a bishop; **ĉefepiskopo**, archbishop.

-Ul- indicates a person characterized by the idea contained in the root to which it is attached. By it we express that an



Voltage of Tubes	No. of Tubes	Type of Tubes (see foot-note)	Total Rated Ampere Drain	Recommended Prest-O-Lite "A" Batteries: Order by following Types	Recommended Prest-O-Lite "A" Batteries: Days between Charglnds
5-Volt Tubes	1	UV-200	1	69 WHR	22
				OR 67 WHR	16
	2	UV-201A	½	67 WHR	33
	2	1 UV-200 1 UV-201A	1¼	611 WHR	22
				OR 69 WHR	17
	3	UV-201A	¾	69 WHR	29
				OR 67 WHR	22
	3	1 UV-200 2 UV-201A	1½	611 RHR	21
				OR 69 WHR	14
	4	UV-201A	1	69 WHR	22
				OR 67 WHR	16
	4	1 UV-200 3 UV-201A	1¾	613 RHR	22
				OR 611 WHR	15
	5	UV-201A	1¼	611 WHR	22
				OR 69 WHR	17
	5	1 UV-200 4 UV-201A	2	613 RHR	19
				OR 611 WHR	13
	6	UV-201A	1½	611 RHR	21
				OR 69 WHR	14
	8	UV-201A	2	69 KPR	21
				OR 67 KPR	15
	For sets using current at a rate higher than 2 amperes.		2¼	69 KRL	22
				OR 67 KPR	13
			2½	69 KRL	19
				OR 69 KPR	16

How to select batteries that run your set for weeks without recharging

WHY select storage batteries by guesswork and risk getting one that requires charging every few days? Buy wisely. Let the Prest-O-Lite Radio Chart guarantee you batteries that fit your set—of ample capacity to bring weeks of fine reception without too frequent recharging.

The above section of the master chart selects Prest-O-Lite "A" Batteries to fit all 5-volt sets. It recommends two sizes for each set, depending upon the days of service you wish between chargings (based on the average use of your set of three hours a day). The larger capacity battery will be found more desirable unless facilities for frequent and easy recharging are provided. Consult the complete chart at your dealer's for data on "B" Batteries and also "A" Batteries for low voltage tubes.

In every detail of construction—special structure plates, highly porous separators and superior internal design—these batteries are made to get the best out of your set. To supply the dependable, unvarying current essential to fine tuning, efficient tube operation and clarity of reception.

Prest-O-Lite Batteries offer you truly remarkable savings. Though standard in every respect they are priced as low as $4.75 and up. They last for years and are all easily rechargeable. See them at your dealer's or write for our 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 San Francisco
In Canada: Prest-O-Lite Company of Canada, Ltd., Toronto, Ont.

Prest-O-Lite

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 battery care and upkeep—information that any radio fan will find of real value in keeping his set at its maximum efficiency. Write us at Indianapolis, Ind., for your copy right now.

individual is "rich," "poor," "bad," "good," etc. Riĉulo, a rich man; riĉulino, a rich woman; malriĉulo (see prefix mal-) a poor man; bonagulo, a good fellow; malbonagulo, a bad, selfish fellow. Juna, young; junulo, a youth; junulino, a young woman; maljunulo, maljunulino, an old man, an old woman.

Suffixes -ar- and -er-. Aro, a collection of persons, or of objects all of the same nature. Ero, an item, a small part of some bigger whole.

Examples: Vorto, a word; vortaro, a collection of words, a dictionary; Homo, a human being; homaro, humanity, mankind. Arbo, a tree; arbaro, a forest; insulo, island; insularo, archipelago; vagono, a railway coach; vagonaro, a train; ŝtupo, stairstep, doorstep; ŝtuparo, staircase.

-Er-. Sablo, sand; sablero, a grain of sand. Mono, money; monero, a piece of money, a coin. Hajlo, hail; hajlero, a hailstone. Fajro, fire; fajrero, a spark. Neĝo, snow; neĝero, a flake of snow.

Suffixes -ĉj- and -nj-. -Ĉj- is an affectionate diminutive to the first name of a person. It is substituted for one or more letters of the name: Vilhelmo, William; Vilhelĉjo, Willie; Vilĉjo, Billy; Viĉjo, Bill. Petro, Peter; Petĉjo, Pete. Johano, John; Johanĉjo, Johnny; Joĉjo, Jack. Patro, father; paĉjo, papa, daddy. -Nj- is a similar diminutive for a female first name: Mario, Mary; Marinjo, Mollie; Klaro, Clara; Clarinjo, Clarrie; Patrino, Mother; Patrinjo, Panjo, Mamma, Ma.

Suffixes -ebl-, -em-, -ind-. These three suffixes; when used as roots, for the words ebla, possible; emo, propensity, tendency; indo, worth, merit, value. As suffixes they are mostly used to form adjectives or adverbs, and the following three, from kredi, to believe, will give an idea of the difference in their shades of meaning:

Kredebla, credible, possible of belief, believable;

Kredema, credulous, having a tendency to believe;

Kredinda, something worthy of belief.

-Ebl- denotes possibility, or what is likely to happen, similar to the English suffix -able, or -ible. Examples: Pagi, to pay; pagebla, payable. Fleksi, to bend; fleksebla, flexible. Fidi, to rely upon, have faith in; fidebla, reliable. Kompreni, to understand; komprenebla, comprehensible; compreneble, of course, comprehensibly.

Do not confuse -ebl- with -em- or -ind- in words which in English end in -able or -ible, but have two distinct meanings. For instance, from senti- to feel, to experience, we get sentebla, susceptible or sensible, and also sentema, susceptible or sensitive. "Readable" may mean either "able to read" or "worth reading." In Esperanto there is no such confusion, for legebla, readable, legible, but leginda means readable, worth reading. Hence we see that -ebl- must always mean possibility.

-Em- denotes propensity, tendency, inclination, or disposition toward a certain way of doing or thinking, similar to the English suffix -ful. Examples: Paco, peace; pacema, peaceful. Helpi, to help; helpema, helpful, obliging. Trompi, to deceive; trompema, deceitful; trompemo, duplicity. Pura, pure; purema, cleanly; purigebla (see suffix -ig-), cleanable.

-Ind- denotes worthiness, worthy of. Examples: Inda, worthy; malinda, unworthy; laŭdinda, laudable, praiseworthy, from laŭdi, to praise. Estimi, to esteem; estiminda, esteemable, worthy of esteem.

Suffix -edz-. This suffix always denotes a married person. It can scarcely be

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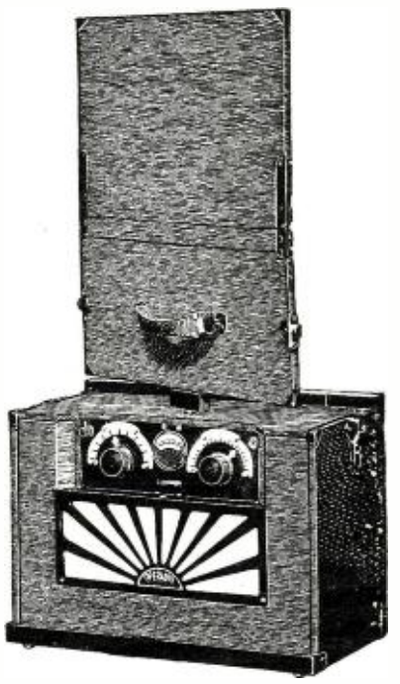

The 1925 Operadio removed from cabinet and ready for use. The cover is the aerial; the case may be closed and carried like a piece of hand luggage.

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called a suffix since it is generally used as a root. Examples: Edzo, husband, a married man; edzino, wife, a married woman; edzeco (see suffix -ec-), matrimony, a state of marriage; edziĝo (see suffix -iĝ-), a wedding, nuptials; geedzoj (see prefix -ge-), a married couple, husband and wife; edziĝi, to become married. Mia edzino kaj mi edziĝis antaŭ dek jaroj.

Suffixes -eg- and -et-. These two suffixes are opposites, -eg- indicating augmentation, and -et- diminution of degree. When these suffixes are attached to adjectives, the adverb "very" often is erroneously used to translate the meaning of degree of these affixes, as: Grandega, very large; malgrandega, very little; but the proper translation of these words is grandega, huge, enormous; malgrandega, tiny. Never think of the meaning of these affixes in terms of "very," but in terms of "excessive," "enormous," "extremely." Examples: Montego, a huge mountain; granda monto, a big mountain; monto, a mountain; malgranda monto, a small mountain; monteto, a hill. Riverego, a huge river; larĝa rivero, a wide river; rivero, a river; malgranda rivero, a small river; rivereto, a creek, a brook.

The suffix -et- is sometimes used to indicate endearment: Etulino, dear little girl (made up from -et-, -ul-, and -in-, with the noun ending -o attached); etulo, dear little fellow; eta panjo, little mama; eta paĉjo, little daddy.

LESSON 8
AFFIXES—(Continued)

Suffixes -ej-, -ing-, and -uj-. These suffixes are similar, since they indicate either a place or thing from which the idea of the root is produced, or in which it is contained.

-Ej- denotes a place especially used for, or allotted to, the idea contained in the root. It is also used as a root word, itself: Ejo, a place, locality. Examples: Safo, sheep; ŝafejo, sheepfold. Preĝi, to pray; preĝejo, a church, a place used for prayer. Fruktarbo, a fruit tree; fruktarbejo, an orchard, place of fruit trees. Lerni, to learn; lernejo, a school. Dormi, to sleep; dormejo, a dormitory.

-Ing- denotes a thing made to hold only one object indicated by the root. It is also used as a root word: Ingo, a socket, a sheath, a holder. Examples: Kandelo, a candle; kandelingo, a candleholder; plumo, a pen; plumingo, a penholder; fingro, a finger; fingringo, a thimble; glavo, a sword; glavingo, a scabbard.

-Uj- denotes that which contains, produces, encloses, or bears. Used as a root, Ujo means a receptacle, a container. It has a wide signification, for it can be used for:

(1) The names of countries, as being the places containing their various races: Franco, a Frenchman; Francujo, France; Ruso, a Russian; Rusujo, Russia; Japano, a Japanese; Japanujo, Japan (-lando and -io are also used: Ruslando, Russia; Germanlando, Germany; Rumanio, Roumania; Italio, Italy; although the latter, -io, has not been authorized by the Academy and is used only sparingly in transient matter, such as newspapers. It is recommended for its euphony, though there are arguments against it).

(2) The names of trees producing fruits: Pruno, a plum; prunujo, a plum-tree; piro, a pear; pirujo, a pear tree. Arbo can also be used with any of the above roots: Pirarbo, pear tree; ĉerizarbo, cherry tree.

(3) The names of receptacles commonly used for certain articles: Mono,

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money; monujo, a purse; papero, paper; paperujo, a portfolio; sukero, sugar; sukerujo, a sugar bowl; karto, a card; kartujo, cardcase; abelo, a bee; abelujo, a beehive.

Suffix -id- denotes the young of a species, the offspring, or descendant. Used as a root, ido means offspring, descendant, a baby of, used more often in reference to the young of animals than of humans; idaro, a collection of offspring, posterity of a race or individual. Examples: Kato, cat; katido, a kitten; hundo, dog; hundido, puppy; ĉevalo, horse; ĉevalido, a colt; Izraelo, Israel; izraelido, an Israelite; reĝo, a king; reĝido, a prince (though the international word, princo, is used for prince, as all princes are not the sons of kings).

Suffixes -ig- and -iĝ-. These two are the most important and most widely used of all the suffixes, as they form an infinity of words, especially verbs. As roots they can mean: Igi, to make, to cause to do something, as: Igu ŝin veni al nia dancado, Make her come to our dance. Li penis igi sian amikon veni, He tried to make his friend come. Iĝi, to become, to make oneself become, or do a thing. La vetero iĝas pli varma, The weather is becoming warmer. Li baldaŭ iĝos riĉulo, He will soon become a rich man.

Used as suffixes -ig- denotes (like English suffix -fy) to make, to cause (by an exterior force) to become, as: ruĝa, red; ruĝigi, to redden, to make red, and from this is formed the noun ruĝigo, the act of reddening.

-Iĝ- denotes to become, to get into a certain state of being oneself, or from internal causes, not from external forces: Ruĝiĝi, to become red, to blush; ruĝiĝo, the action of getting red, a blush; ruĝiĝa, blushing (adjective).

These two suffixes can be applied to almost any part of speech. Examples: Bona, good; bonigi, to make good, to cause to be good; boniĝi, to become good. Plibonigi, to make better, to improve a thing; pliboniĝi, to become better, to improve oneself; plibonigo, the act of making anything better. Laca, tired; lacigi, to tire, to make tired; laciĝi, to get or become tired. Preta, ready; pretigi, to make ready; pretiĝi, to get (become) ready; Pretiĝu vin por iri kun mi, Get ready to go with me. From all these verbs, nouns, adjectives and adverbs can be formed:

From Nouns: Fianĉo, a fiancé (man); fianĉigi, to betroth, to affiance; fianĉiĝi, to become betrothed, to become engaged to marry; fianĉiĝo, betrothal, engagement; fianĉiĝa, betrothal; fianĉiĝe, by betrothal. These words relate to the betrothal of a man, but in case of a woman, we add the feminine suffix, as: fianĉino, fianĉinigi, fianĉiniĝi, fianĉinigo, etc.

From Verbs: Morti, to die; mortigi, to cause to die, to kill; mortigo, killing; malicmortigo (lit. "malicious killing"), murder; mortiga, deadly; mortiganto, a killer; mortige, mortally. Memmortigo, suicide; memmortigi, to commit suicide. Sidi, to be sitting, to sit; sidigi, to cause to sit; sidiĝi, to seat oneself; sidigo, the act of causing to sit, seating; sidiĝo, the act of sitting down, or seating oneself. Li kondukis la vizitantojn al iliaj sidejoj, sed la sidigo de tiom da gesinjoroj estis tasko malfacila, ĉar la sidiĝo de eĉ unu sinjorino bezonas iom da tempo, kvankam ne tiom, kiom la sidiĝo de hundo, kiu ofte turnadas sin multefoje antaŭ ol sidiĝi, He conducted the visitors to their seats, but the seating of so many ladies and gentlemen was a difficult task, since the sitting down of even one lady needs some little

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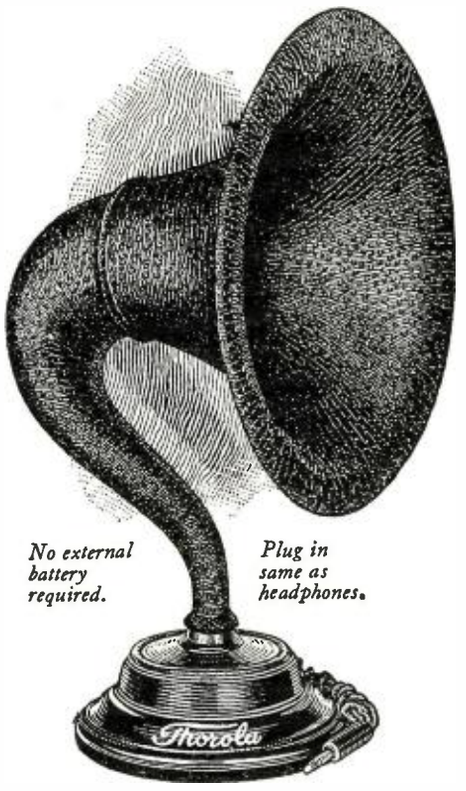

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time, although not so much as the sitting down of a dog, which often continues turning itself round many times before seating itself. Sciigi, to cause to know, to inform; sciiĝi, to become informed, to become learned.

Verbs formed by -igi- are transitive, but those by -iĝi- are intransitive.

Suffix -il- denotes an instrument or tool by means of which something is done. As a root, ilo, a tool, an instrument, an implement, or a means of. Examples: Kombi, to comb; kombilo, a comb. Razi, to shave; razilo, a razor. Tranĉi, to cut; tranĉilo, a knife. Haki, to hack, to chop; hakilo, an axe; hakileto, a small axe, a hatchet. Kudri, to sew; kudrilo, a needle; kudrilmaŝino, sewingmachine.

Suffix -in- denotes the feminine gender. As a root: Ino, a female; ina, female (adjective). Examples: Frato, brother; fratino, sister; patro, father; patrino, mother. Kuzo, a male cousin; kuzino, a female cousin. Avo, grandfather; avino, grandmother. Ĉevalo, horse; ĉevalino, a mare. Ŝafo, a sheep; ŝafino, a ewe.

Prefix Bo- denotes relation by marriage: Bopatro, father-in-law; bopatrino, mother-in-law; bofrato, brother-in-law; bofratino, sister-in-law.

Prefix duon- also is used to show relationship. The root, duono, a half, should properly signify only half-blood relationship, but as relationships of this nature are few, it is also applied to "step" relationships: Duonfrato, step-brother, or half-brother; duonpatrino, step-mother, etc.

Prefix pra- gives primordial meaning, referring to past times, often ancient times. In relationship it is like the English "fore-," "great," or "grand." As a root, praa, primeval. Pratempo, primitive time; prapatroj, forefathers, ancestors. Praavino, great-grandmother.

Prefix ge- denotes both sexes taken together. The words are always in the plural, and the feminine suffix is, of course, never added. Examples: Edzo, husband; geedzoj, husband and wife; gepatroj, mother and father, parents; gefratoj, brothers and sisters; gesinjoroj, ladies and gentlemen (used by public speakers in addressing a mixed audience), also is used for Mr. and Mrs. So and So.

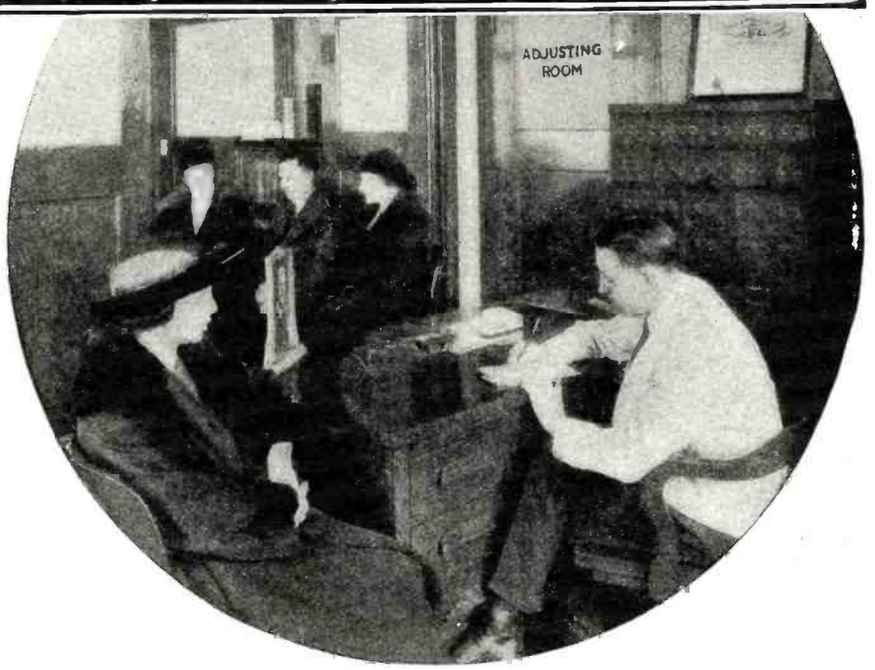
Prefix dis- denotes a movement from a given point into all directions, as the same prefix in English dispersal, and separation, in the sense of rupture, breaking up into parts. Examples: Ŝiri, to tear; disŝiri, to tear to pieces and scatter, ĵeti, to throw; disĵeti, to throw about, scatter. Disiri, to go in different directions, to separate.

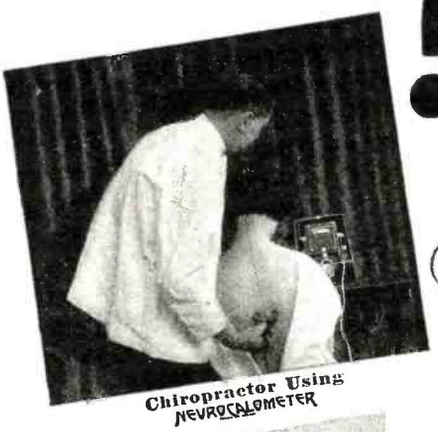
Prefix ek- denotes an action just begun, of short duration, sudden and momentary; Kanti, to sing; ekkanti, to begin to sing, or start singing; ridi, to laugh; ekridi, to burst out laughing; lumigi, to light up, make light; eklumigi, to flash on light; krii, to cry; ekkrii, to exclaim, to cry out; kapti, to capture; ekkapti, to seize. Ekpensi, to begin to think: Kiam mi ekpripensas ĝin——, When I come to think about it——.

Mal-, perhaps the most important affix in Esperanto, needs little explanation. Where there are two ideas direct opposites in meaning, one is used as a root and to indicate the opposite, mal- is prefixed: Bona, good; malbona, bad; dolĉa, sweet; maldolĉa, bitter; luma, light (adj.); malluma, dark.

Re- is the same as the English re-, meaning "back," or "again: Reveni, return (lit. "recome"); rediri, resay; reprodukti, reproduce.

What Do YOU Know?





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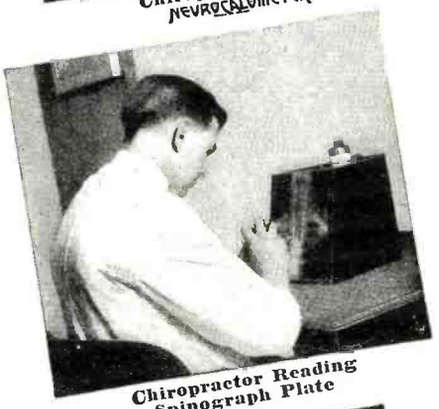

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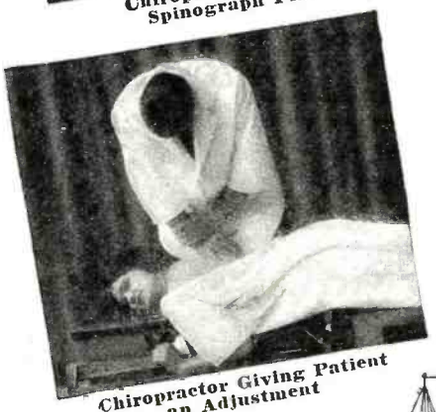

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Suffix -ec- is equivalent to English -ness: Boneco, goodness; bonkoreco, goodheartedness, kindness; bela, beautiful; beleco, beautiousness, beauty.

Suffix -um- has no special meaning, similarly to "je" among the prepositions. Its different meanings are easily suggested by the context and the signification of the root to which it is joined. There are but a few words in which it is used, and these must be learned like simple words. The following few examples will indicate the manner of use of -um-, so that the student will recognize it readily: Malvarmo, cold; malvarmumi, to take cold; malvarmumo, a bad cold; kalkano, heel (of a foot); kalkanumo, heel (of a boot, shoe, etc.); kolo, neck; kolumo, collar; komuna, common; komunumo, a commune, community; mano, hand; manumo, wristband, cuff; sapo, soap; sapumi, to soap; kolombo, dove; kolombumi, to coo.

(To be continued)

The Strong Arm Circuit

(Continued from page 2053)

cause we've been listening in for the past three weeks, and have heard nothing at all traceable to any known form of radio communication. We have used all manner and makes of radio apparatus, of all types and designs, but not a thing have we been able to pick up. Yet they are in close contact at all times."

"But couldn't they be communicating through some other means than radio?" puts in Doris, sensible for once.

Jerry shakes his head. "Other means are out of the question, since this ship must remain at least twelve miles out, and matters of undetected landings are of a comparatively few moment's duration. It is, and has been, solely a case of hop, skip and run; they come in, unload somewheres, and get out. We've never seen them unloading, although we once captured a small quantity of their liquor. But we have three times seen them either coming in or going out. They never seem to land twice in the same spot; the information they are receiving is extremely authentic and quite apparently detailed, because they are timed to the minute."

There's silence a moment. Then I butts in. "Say, Jerry, what kind of a ship is it?"

"And there's another funny thing," muses The Master. "The ship is designed along the lines of an old-fashioned clipper, although anyone familiar with vessels can see that these lines have been appreciably altered to give the speed of a modern destroyer. There are sails, all correctly arranged, but the one good look we've had proved that these sails were for ornament only. Steam or gasoline provides the motive power, of course, as evidenced by a small inconspicuous funnel amidship. Now, despite what might seem a handicap due to design and sails, this boat can attain a speed that is nothing short of marvelous. Sufficient to say that no one has been able to catch her; even the revenue cutters are helpless."

"Odd," I admits.

"And what makes it worse, they flaunt their speed at us. It would seem that such a ship would desire to attract as little attention as possible, yet this boat has six immense floodlights, inverted, and fastened to the masts in such a way as to create daylight for a radius of a hundred yards about the vessel. Added to that the crew stand around on deck and yell, sing, swear and throw taunts at us. Why, so fast is this ship that the boys have nicknamed her 'The Flying Dutchman'."

"Unusual," I admits. "But where do you, and us, come in?"

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"Here: Our only hope lies in apprehending the form of communication that is being employed. I, for one, feel certain that they have conceived some new method of radio, and it is with this end in mind I am working. I need assistance, and thought if your early mornings are available, you might like to help me, for the adventure if nothing else."

And I would, any excuse to get away from my foolishly contracted partner being welcome, but when you says "mornings" to an actor you're taking away his life blood and beauty sleep. I'm sorta undecided.

"Well, much as I'd like to help, if it's mornings——"

Jerry smiles. "I should have said late evening. I mean the hours from midnight to three or four in the morning."

I'm all smiles. "That's a flivver of another hue," I says. "I'm with you."

"Well, you are not!" declares Doris. "Do you think I want a fairly good husband coming home looking like a honeycomb coil? When some of those dead-shot bootleggers takes a good crack at your frame there won't be any more 'Hammerstein's Flips and Flops' this season."

Jerry hastens to assure her to the contrary. "Oh, I don't think there's any danger of that kind, Doris," he soothes. "At least, so far they've never evidenced any desire for mortal combat. It's never been possible. We can't get within hailing distance of them. And besides, we shall concentrate on the radio angle."

Doris is suspicious of anything that might connect me with a drink, but after a while she gives in.

"Well, you may go, Joe," she says. "But if you ever come home drunk I'll sock you so hard on the ear you'll never get a pair of cans onto your dome again."

"Agreed," says I. "What's on the docket, Jerry?"

The Master is meditating. "By the way, Joe, it might not be a bad idea to have another man or two along."

"O. K. with me," I says. "Gonna get another revenue agent?"

Jerry shakes his head. "No," he says. "I'd rather have someone as yet unknown in the underworld. Preferably someone with a good deal of physical strength."

"Easy," puts in Doris. "Why not take Willie?"

"Nix," I says. "No brains."

"Jerry said 'physical' strength," reminds my human copyright. "Willie's got plenty of that."

I'm forced to agree. "You're right," I admits. "And why not take Oscar, too, and have a little battalion of our own?"

So I explain it to The Master and he's agreeable. Then the job is to rope in Willie and Oscar.

These two worthies never went through college, having graduated from somewheres along in the seventh grade in Norway, which may have an American equivalent, although I don't know it. They're not exactly dumb, but neither are they shining lights; just a coupla plain boys trying to get along. After half an hour's arguing the boys has a fair idea of what we're after, barring a few deep technical facts which I couldn't explain and Jerry forgot. We're out after booze runners, that they know. Their part, as they take it, is to be a sorta combination witness, guest and ballast. Everything's smooth.

We're playing New York for several weeks, so there ain't much trouble getting down to the docks after the show's over. Each night we gets into The Master's high-power launch and scoots out onto the high seas in response to the various clues, signs and so forth that have been recorded during the previous twenty-four hours. For the first week we don't get a nibble. By this time the novelty's beginning to wear off; it's Saturday night, and we're coming home early, so's to be able to get up and out all

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The outfit advertised here is complete, as listed below, everything needed is included, down to the last screw. The charts, blueprints, directions and photos furnished are so complete and explicit that anyone can build this set and have it working within a few hours. There is nothing additional to buy except the necessary batteries and tubes. Price includes mahoganite cabinet and folding loop aerial.

You can pay $150 or more for an outfit, or $200 or more for a set, but you cannot possibly buy a better set than this one.

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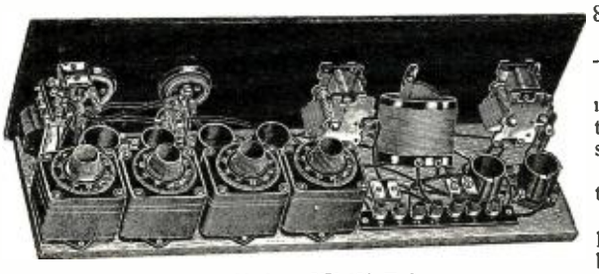
REAR VIEW OF TROPADYNE



Set uses 201A or UV-199 Tubes.

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LOOP RECEPTION—Outside aerial not required with this set—the complete loop is included in outfit.

PERMANENT LOGGING OF STATIONS—Follow chart furnished; there are only two tuning controls and you will always find the same station at the same spots on the dials. Our log chart shows you at what point to find any station.

MICROMETER VERNIER DIALS giving you the full advantage of the exceptionally sharp tuning.

OUTFIT IS ABSOLUTELY COMPLETE—Drilled panel, Mahoganite Cabinet and everything else needed, except tubes and batteries.

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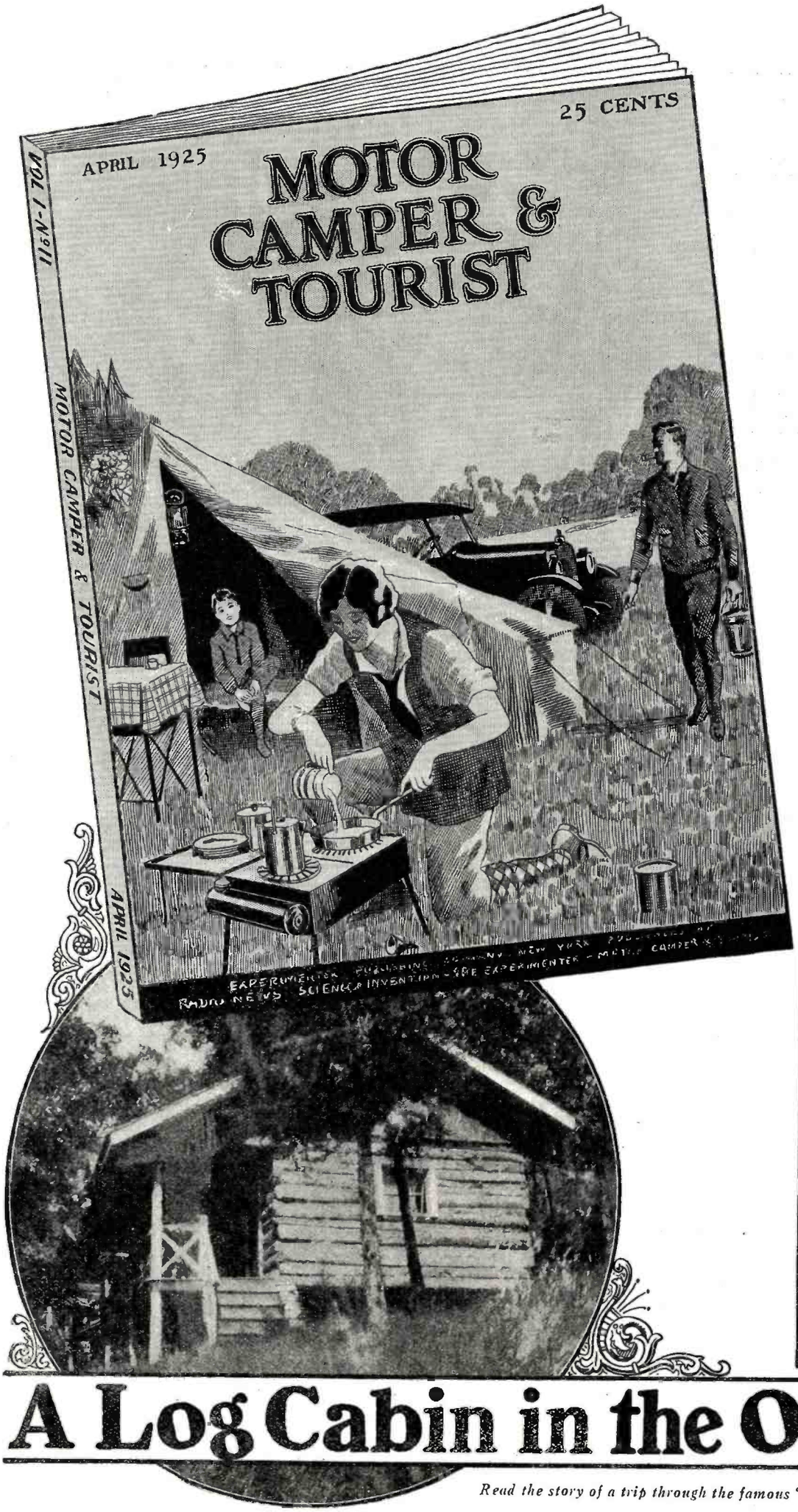

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Read the story of a trip through the famous "Ozarks" in the April issue

day Sunday. The Master, as usual, is busy; Willie and Oscar used to be fishermen, and are suffering a relapse; me, I'm a bit bored.

Jerry and me are in the cabin, the boys being on the front deck. I gets a case of tongue itch, and starts to broadcast.

"Gimme action, boy," I demands. "I'm all primed for a——"

"Hey!" comes Willie's voice. "Look!"

We're just passing a small cove, and therefrom charges the Flying Dutchman, right at us. It looks like we're going to be hit, but our stern clears the bow of the clipper and we takes a nice heavy roll on the wave. True to form, the crew are leaning over the edges, talking and yelling. The floodlights are blinding. And there's a low, steady hum coming from the vessel.

"Hey, you!" yells somebody. "Get that hulk outa the way!"

"Get outa the way yourself," I yells back.

In the excitement Jerry has been taking as keen a view of the ship as the roll of the launch will permit. Pursuit is obviously out of the question; I've seen some fast things, but this baby gets the fur-lined vacuum tube. Speed? Oi!

Just as the stern of the ship passes us, Willie, who's managed to get around to the rear, stands up and shakes his fist at the vessel. Then a big red-headed sailor on the stern yells out this sterling affront. "Aw, go to Hell, you dirty Swede!"

Now, Willie is a Norwegian, and Norwegians and Swedes have for each other the friendly disdain of a Rabbi for salt pork. The minute the red-head calls Willie a dirty Swede I expects trouble. I'm right. The Midnight Sons arise to the occasion.

Shaking his fist and swearing in his native tongue Willie, aided and abeted by Oscar, tells the vanishing clipper—well, it wouldn't be fit to publish. Then the two lutefisk lads comes into the cabin.

"That damn red-head call me dirty Swede!" yelps Willie. "If I catch him I bane wring his yellar neck!"

"Ay!" agrees Oscar.

Even The Master smiles, although the occasion doesn't warrant much. Then he seizes the receivers and clamps 'em on, listening in feverishly. He tunes fractically for a few moments; then a faint gleam of hope comes to his eyes.

"I'm getting something," he says. "It sounds like a continuous hum, broken by high and low notes. Some code—there's a high—two highs—a low——"

The Master keeps on muttering to himself while he's writing down the message. After two or three minutes the hum is gone, and the sheet before Jerry is filled with highs, lows and mediums. He immediately begins to translate; Willie and Oscar converses in their own code while I takes charge as captain, engineer and boatswain. It's a great life on the ocean wave.

As we're nearing port Jerry comes outa the cabin.

"Any luck?" I inquires.

The Master shakes his head. "Funny," he says, "I can't make head nor tail of it. I'm afraid I'll have to leave it to the experts at headquarters."

I nods. "Will we be going out tomorrow?" I asks.

"I should say so!" exclaims Jerry. "At last we're onto something at least partly definite. Tell the boys we'll need them, if they'll come."

Will they come? Shades of King Knute!

"I bane find that fellar who call me Swede," growls Willie. "I bane knock his block off."

"Ay!" agrees Oscar.

Well, the next morning we're out by ten o'clock, onto the high seas by twelve, and the afternoon is spent up and down the near coast, but with no results. Of course, the Flying Dutchman ain't expected until after dark, but Jerry hopes to pick up some more

code. I'm pilot, ad infinitum, while The Master figures in roots and logarithms and sines. Oscar finally decides to cook, so about five we has dinner. Shortly thereafter Jerry draws me to one side.

"I've a thin idea running through my head," he says. "I can't explain it now, but if things happen as they did last night—if we meet the Flying Dutchman—will you, if I'm not here, throw in this switch when the ship comes nearest? I shall be busy on the front deck from now on."

"Sure," I says.

So we cruises around while The Master rigs up a peculiar looking aerial on the bow of the launch. Knowing Jerry rather well, I asks no questions, and Willie and Oscar can't, so things is quiet.

By nine o'clock it's dark, and all eyes are peeled. Neither The Master nor myself thought we'd be lucky two nights in a row, but we are. Rounding a point, we sees The Flying Dutchman, just putting out of a cove.

"Kill the motor, quick!" calls Jerry hoarsely.

I shuts off the power and we glides around the point. The other ship, in order to pass us, must come within a hundred yards from where we're trying to hide.

They sees us right away, and starts to come out, lights flaring and crew yelling like mad. Then The Master yells for me to throw in the switch.

I does, and to my utter surprise The Flying Dutchman slows down and stops, right in front of us. Then funny things begins to happen.

As we brushes alongside the ship Willie makes a grab for a ladder. I've my gat ready, expecting somebody to start fireworks, but no! The crew just stands where they are and calls us names! I'm onto them. It's too easy—there's something wrong. Here we are coming up the side of the vessel and all they does is swear at us!

"It's a trap!" I yells to Willie. "Come back!"

But Willie is seeing red. He climbs over the rail and makes a bee line for the stern. The big red-headed gink is still there, swearing all colors and styles. *But none of them moves an inch!*

"Willie!" I yelps, terrified. "Come back! It's a frameup!"

But centuries of Norse blood are out to seek vengeance. Willie is strong, extremely so. Although he ain't had no training as either a boxer or a fighter, if you happens to be foolish enough to let him land on you, well, wooden overcoats is in order. This red-head is game, all right. He don't quiver an eyelash. Willie's fist comes into swift, sincere and violent contact with the sailor's jaw, when——

"Owww!!"

"What is it?" calls The Master, unduly calm.

"Owww!" yelps Willie. "My fist!"

Well, it's a case of but-you-oughta-see-the-other-fellow. Willie's hand is cut up, but the red-head's whole face is shattered. *And he stonds there, still swearing!*

"What the—"

Jerry laughs, triumphant. "I came to this conclusion last night," he says. "They're wax dummies!"

I let's that sink in a coupla megohms.

"D-Dummies?"

Jerry laughs again. "When I found that I couldn't translate that message, I suddenly decided that it wasn't meant to be a message. And it wasn't! That continuous wave was a stream of power, fed by apparatus on the shore!"

Willie's nursing his hand, but he gets that much. "What?" he asks.

"The high notes and low notes must have meant turn right and left—but wait—let's find out for certain."

We takes a run into the cabin. Jerry's

right. I can see that without glasses. The room's full of radio equipment.

Willie and Oscar are posted as guards while The Master and me goes over the cabin. Jerry's amazed, and I am, too, after he's explained what's what.

"Joe, it's nothing short of marvelous!" he exclaims. "There wasn't a human being aboard this ship!"

"All radio controlled?" I asks. "But how?"

"So far as I can determine, the ship was regulated entirely through this heavy power wave, although just how I can't say until I have investigated further."

We goes into the hold, filled with ten-tube whiskey——the kind that needs no amplification—and there's more apparatus. The Master finds it's a special multiplex transmitting and receiving outfit, used for receiving the profanity and relaying it to the sailor-dummies through a clever system of automatic contacts. Jerry's still puzzled.

"But this doesn't clear it up," he says. "In the first place, how could the persons who were doing the talking know what to say, and in the second place how could this station receive the voices without anyone else getting it? We tried every known means to no avail, and yet this outfit seems to be wired in quite the ordinary way."

"And also," I puts in, "how in the devil could they steer this ship? Oh, I know the thing's possible, technically, as long as the ship is in sight of the operator. But when the vessel gets out a coupla dozen miles, how do they do it?"

Jerry s iles at my display of gray matter. "I'd been wondering about that, too. Offhand, I can't say until I've traced the wiring of the apparatus upstairs. It'll take some time. But it's certain that whoever did guide this ship, isn't on it and he most certainly could not see over a few miles in daylight, let alone at night."

After half an hour The Master decides he can't do much more until daylight, and assistance arrives, so we shoves off into our own launch while Jerry dit-dats into headquarters for a cutter to come and guard the clipper.

"You might turn off the switch I mentioned," says The Master. "It merely counteracted the wave as sent from the shore."

I pulls the switch and BANG!

The shock of the explosion almost capsizes the launch. When we gets to our feet, the air is raining bits of wood, steel and glass, and there's a beautiful hooch fog and spray all over us. The Flying Dutchman is no more.

It's a minute or so before we can get our breaths. Willie is the first to speak.

"Well, she's gone!" he remarks.

I turns to Jerry. "What the deuce caused that?"

The Master's almost white. "Good Lord, Joe," he gasps. "We came within an ace of being blown to atoms!"

"Oh, we were safe," I says. "We were a good two hundred yards off."

Jerry shakes his head vigorously. "Oh, not now. Don't you see? The bootleggers'd fixed a bomb to blow up the ship in case it was captured. All they had to do was stop the power wave and the vessel would be shattered. My counteracting wave held off the explosion."

We lets that rest for a little while. Then I speaks.

"Well, we found them, anyways."

The Master nods. "We've destroyed this ship, but we haven't found out how it was handled. There's nothing to prevent their building another. The thing was extremely clever—exceptionally so; but I can't figure how they guided it or controlled the speaking."

If there's one thing that gets on Jerry's nerves, it's to be unable to analyze some

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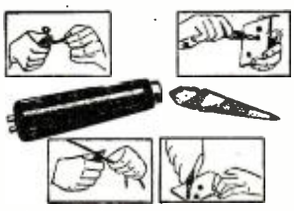

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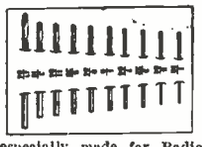

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scientific fact. All the rest of the way into port he's cranky as a flivver and it takes all my persuading powers and Willie's strong arms to pilot him into a small sailor's café for a bite to eat. The Master is plain, good, old-fashioned, peevish; he gulps his coffee just as if he'd never known which spoon to use on the eighth course. Me, I'm amused.

"Say, Jerry," I asks, "have you solved it yet?"

"Aw, shut up!" growls The Master. Really, it's such a novelty to see his serenity ruffled that I sorta teases him along. We're in one of a string of small booths, a kind of breakfast nook effect, with curtains and low partitions, with Jerry and me on one side and the Herring brothers across from us.

There's another party of sailors in the booth back of us, talking low and angrily, and between them and The Master I'm enjoying myself to the hilt. Honest, it's a pleasure to be in such congenial company after a season in close contact with your family.

Suddenly Willie utters a big, explosive oath and hops onto the table, making a nose dive over the partition into the next booth. Oscar follows. So does pandemonium.

I ain't seen such a swift and sure milling since coherers was an essential. Willie and Oscar, although they ain't boxers—well, within two minutes there's four guys laying on the floor, knocked cold. Willie's steaming over one of them.

"That's him!" he yelps. "He bane call me dirty Swede! I know his voice!"

"Why, you're mistaken," says The Master. "Now we're in for it—"

He shuts up like a clam and bends over the chief victim. Closely he scrutinizes the gentleman's map and then consults a photograph. A smile slowly comes to Jerry's face, topped by a shout of pure joy.

"Solved!" he yells. "Solved!"

"Explain," I demands, feeling a bit unnecessary in front of the growing crowd. "Whadda ya mean, solved?"

Jerry hands me the photo. Sure enough, it's labeled Martin Pemberton, alias Marty the Soak, wanted for violation of about everything on the list, most recently of big-time bootlegging.

"Nice," I comments. "Where does this help us so much?"

"Look at his clothes!" cries Jerry. *"Look at his clothes!"*

I does. Then the dawn comes up like thunder.

"Well, I'll be—" I gasps. "An aviator!"

"Everything's explained!!" gurgles The Master.

"But how—"

Jerry waxes enthusiastic. "You see, by use of a heavily muffled plane they could drop down to a comparatively short distance from the ship. Without lights on the plane, supplemented by the inverted floods on the ship, together with the racket the sailors made, no one would be able to detect their presence. That accounts for the low hum we heard just as we passed the vessel. It was the exhaust of the 'plane."

"But the voices—how was it we couldn't hear them on our radio?"

Jerry laughs. "Well, we could have—at one time. You see, by what must have been marvelously delicate instruments, coupled with a closely directed aerial, they were able to confine the waves of speech to an area perhaps not exceeding a hundred yards about the ship. They logically deduced that anyone coming within this radius would be so flustered as to forget to listen in. They were right. We forgot to. By use of telescopes they were able to see what was going on and supplied words to fit the setting."

"That accounts for Willie being called

a Swede," I grins. "You see, Willie, from five hundred feet up it ain't no easy matter to pick nationalities."

"Ay," admits Willie.

We all have a good chuckle. "Well, it's solved," I says.

"Solved by Willie," adds The Master, offering his hand to that individual. "Any reward coming from this goes to you."

It takes a few moments for Willie to get things straight, but then he's all smiles. "I say I solved him!" he declares. "I bane knock his dirty block long ways off."

The police comes in and drags out the prisoners, while Jerry sets 'em up to the house. All is merry.

"Say, Willie," I asks, "whatcha gonna do with that reward?"

"Well," he replies, scratching his head, "I bane think I buy me a radio and get more rewards."

I laughs. "Nix, Willie," I says. "Stick to your pole."

All of which goes to prove that might is right if you have might in your right—or left. Get me?

Radio and the Copyright Problem

(*Continued from page* 2046)

has expired, but audiences demand up-to-date music as well as the popular songs of the past. So it is practically necessary for artists performing at broadcast stations to resort to newly copyrighted music. But here comes the difficulty. If I buy printed sheet music, the possession of the tangible property does not vest in me ownership or control of the thought and creation of the author for any other than my own and others private enjoyment. May I legally sing that selection, which I have learned from the sheet, into the radio apparatus for the enjoyment of an unknown and unseen audience?

The opinions of the Federal Courts are conflicting. In 1923 it was held that broadcasting from a department store was a performance for profit. L. Bamberger & Co. conduct a department store in Newark, N. J. It also has instituted a radio department, selling radio equipment of all sorts. This company also conducts a broadcast station (WOR) from which vocal and instrumental concerts and other entertainment and information are broadcast. The station performed "Mother Machree" and the owner of the copyright claimed the copyright was infringed upon, and sued for relief. The District Court granted the injunction. Judge Lynch held that this was a public performance for profit for the following reasons: 1. The defendant charged the cost of the broadcast station against the general expenses of the business. 2. While the Bamberger Company does not broadcast the sale price of its wares, it does broadcast a slogan, "L. Bamberger & Co., one of America's greatest stores, Newark, N. J.," at the beginning and end of each program. 3. If the purpose had been eleemosynary, for charitable purposes, and not for profit, it is likely that it would have adopted some anonymous name or initial.

PUBLIC PERFORMANCE?

Other Federal Courts have held that the act of broadcasting is not a public performance. In the fall of 1923 the American Automobile Accessories Company, of Cincinnati, a manufacturer of radio receiving sets and parts, caused the rendition of "Dreamy Melody" by means of singing and an orchestra to be broadcast from its station in that city. The owner of the copyright, arguing that this was a public performance for profit under the Act of 1909, petitioned

for an injunction restraining the Automotive Accessories Company from further rendering this composition by radio.

The Federal District Court, speaking through Judge Hickenlooper, dismissed the case on the ground that this was no public performance for profit. The argument of the Court may be briefly summarized:

1. A strict construction of the statute is necessary. The law must be read according to the natural import of the words used. Radio broadcasting was not within the mind of Congress when using the term "perform publicly for profit."

2. In order to be a public performance in the sense in which Congress intended the words, there must be an assemblage of persons. "We simply feel that the rendition of a copyrighted piece of music in the studio of a broadcast station, where the public are not admitted and cannot come, but where the sound waves are converted into radio frequency waves and thus transmitted over thousands of miles of space, to be at last reconverted into sound waves in the homes of the owners of receiving sets, is no more a public performance in the studio, within the intent of Congress, than the perforated music roll which enables the reproduction of copyrighted music, by one without musical education, is a copy of such music. A private performance for profit is not within the meaning of the Act, nor is a public performance without profit. All contemplate an audience which may hear the rendition itself through the transmission of sound waves, and not merely a reproduction of the sound by means of mechanical device and electromagnetic waves in ether. The auditor 'listening in' at Indianapolis, Cleveland or Chicago would be surprised to learn that he had, that evening, attended a public performance in Cincinnati."

The third important decision to be noted is that of Remick vs. General Electric Company. The General Electric broadcast station (WGY) at Schenectady, N. Y., had broadcast the song "Somebody's Wrong," the copyright of which belongs to the Jerome H. Remick Company. The plaintiff petitioned the United States District Court of the Southern District of New York to enjoin the General Electric Company from further rendering this song by radio.

The Court, speaking through Judge Knox, refused to grant the petition on the grounds that the infringement of the copyright, if any, is committed by the performer and not by the owner of the broadcast station; the performer, if entitled by license to use the copyrighted music in any way, may extend his audience without incurring any further liability."

So far as the practical results are concerned, the broadcaster of the authorized performance of a copyrighted musical selection does little more than the mechanic who rigs an amplifier or loud speaker in a large auditorium to the end that persons in remote sections of the hall may hear what transpires on its stage. Such broadcasting merely gives the performer a larger audience and is not to be regarded as a separate and distinct performance of the copyrighted composition on the part of the broadcaster."

A CONFLICT

Thus it is apparent that the Federal District Courts are in conflict. It is generally admitted that most of the broadcasting performances are for profit—not for a direct gain, it is true, but for indirect profit, such as building up goodwill and maintaining the sale of receiving sets and parts. The owner of a broadcast station hopes, no matter what his business, to keep his name constantly before the public. The big problem is this: Is a broadcast performance a *public performance*, as intended by the framers of our Copyright Act?

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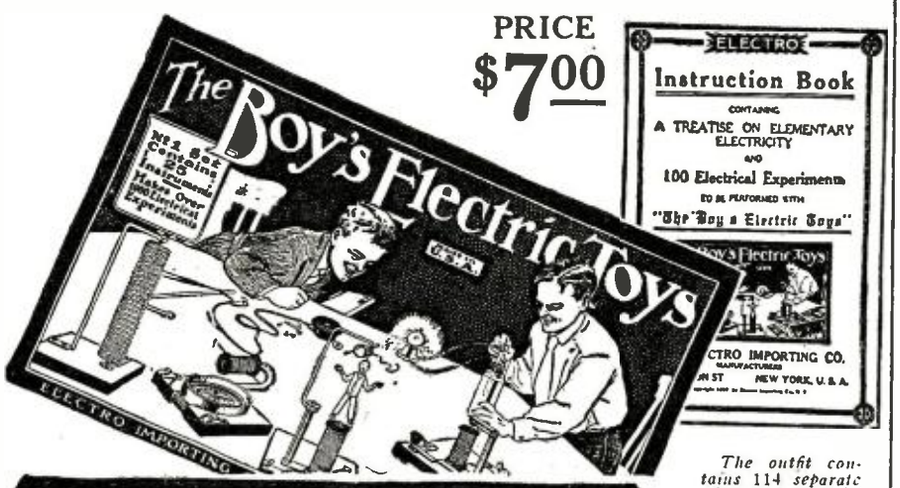

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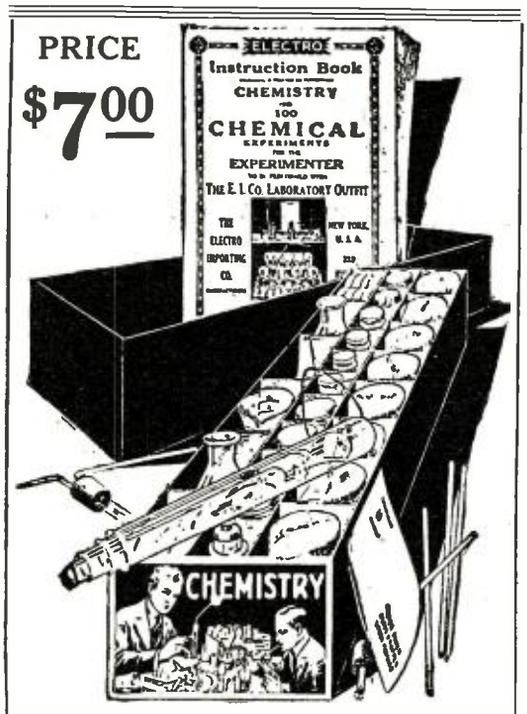

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The final adjudication of this question lies with the Supreme Court of the United States. The Copyright Law of 1909 is very general. It merely says "publicly perform for profit," without mentioning any specific type of performance. Congress evidently saw that a public performance of the future might not be the same as a performance in 1909, so it couched the statute in general terms. "It is a general rule," says Sutherland, in his book on Statutory Construction, section 589, "that courts must find the intent of the Legislature in the statute itself. Unless some ground can be found in the statute for restraining or enlarging the meaning of its general words they must receive a general construction; the courts cannot arbitrarily subtract from or add thereto."

Congress has power to regulate interstate commerce. The founders of our government probably never dreamed of the railroad, the telephone and telegraph, and the airplane, yet one by one these instrumentalities have been, and are being, subjected to Federal regulation under the Commerce Clause.

The settlement of the copyright problem is an important matter of public policy. The problem is legislative rather than judicial. It is up to Congress to determine the rights of the owner of the copyright. The Courts interpret the law as it is, but Congress may change a statute so as to include broadcasting, if the courts say it is not included, or so as to exempt broadcasting, if the Supreme Court should decide that it is covered by the present law.

In order to settle this question, Senator C. C. Dill, of Washington, introduced into the last Congress bill No. S2600, which was intended to amend the copyright law by exempting the radio and the telephone from the operation of its provisions. The important change in the law comes near the end of section I:

"And provided further, That the copyright control shall not extend to public performances, whether for profit or without profit, of musical compositions where such performance is made from printed or written sheets or by reproducing devices issued under the authority of the owner of the copyright, or by the use of the radio or telephone, or both."

Let us examine the effects of this bill. If it should be enacted I would have the right to purchase sheet music or a phonograph record and have it played in the public dining room, or in the auditorium of a theatre, or in a broadcast station without extra charge. The theory of the amendment is this: When I buy a sheet of music or the device for mechanical reproduction, I include in my purchase price an amount sufficient to pay the royalty accruing to the author or composer. He has already, then, received one fee, which is all the law ought to grant. It was never the intention of Congress that the composer should have the double right of selling his product to the public and then following it up and requiring further payment every time it is played in public. This is the theory and purport of the bill.

THE BILL'S ARGUMENT

The arguments for this bill may be briefly summarized as follows:

In the first place it will free radio broadcasting. On account of the great expense, the lack of direct income, and the instability of this new public utility, the proprietors of these stations cannot afford to pay royalties.

In the second place, it is unjust to permit the owner of a copyright to collect two fees for the same service. The owner of the copyright has already gotten his just desert from the royalty included in the price of the record or sheet of music.

Broadcasting a new piece of music tends

to advertise it and to stimulate its sales. Since the owner of the copyright suffers no loss, and probably gains by the act of broadcasting, he should receive no extra compensation.

If the owners of copyrights are allowed to make this extra charge the effect will be cumulative. For example, how about the bootblack who places a radio receiving set in his shoe shining parlor for the enjoyment of his customers? Here, again, would be another public performance for profit. Surely, the advocates of the Dill bill say, the 1909 law cannot be intended to have such far-reaching effects.

But, the opponents of the Dill bill argue, whether broadcasting helps or retards the sale of music is really beside the question. As Judge Lynch said in the Bamberger case:

"Our own opinion of the possibilities of advertising by radio leads us to the belief that the broadcasting of a newly copyrighted musical composition would greatly enhance the sales of the printed sheet. But the copyright owners and music publishers themselves are perhaps the best judges of the methods of popularizing musical selections. There may be various methods of bringing them to the attention of music lovers. It may be that one type of song is treated differently than a song of another type. But, be that as it may—the method, we think, is the privilege of the owner, he has the exclusive right to publish and vend, as well as to perform."

The owner's rights of copyright should be strengthened rather than weakened. Art, music and culture can be encouraged under our present state of society, by making special inducements to the authors. The private property rights in copyright should be maintained on a sound basis.

Against the passage of this bill the opponents argue:

Broadcasting should be placed on a sound economic basis so that royalties can be paid. Our big problem at the present time is the determination of who shall pay and how. If some adequate way of compensation were devised so that there would be a proper balance between the broadcaster's income and expenditure, the broadcast stations could afford to pay royalties to the owners of the copyrights.

This is not a case of two fees for the same service, but of two fees for two different services. If I buy a sheet of music, the opponents maintain, and have it played at a private entertainment for my friends or relatives or at a public non-profit performance, I have paid one royalty charge. In return for that I acquire the privilege of reading the physical notes from the physical paper and transforming them into things spiritual and mental. If I had not bought this sheet, this transformation could not have taken place. This is service number one.

Now, if I render that selection before the microphone of a broadcast station, the expenses of which I charge up to my general business costs, I am enabling many other people to hear it who otherwise would not have had the opportunity, unless they had purchased the sheet. This is service number two, for which an extra payment is legitimate.

As to the question whether broadcasting helps or hinders the sale of sheet music or victrola records, it must be admitted that it is difficult to decide. The evidence is strong that the recent McCormack-Bori broadcast concert has stimulated the sale of Victor records. A considerable number of music publishers state that they have received orders for sheet music, which can only be explained by the fact that the purchasers have had their interest aroused by hearing these songs on the radio. Some of the

theatre owners and music publishers apparently forget that the advent of radio will multiply popular interest in music, and that in the future there will undoubtedly be room for both.

Radio in the Cave Disaster

(*Continued from page 2073*)

splice between this point and the lamp, the amplifier was turned on. My idea was that if there was a loose connection on the lamp socket on Collins' chest, that being looped in series with the primary of the amplifying transformer, dry cells and milliameter, any move he might make or even his breathing would move the socket enough to make a break or partial break in loose socket connection, which would be stepped up through the transformer and amplifier and make a sound in the head set.

The first day of this test (February 8) sounds were heard at times as if the socket were being moved, but the milliammeter showed the circuit closed most of the day. The second day the milliammeter showed that the connection at the lamp socket was not so good, and the head-phones registered a steady click like the making and breaking of a connection from 18 to 22 times per minute. At times it would run up to 30 clicks a minute, and on the last day of test it slowed down to 12 per minute. For two days this sound continued without missing a time. Physicians who listened to this test with me, stated that these impulses or clicks corresponded with the normal respiration. There was no other sound heard from outside or any interference, as no detector was used. Everything was as still as death. All that could be heard was the regular click, click; only a few times a scratchy sound was made as though he had moved just a little. On the third night of this test, this circuit to the lamp on Collins became open. It seemed that the bulb was out or the connections broken and we failed to get any further results.

We had a man go as near Collins as possible and rub the wires together, moving them about to see if we could find another way to make this click, but it failed to make any sound and the steady click still came through when he returned. As there was no one in the cave beyond or between where we were testing and Collins at any time, only when this man was sent in to see if he could make the sound, and no outside interference that could have made this sound, it seems that it could not have been anything but Collins' breathing causing the lamp socket to rise and fall and make contact.

This is an authentic description of the test, as I furnished the apparatus, connected it up, and made the test personally. And no one else knows the circuit I used. This is the first time it has been given out.

Some newspapers made the false report when this test was first made that we could hear his heart beating, and other sounds that could not have been heard without a microphone instead of a light bulb.

The Radio Inauguration

(*Continued from page 2059*)

safe to say that something is interesting it exceedingly. And that is what happened on the above date. Restaurants were almost deserted until after 2 o'clock, for the vast invisible audience went hungry rather than miss a single word of the program.

Very few people who took such great pleasure in listening to the broadcasting of

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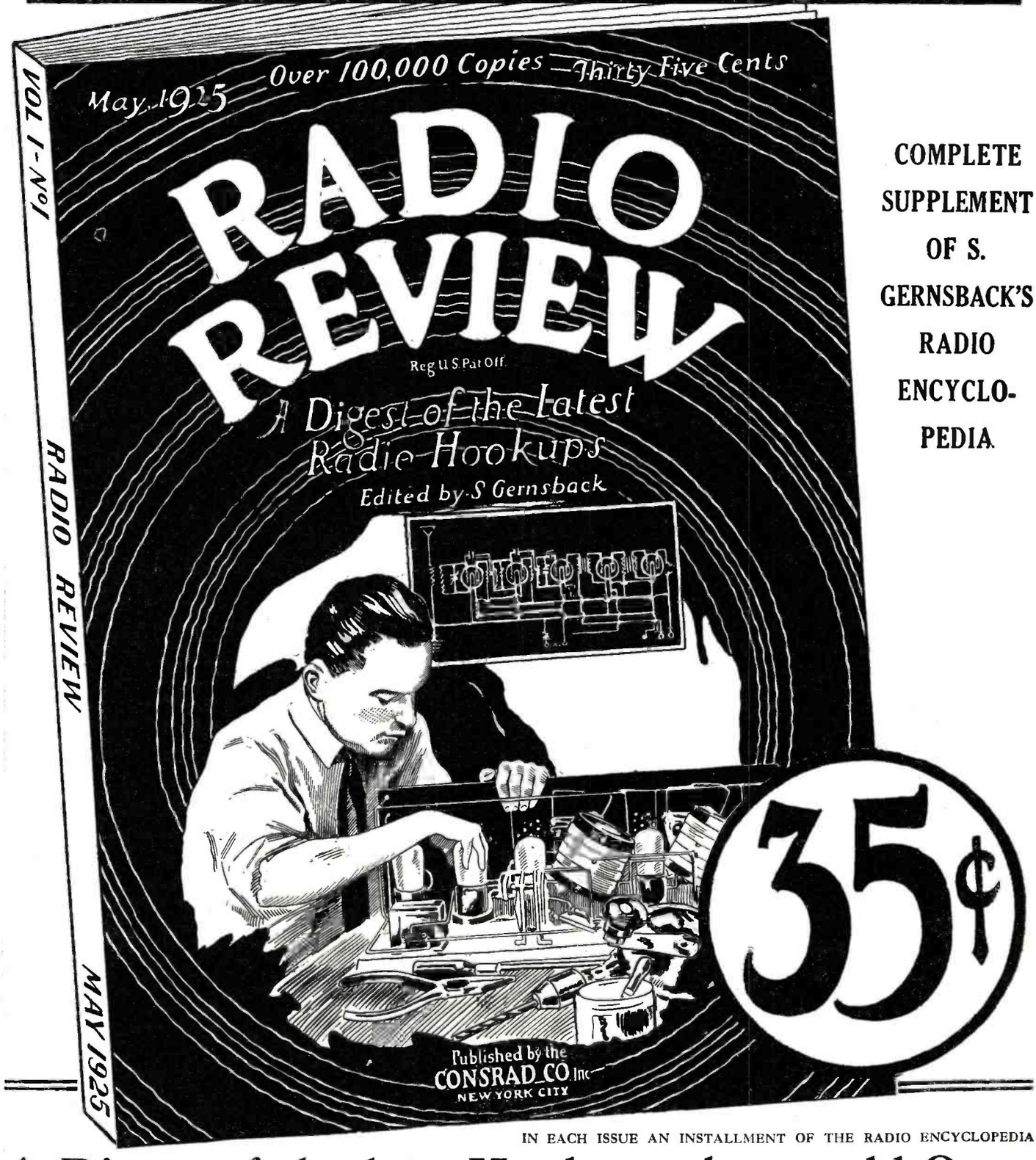

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such a program realized just how much labor was involved in the undertaking. After the speech was picked up by the microphone on the speaker's desk it went to controls under the platform, from which it was led to the power amplifiers in the telephone exchange. Here the signals were put on the land wires leading to the different stations throughout the country, where they were put on the air.

Very few people who were gathered around the platform in Washington noticed a very busy gentleman on the grounds, with a microphone strapped on his chest and a pair of phones on his ears. This gentleman was the monitor. He could plug in at will on any of the lines that left the platform and ascertain just in what manner the speech was going through. However, he was not the only one to watch to see that nothing interfered with the radio program. Every 200 miles of telephone lines had power amplifiers and at these points, too, were men who were performing the same duties of monitoring and watching. In case anything went wrong with a land wire, there were other wires available at an instant's notice, so there would be no break in the speech.

All these telephone lines had to be inspected thoroughly to see that they were in the best of working order. This, in itself, was a task that required weeks of patient labor and testing. In order that there should be no interference whatever from induction, static and all the other things that make the life of a telephone engineer miserable, special filters were installed in these lines to eliminate such interferences as far as possible. All this special apparatus had to be watched over with as much care and consideration as any other portion of the equipment.

This is really the first time that the fact that radio is more and more becoming a necessity to the country as a whole, has been demonstrated. As we have mentioned above, there have been other simultaneous broadcastings, but never has there been an event broadcast of such tremendous interest to the nation. Every citizen of the United States has a voice in the choice of a President and what could be of greater interest to every citizen than what the man he has elected presents in his inaugural speech? It is true that this speech is printed the following day in all the newspapers, but there is a personal touch in the radio reception that it is impossible to give in the papers.

The Month in Radio

(*Continued from page* 2065)

On the lonely ranges of Southwest Texas an aged sheepherder nightly listens to the musical concerts broadcast by radio sending stations in Dallas and Fort Worth, Texas. The sheepherder, according to a legend of the Big Bend district, drifted into the wilds of the border country years ago and has always been a man of mystery, but was known to entertain a great love for music. For almost 20 years the recluse followed the herds over the lonely foothills of the sheep country. With the perfection of radio the sheepherder one day ventured to El Paso and bought a receiving set. Now the old man sits in the evenings by his campfire in some western arroyo with only his dog for company and drinks deep of the art flashed to him through space.

Mrs. Miriam A. Ferguson, Governor of Texas, the world's most talked of woman, is a devoted radio enthusiast. When she entered the Governor's mansion at Austin as the first woman governor of the Lone Star State, one of her hobbies was radio.

"Ma" Ferguson took with her a receiving set which will permit her to listen in evenings and keep in touch with the world's happenings. The great Texas woman declares that her recent months have been so filled with activities that she has had but little time to read the newspapers. Therefore, she plans to substitute the bulletin news service of various broadcast stations of Texas newspapers. These crisp little pieces of news give all the big world and state happenings in condensed form and Mrs. Ferguson plans to make the most of the innovation.

Radio has reached the heart of the hardened border outlaw, according to a story told by Texas Rangers. A Ranger captain on duty in the Big Bend district declared that when he raided the rendezvous of a notorious band of Mexican bandits in an isolated box canyon near the Rio Grande, the robber gang fled in such haste that the camp fixtures were left behind. A radio receiving set was on a small table and the Ranger captain, picking up the ear pieces, listened to a dreamy waltz, tinged with the love and romance of Mexico, evidently played by some orchestra in the Southern republic.

Correspondence From Readers

(*Continued from page* 2106)

"For half an hour or so, Pickard and his accomplice sent rambling sentences, single words—anything they could think of handily to pound out into the ether. Pickard, however, was something of a poet and he called to mind Scott's 'Lady of the Lake.' No sooner had he begun to call up the lines in his memory he began to give the other operators listening in a lesson in English literature. Complete, it was, even to the capital letters at the beginning of the lines and the flourishes between the Cantos. When he tired, his pal, Shoemaker, filled the ether with English, not so classical as profanely expressive!"

I regret that I must deny this soft impeachment. In 1903 I was in Boston, working on radiotelephonic development in the laboratory of the American Telephone & Telegraph Company. In view of this fact, it is perhaps unnecessary to add that I loathe Scott, and have yet to complete my education by reading the "Lady of the Lake" in its entirety.

Will you be so kind as to publish this little correction? Possibly this will embolden the real etheric poet to come forward and take his laurels.

GREENLEAF W. PICKARD,
Newton Center, Mass.

BRITISH VS. AMERICAN BROADCASTING

Editor, RADIO NEWS:

It seems that in the March, 1924, issue of RADIO NEWS you published an editorial which aroused the ire of one Mr. Bayes who resides at 48 Lavender Gardens, London, S.W., England.

In the June, 1924, issue of your publication you printed a letter written by Mr. Bayes, which severely criticized your editorial, and American broadcasting in particular. In your September, 1924, issue you published my letter which attempted, in a small way, to answer Mr. Bayes and incidentally to throw some light on English broadcasting as seen from a commercial operator's viewpoint at sea.

In the December, 1924, issue of RADIO NEWS, you published another letter from Mr. Bayes in which he replied to his critics

using his customary sledge-hammer phraseology. In this letter of his he refers to me as being a "First-class distorter of the truth" and he also says: "I have no peeve against the Yanks, but I have against those who lie about my country." He didn't exactly call me a liar, but it wouldn't have been any worse if he had said so in less uncertain terms. Permit me to say that I am not at all offended by his remarks, but would wish to ask you as well as Mr. Bayes to kindly look up the facts referred to and learn if I told the truth or not. I will then not fear the final verdict.

I have now made my sixth and last trip to England aboard this vessel and have had a fair opportunity to observe British radio, both broadcasting and commercial. I have purchased considerable radio apparatus in British stores, worked their commercial land stations and listened attentively to the oscillations of the B.B.C. I also purchase all the wireless magazines on sale at public places and read them quite thoroughly. I might say that I have also worked many British vessels and have visited the radio room of a few of them. These remarks are merely to give you a background to judge whether or not I am capable of judging, even in a small way, the efficiency and modernness of British radio.

First of all I would like to compare some results obtained by me in listening to American broadcast stations from the time our vessel left San Pedro, Calif., until it was close to Britain's shores, with those obtained in listening to British stations. On leaving San Pedro I clearly and distinctly heard WTAM, of Cleveland; KYW, of Chicago, and KFKX, of Hastings, Nebr. These stations were heard when less than twenty-five miles from San Pedro breakwater. On the way down the west coast of Mexico and Central America I distinctly and clearly heard all the principal stations of the west coast such as KHJ, KPO, KGO, KFI and the station at Calgary, Canada. Several stations in Texas, KSD, of St. Louis, and another at Kansas City, all came in loudly and clearly on the SE 1420 U. S. Navy type receiver. Every night down the west coast until less than 1,000 miles N.W. of Balboa I heard from one to five stations located more than 2,000 miles from our ship.

On account of static no further effort was made to hear music until about 250 miles N.E. of Colon while in the Caribbean Sea. I then began again to listen to American broadcast stations. From this time on, until our ship was within less than 500 miles of London, I clearly and distinctly heard from one to six American broadcast stations each evening. The nearest point to American soil was about 1,500 nautical miles and the farthest was about 2,500. When one realizes the fact that our course was almost directly up the middle of the Atlantic and such a long way from most of the high class stations, the record is not a bad one. For three or four nights we were in the midst of a heavy gale which swept the North Atlantic and rocked our ship badly, but in spite of the heavy rolling KDKA and WBZ, as well as WGY, came in quite loudly and clearly 2,500 nautical miles away. One night we heard Kansas City and on another Davenport.

I do not mention the above in order to brag about what was accomplished, but merely to show that my receiver was in good working condition, and I believe it indicates to a liberal mind that if British broadcast stations radiated energy as well as American stations, I could have heard them about as far. I see no reason why a British station should not carry as well out into the Atlantic in a westerly direction as an American station does in an easterly direction, but they do not seem to.

I was able to hear the carrier wave of

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5XX, the British station at Chelmsford, at a distance of 2,100 nautical miles, but speech at this distance was not audible. When at a distance of 1,800 miles, the words of the announcer could be distinguished but the signals were weak. At a distance of 1,500 miles the voice and music were received quite well, but I believe not as loudly as WGY, KDKA and other American stations when 2,500 miles away. This seems very peculiar, owing to the fact that 5XX uses 25 kilowatts of power, while the highest powered American station is listed in the U. S. Government radio call book as one kilowatt. I might add that I made a special effort to receive this station at distances greater than those mentioned, but found it utterly impossible to do so.

Just why British broadcast stations use so much power and radiate such a small quantity into space is an enigma to me. But I am strongly suspicious that it may possibly be due to the poor quality of the apparatus, the type of circuit used, or perhaps inefficiency in the operating personnel. The chief engineer of the B. B. C., Capt. P. P. Eckersley, said in your December issue that the chief difference between American and British broadcasting lies on the technical side. I think everyone who has attempted to listen to an English broadcast station at an appreciable distance will agree with him in that statement. There is a technical difference, and it probably accounts for the poor radiation of English stations. Capt. Eckersley said in the same issue of your magazine that radio engineers are agreed that 30 or 40 miles is about as far as one can hear music when the transmitting station is using one and one-half kilowatts of power. He said this is as far as you can hear it so as to enjoy it.

In RADIO NEWS for September, 1923, Dr. J. A. Fleming said that a ½ k.w. transmitter gives a range of 100 miles in daylight. In the article referred to, Prof. Fleming was writing and describing a Marconi tube radiophone and C.W. transmitter. In my letter published in the September, 1924, issue of RADIO NEWS I quoted from the Harmsworth Encyclopedia, showing that 520 miles was the greatest range that British scientists expected to get from the best of receiving sets. Mr. Bayes took me severely to task for quoting this authority, claiming it was no authority and that I knew it, nevertheless Sir Oliver Lodge is a consulting editor and Dr. J. A. Fleming is a contributing editor. On page 5, of British *Radio*, the wireless quarterly, the writer has this to say: "I propose to describe in this article a simple four-valve receiver which can be relied upon to give excellent loud speaker reproduction at moderate ranges, say, up to 30 or 40 miles from any one of the main broadcast stations." Just think of it, using four valves while the transmitter is using 1½ k.w. to 6 k.w., and 5XX uses 25 k.w., and then being able to get good results only 30 to 40 miles. I say now, as I said before, that something must be wrong with British radio. A new station is now under construction at Daventry which will consume 100 k.w. of power and perhaps when it is finished one will be able to hear it as far as an American 500-watt station, but I sincerely doubt if it will at all excel it.

The plain truth of the matter is that European stations do not radiate energy as well as American stations. They consume much more power and cannot be heard half as far. When it comes to listening to 2LO and other British short wave stations, it isn't worth the trouble unless you are less than 1,000 miles away. In fact, I still stick to the 520 miles as being a good distance for 2LO where you can really enjoy the music. At greater distances the difficulty in tuning him in and the weak signals are not worth the effort involved. It is possible to hear him further and I am willing to admit this,

but for distances much over 500 miles 2LO is not worth listening to and I am willing to wager that everyone who has attempted to with an ordinary receiver will admit this truth.

As far as my experience goes the British stations are the best in Europe, and that is about all the praise one can offer. No fault can be found with the quality and tone, and the programs are quite good as a rule. They have improved greatly during the past year. The long delays between items on the program are an annoyance and a nuisance and should be abolished. The announcers are altogether too brief in their remarks and not as capable as the average American announcer.

If the harmonics of the high-powered stations of English were abolished, much less interference would be experienced. I heard the harmonic of GBL on 2,200 meters 450 miles west of the Isle of Wight and GBL is supposed to work on 12,200 meters. I heard the harmonic of GKU on 450 meters about the same distance and GKU is supposed to radiate on 2,100 meters. YN is another bad offender, but he is a Frenchman. 5XX is also a bad offender. I heard one of his harmonics on 450 meters, 245 miles west of Southampton. It seems to me that if British radio control were as efficient as Mr. Bayes claims it is, the G. P. O. would see that these stations were improved.

If you read an English magazine and desire some information on radio, it will cost you two shillings and six pence (about 60 cents). British radio publications do not give out information free of charge. If you think British radio apparatus is comparable to American, take a look at the British tube socket, the clumsiest piece of apparatus you can imagine. Great care must be exercised or the filament will be burned out by the high tension battery owing to the fact that you can't tell how to insert the tube until you have tried every one of the four different ways of how it might go. One type of Brown phone has a resistance of 120 ohms and sells for 22 shillings and 6 pence or a little over $5. These phones have a crude metallic head piece which pulls your hair and are anything but comfortable. The better type of Brown phone sells for 58 and 62 shillings or nearly $15. Again the idea of mounting tubes on the outside of the cabinet is a poor one which destroys the beauty effect, if there perchance should be any, and besides leaves them exposed to breakage.

Just where the British stand in commercial radio can be imagined when one looks for a Radio Beacon on a foggy night. You will appreciate this if you happen to be a commercial operator. It is a rainy, foggy night and the compass stations are all busy (both of them) and the captain wants to know the ship's position. On board we have the latest marine safety device, the Kolster Radio Direction finder using six tubes. We are entering the channel after three days of heavy gale and no sun to "shoot." I tune and tune in vain to find a radio beacon working and I conclude they don't have them over there yet. The best I can do is to wait until FFU and GLD begin working and I get the best bearing I can from their signals. Compare this situation to the numerous automatic transmitters around both American coasts which make it possible to get a bearing at any time during foggy or rainy weather. In commercial radio as well as in broadcasting, my dear Mr. Bayes, you are a little behind the times.

If you are a commercial operator and the crowd aboard is desirous of press, what are you going to do to get it? If you are a "pirate" you may steal it from WCC if he is not too weak to copy, or you might steal it from GBL's paid press, or you can copy his CQ, all of which is wholly about the British Parliament. Luckily in good weather

we can copy American stations all the way across and thus get the news of the world. NBA can be copied all the way to England if there isn't too much QRM. In good weather NAA can be copied nearly all the way over.

If the British postoffice is as efficient as Mr. Bayes claims, why does it not pull down the antiquated spark stations and erect a few modern tube transmitters to take the place of GCK, GLD, GNI, GNF and others which are nothing more nor less than rock crushers. Where, in Europe, is there a station at all comparable to WSC or WIM? Where, in Europe, is there a station that can compare to WCC for quick and efficient handling of commercial traffic? Where are your stations which compare to the new WSH or KS? I might also mention KPH and KOK, WNU, WAX and a host of other notable American stations which are equipped with modern apparatus and handle much long distance communication. Mr. Bayes, your stations are far behind any of these. British stations are using the old spark transmitters in a locality where interference is the worst of any place on earth. If the G. P. O. had any desire to improve the situation in the Channel, it would or should begin on the spark transmitters.

The latest Marconi spark transmitter is equipped with a spark coil for an emergency apparatus, the most inefficient and unreliable piece of mechanism used in radio. It uses the transmitting inductance as part of the receiving set. I visited a British vessel where one of these had recently been installed and was told that it was one of Marconi's latest in sparks. Mr. Bayes claims that British apparatus can be compared to American and demands the receiving set I offered to give him if he could honestly say that British commercial radio apparatus was equal to American. He tells me in December RADIO NEWS that he will accept a Super-Heterodyne.

I was rather surprised to read what Mr. Bayes said in his December letter to your magazine, but was most astonishingly surprised by his requesting an *American* Super-Heterodyne. After writing several letters to your magazine criticizing American methods and claiming British goods were superior, he makes known to you and your host of readers that he would like to have an American receiving set. I offered to give him this set out of my own funds without his having to prove, only to assert, that British commercial radio sets were comparable to American. I would just as soon have purchased a British or Dutch set, using some of those "good" dollar tubes which he praises so highly, instead of annoying him with a 10-tube Super-Heterodyne. I can't understand why he chose an American when British are equal, if not actually superior, to the American sets, as he claims. It may perhaps be that he is "talking through his hat" and doesn't mean exactly what he says. At any rate, I have enjoyed the discussion and will assure him that I have no peeve against the British, simply because they are a little behind the times.

FRED M. HOWE.
Radio Operator S.S. Emidio.
San Pedro, Calif.

Push-Pull Amplifiers with Standard Parts

(*Continued from page* 2095)

Practically no current flows through the grid circuits of the tubes, so the potentiometer method of getting the mid-point between the two grids is available. This potentiometer is made up of two half-meg-

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The Battle of the Colors

One of the most brilliant effects that has ever been produced on a screen is presented in a New York play. This remarkable new chemical optical effect is produced in the following manner: A light from an incandescent bulb or other source is concentrated through lenses and reflected by mirrors in conjunction with a small container that is filled with water, mixtures of analine dyes and some oily vehicle are ejected from syringes to the surface of this water. These dyes when freshly prepared do not mix with each other but perform weird gyrations on the surface of the water, thus producing a veritable battle of colors on the screen.

This novel and interesting effect is but one of the thousands of odd scientific developments explained in the April issue of SCIENCE AND INVENTION. Ask your news dealer to let you see a copy the next time you pass his stand.

The Experimenter Publishing Co., Inc.

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ohm grid leaks connected in series, their outer ends connected to the two grids, and their junction to the — terminal of the "C" battery and through the latter to the filaments. The secondary of any good audio transformer is connected to the two grids, and the trick is done.

If you look at the windings of a head receiver or of any loud speaker of the iron diaphragm type which has two coils, you will see that the coils are connected by a little soldered pigtail. This is the mid-point of the whole winding, and it can be used in just the same way as the mid-tap of an output transformer. Connect it to the positive end of the "B" battery, the plate of one tube to the end of one coil and the plate of the other tube to the end of the other coil. Current will flow from the battery through one coil to the plate of one tube, and in so doing, will aid, let us say, the permanent magnet in creating a magnetic pull on the diaphragm. Current will also flow from the battery through the other coil to the plate of the other tube, but this time it will oppose the permanent magnetism. Suppose that the audio wave makes the first grid more positive; more current will flow through the first coil, and increase its assistance to the permanent magnet of the speaker. Result: more pull on the diaphragm; it moves toward the magnets. At the same instant, the second tube's grid becomes more negative; less current flows through its coil, and its opposition lessens. Result: again more pull on the diaphragm. So the loud speaker coils cause the outputs of the two tubes to add up their energy and give louder signals.

LOUD SPEAKER CONNECTIONS

It has just been said that the steady flow of "B" battery current in one coil opposes the magnetic effect of the current in the other. The two effects are equal and opposite, and hence cannot demagnetize the permanent magnet. This is a danger in the usual amplifier connection (speaker in series with battery and plate) which calls for care in connecting the proper speaker terminal to the battery lead. There is no "proper" terminal in this new hook-up; either terminal goes to either plate, and the battery goes to the connection between the two coils.

This hook-up may be used with any loud speaker which has two coils in the voice circuit. In some cases, where the inter-coil lead is covered with braid, a little delicacy is needed to remove the braid without cutting the wire. The writer has found that an old safety razor blade, broken obliquely to give a sharp corner, is ideal for the job. After carefully slitting the insulation, it is pulled back and the wire inside served with a drop of solder from a soldering iron. Then a piece of stranded wire is soldered on, and led to a terminal, whence a lead is taken to the + 90-volt terminal of the set.

To compare this method with one of the standard two-transformer circuits, the writer built it up, as shown in the photograph. The parts were those which happened to be on hand and are evident when recourse is made to the diagram.

For test purposes, a Neutrodyne receiver was used whose last stage was a push-pull amplifier using a pair of well-known transformers. A two-circuit jack just ahead of this stage allowed the output of the first stage to be diverted to the special amplifier. The same tubes, filament current, and "B" battery were used in each amplifier. The same loud speaker was used. When on the regular amplifier, the extra lead was left dead. No difference in tone quality or volume could be noticed between the two circuits, yet the second represented a saving of at least $5, and several square inches of valuable back-of-panel space.

In conclusion, it might be well to add that a push-pull amplifier will not "show its stuff" unless the tubes are worked hard. This means 130 volts of "B" battery and nine volts of "C" battery. If you can get enough volume without distortion with 90 volts, or less, of "B" and a 4½-volt "C" battery, probably the conventional single tube will answer for the last stage. But even so, people are coming more and more to realize that a liberal margin of load capacity is just as desirable in a radio set as in an automobile, and they are more and more willing to ensure good quality by providing for it.

The Most Selective Set

(*Continued from page 2078*)

quency amplification using this method of coupling can be used, although the circuit must of necessity contain numerous controls. It is most desirable, however, to use the circuit of Fig. 2, with no further alterations, since exceptionally good results may be had with it.

The Life and Work of Lee DeForest

(*Continued from page 2067*)

papers announced over the signature of the Marconi Company that Mr. White had done nothing of the sort.

DeForest, as usual, had paid a great deal more attention to the development of the art than he had to the development of his personal fortune, so when the crash came he was almost as badly off financially as he was back in the hard days of 1901 and before.

He saw this, but failed to take it into serious consideration when he learned of the management of the company and of the methods it was beginning to employ for obtaining more money to tide them over the crisis. Instead of making his plans with care and attempting to salvage what rightfully belonged to him, he simply got himself wrought up with righteous anger, went into Mr. White's office, read the proverbial riot act, offered his resignation and then began to talk settlement. He asked for a license under all patents already assigned to the company, a quit claim deed to those in the process of granting and development and one thousand dollars in cash. The directors through Mr. White, their president, did not at first see their way clear to grant the cash portion of the settlement, but a little pursuasion on DeForest's part brought them to his point of view.

But hard luck seldom travels alone. DeForest retained a lawyer, one C. C. Higgins, to draw up the final papers, including the assignments and the claims. The company paid him the money and turned over the cash to him, taking his receipt on behalf of his client. Then he came to DeForest, handed over the papers and $500. DeForest asked about the remainder of the cash and the attorney said it had been retained as his fee!

FOR more than a year previously DeForest had been coquetting with the idea of a wireless telephone. While in the company and actively engaged in the technical supervision of all its stations and plants he had had little time for work of this nature. So as soon as he had severed relations with them and was free again to carry on his researches unmolested, he dived headlong into the solution of his newest problem—the construction of a wireless telephone.

The three-electrode tube was almost fully

developed for the time and so spared him time on those investigations.

The first attempt was made with the Poulsen arc. As all know, the chief trouble with an arc transmitter is to make it function efficiently on the shorter wave-lengths.

He constructed an arc, and after much time and worry had been spent in making it work on the wave-lengths generally in use, he began the long search for the most effective method of modulating the continuous—or undamped, as it was called then—output of the oscillator. Of course, the oscillating characteristics of the audion were not known at this time.

While in the midst of these researches he was, one day, in conference with D. McFarlan Moore, a savant in the construction of lighting devices and vacuum tubes, when Mr. Moore called Mr. DeForest's attention to an account in one of Nikola Tesla's books dealing with the operation of an arc in the flame of a gas light and its extreme efficiency and stability. DeForest decided immediately that possibly this would produce some results in the new wireless telephone he was then engaged in perfecting. Accordingly, when the conference was completed, DeForest rushed back to his new laboratory in the Parker Building—whence he had moved when he left the old DeForest Company—and proceeded to build the Tesla apparatus and attempt to modulate it. The results were much better than he expected at first.

He had tried the straight Poulsen arc, the arc in hydrogen and a number of adaptations made for the sake of keeping the arc steady and in oscillation. The new method proved the best of the lot.

Having found a way of producing undamped oscillations, he started work on adapting the modulator. He found with the new system that the most efficient location for it was in the ground lead of the antenna circuit.

It was on the last day of the year that the first speech was transmitted across his laboratory, December 31, 1906.

After once having proved to himself that he was correct in his belief that telephony was entirely possible by wireless, he applied himself to the task with redoubled effort. The laboratory apparatus was of course bulky and heavy, hardly adaptable to commercial installation. So he set out to make its work practicable, that is, of sufficient strength and dependability for a commercial installation and to put it into a form which would be simple and rugged. Accordingly, he set about to find the proper form for the completed set.

The result was in the form of two cases with panels on top. In this form, they were made available to the public. The first installation of them was on a Lackawanna ferry boat on the Hudson River.

THE FERRY

One fine day in the latter part of May, 1907, the skipper of the *Bergen* received the surprise of his life when three men boarded his vessal, walked straight up the companion leading to the wheel-house deck, and did not even stop there. They went so far as to traverse his own sacred domain; they went directly into the fore wheel-house without knocking! Once inside, they dumped the bags—they looked suspiciously like plumbers' kits—on the floor unceremoniously, turned about and went below after another load.

Now, Hell itself has no fury like a ferry skipper whose dignity has been violated. So when DeForest and his assistants returned with the remainder of their apparatus to install the first moving wireless telephone station, the skipper treated them to some choice deep sea language, ending it with a lesson in sea etiquette.

It was not long, however, before they had installed a small generator in the engine room, connected it to the boiler and run the

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STATION 3BQ
Bon Hill, Victoria, Australia

The cover illustration, as shown here, is of a well known amateur short wave station. This is amateur station 3BQ, Bon Hill, Victoria, Australia, which has worked many U. S. A. and English amateur stations. The transmitter is supplied with 1500 volts through an electrolytic rectifier consisting of 104 jars. The tube is a Phillips Z4 operated at a normal plate current of 100 milliamperes. The aerial is a 50-foot five wire cage type suspended between two 80-foot masts. The remarkable work accomplished by this station and many similar stations throughout the world should stimulate the interest of our readers in amateur radio.

The EXPERIMENTER

Radio for the "Amateur"

The EXPERIMENTER concentrates its entire radio pages to the problems of the radio amateur, covering the real, practical problems of the day that affect the actual transmission and receiving apparatus of the Amateur Station.

The special feature of the April issue, shown on this page, is the complete construction and operation, in detail, of a practical short wave receiver.

The EXPERIMENTER is carried by all Newsstands. You can obtain a copy of the latest issue today.

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output wires to the cabin. The antenna was strung between the flag poles atop the ferry boat and the station was put into operation in the fore wheel-house.

The Lackawanna had erected a land station at the Hoboken terminal of the ferry and another at Twenty-third Street, Manhattan. These stations were put into operation, an operator installed on the ferry and the newspaper men invited to look over the works.

Communication was easy; the ferry station had ample power and the land stations were fairly pouring current into their antenna. The following Sunday the papers came out with full page spreads telling of the latest great advance of science, the radio telephone.

Incidentally, the skipper's feelings were assuaged when he saw the papers and saw his own photograph in spick and span uniform enjoying the place befitting a staunch sailorman.

"Black Listening is Theft"

(*Continued from page* 2045)

an obnoxious tax. Of course, it must be said that in the United States such a tax would be well nigh impossible, whereas in Europe the public has been educated to heavy taxes and gracefully submits to them as a rule.

RADIO NEWS has no interest in the matter except that it sincerely believes that if the ether is free for all, radio can expand in a normal manner. And if that happens, within less than twenty years people over the entire world will be able to converse freely with each other and will then be able to understand each other, which they do not today. And once nations understand each other, wars will become only a remote possibility.

An Efficient Crystal Detector

(*Continued from page* 2082)

inch short. F is now mounted in position, with the two No. 6 R.H. brass screws one inch long. Place the camshaft bearing M in position under the arm A at the end near the crystal cup, put the cam and shaft in place, arranging M so that it will be about ⅛ inch from the end of the arm A. Clamp M in place and mark its position. Drill and countersink the base for a 6/32 clearance and bore and tap the block M for the same size thread. M may now be fastened to the base. Replace the camshaft and so fit the knob N that there is no end play in the system. The base is drilled for the fastening screws of the two binding posts which are placed an inch apart in the positions shown.

The strip C with its needle guide and spring is attached to the arm A with the 4-36 screw K, placing a washer under C and one under the head of the screw. Under this same screw K is fastened the flexible lead P from the left-hand binding post. Place the crystal cup in position and mark. Drill and tap for a 6/32 screw. Countersink the hole in the cup for the flat-headed screw. Before screwing the cup in place, cut a strip of thin copper or brass ¼ of an inch wide equal in length to the distance be-

tween the crystal cup and the nearest binding post. This strip is screwed under the cup and binding post and acts as a connection between the two. It is necessary that the screw holding the crystal cup fit tightly in the base, otherwise the cup might be loosened when it is rotated to bring a new portion of the crystal under the needle. The flexible lead P is then secured under the other binding post.

To place the phonograph needle (which should be a long one) in its spring holder, insert it from the top, point downwards until its top is flush with the top of the small diameter of the spring. If the spring has been wound according to the above instructions, it will be found that the small diameter of the spring rests on the top of the needle guide and so allows the needle to be pushed into position without injuring the spring. When replacing the needle, which should be done frequently, pull the needle out by the point with a pair of pliers; *never* pull it back up through the guide. It will ruin the spring if this is done. The spring should be stretched *slightly* so that there is a small amount of travel downwards, thus giving the needle the floating action referred to above.

The felt is then glued to the base. This together with the method of holding and adjusting the needle makes a crystal detector that is not easily jarred out of adjustment.

Radio in 1935

(*Continued from page 2051*)

LOUD SPEAKERS

As long as telephone receivers were good enough to listen-in to radio, some little headway was made in making receivers more sensitive for faint sounds, but suddenly the public demanded loud speakers. Up to that time not a great amount of original research work along these lines had been done. So our good old friends, the telephone receivers, were pressed into service, to fill a duty for which they were not at all suited. Filling one's ear with music by means of a small telephone receiver is one thing, and filling a room full of music from the same sort of a receiver is a totally different problem. Naturally, our present-day loud speakers, which have as their basis the telephone receiver principle, are all faulty and have helped, more than anything else, to bring radio into disfavor, due to their squawking and unnatural nasal sounds. In other words, the loud speaker today is the weakest part of a radio receiving set. The few loud speakers made which do not work on telephone receiver principles are, as a rule, much superior, but even the present-day loud speakers are not what we shall use in 1935. As a matter of fact, the writer predicts with certainty that anything that has a small iron diaphragm, as have 90 per cent. of the loud speakers today, will not be used in 1935.

Imagine what happens to the small iron disc, measuring 2⅛ inches in diameter, when called upon to reproduce transmitted sounds from a 50-piece orchestra. This little diaphragm has to be drum, violin, saxophone, oboe, flute, trombone, 'cello, cornet and piano all at the same time. Manifestly, it is impossible to get the one diaphragm to vibrate in such a fashion as to produce not only all the tone values, but all of the overtones simultaneously. As a matter of fact, it never happens. All we do get is an "average" of these sounds. Hence the distortion, and squawky reproduction.

The loud speaker of 1935 will not have a diaphragm at all. On our front cover the writer has pictured a talking, gaseous lamp, the sounds emanating from the glass walls of the luminous body of the lamp. This is not a wild prediction either, because it can be done this very minute. In RADIO NEWS

Laboratories we have made 110-volt incandescent lamps speak and sing—and everybody has heard of the singing arc lamp. In neither of these are diaphragms used. Then there is also the Peukert Talking Dynamo principle, as pictured in these pages. Here we have a wire wound upon a steel magnet which, when mounted upon a resonant base, becomes a wonderful loud speaker. The effect here is had through molecular action. No diaphragm is used here either. These are only a few principles. There may be many more which have as yet not been discovered. But you may rest assured that in 1935 you will not be able to tell the difference between the singer's voice when singing over the radio and actually hearing her on the stage. The chances are, in fact, that you will hear her better by radio than from the stage, because if the transmission is perfect, you will be only a few feet away from the loud speaker, whereas in the theatre you may be 100 or more feet away from the singer.

THE SATURATION POINT

It is altogether probable that in 1935 the saturation point of radio will have been approached. By that time anywhere from 25 to 35 million radio receiving outfits will be in operation in the United States. In putting down this figure, the writer has, of course, borne in mind that the population of the United States within 10 years will be greatly in excess of what it is now.

Rather than decreasing, the number of radio broadcast stations will probably keep on increasing during the next few years. At that time we shall also have moving broadcast stations, as, for instance, stations on board ships, stations on board airships and airplanes, for commercial and semi-commercial purposes. Every rich man's automobile will have its radio transmission and receiving station to enable him to keep in direct touch with his office.

As the writer mentioned at the start of this article, all of the views expressed herein are very conservative. The chances are overwhelming that progress will be a great deal faster and a great deal more wonderful than the few predictions made in these pages would indicate.

A Noiseless Intermediate Amplifier

(*Continued from page* 2079)

However, since the trap circuit is tuned exactly to the intermediate frequency which it is desired to pass, an infinite resistance is created and the desired signal prefers rather to travel on toward the grid of the next tube. Thus it is seen that all the extraneous currents traveling along with the signal on account of the broadness in tuning of the first circuit or due to other causes, are eliminated, thus making the set much more selective.

The same line of action is repeated in the second resistance stage. The last two are of the usual transformer coupled type and are standard in every way. These are followed by the second detector and two audio stages.

Constructed in RADIO NEWS Laboratories, the set was found to work very well indeed. The only trouble encountered was in tuning the trap circuits, which was more tedium than actual trouble.

A glance at the photographs will at once show the proper method of arranging the parts on the baseboard. As the set is hardly one to be advised to the beginner, it is pictured here in the experimental stages. Though it may seem complicated, the man who has built a few of his own will encounter nothing in the present one to give him forebodings.

The detector and oscillator are of the standard type. The tuning coil A may be made by winding 64 turns of No. 18 S.C.C. wire on a 3-inch tube. The condensers F and E are both of the .0005 variety and are variable. The pick-up coil D may consist of 10 turns of No. 18 wound at the end of the oscillator inductance tube, which is also three inches in diameter. The plate and grid coils B and C for the oscillator may consist of 40 turns for the former and 64 for the latter, separated about half an inch from each other, on the tube.

Fifty kilocycles were selected as the best intermediate frequency at which to amplify, so of course it will be necessary to purchase three transformers designed for that frequency. And here it might not be amiss to note that, for the sake of efficiency, it is probably better to purchase these instruments than to attempt constructing them.

The condenser C_1 is used to tune the transformer secondary and if it is necessary, the manufacturer of the instrument will furnish a notation with it as to the proper value for this capacity.

The resistance R_1 is of 25,000 ohms value and is fixed. Since it is not in the least critical, any resistance which will fall within 20 per cent. of its rated value will suffice. The trap circuit consists of a 400-turn honeycomb coil shunted with a .001 variable condenser.

The resistances R_2 may be of about three megohms if the 199 or 299 type tubes are used. It will be noted from the photographs that this form of tube was used in the experiment. There was no mechanical or electrical reason for their use, however, and the 201A or 301A might serve as well.

In the hook-up no audio frequency is shown. Any type amplifier may be added at the output posts or incorporated in the set.

Latest Radio Patents

(*Continued from page 2107*)

formers and particularly to arrangements of this kind used in wave or wireless transmission systems.

This arrangement of the kind described comprises an oscillation producer, a wave radiator, a frequency multiplying transformer, a primary circuit including the oscillation producer and the primary of the transformer, a secondary circuit including a coil of the transformer, a disturbance elimination circuit, a coupling of variable effect between the secondary circuit and the disturbance of elimination circuit. and another coupling of variable effect between the disturbance elimination circuit and the wave radiator.

History of Radio Inventions

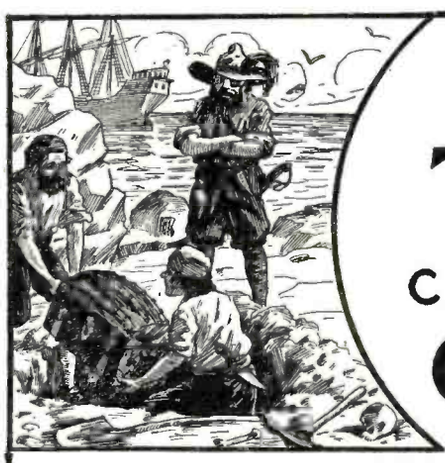
(*Continued from page 2049*)

In the same month Guglielmo Marconi filed an application for a patent on an invention whereby "electrical actions or manifestations are transmitted through the air, earth or water by means of electric oscillations of high frequency." The provisional specification which accompanied the application dealt chiefly with modifications in the Ruhmkorff coil, the coherer and coherer circuits, and associated tapper. For the "greatest possible distance" of communication, it recommended the use of reflectors at the transmitter and receiver.

In September, Nikola Tesla filed an application for a British patent on "Improvements relating to the Production, Regulation and Utilization of Electric Currents of High Frequency, and to Apparatus therefor," the latter of which included the synchronous rotary discharger. The application was accepted on November 21, whereupon was disclosed a method of producing radio frequency oscillations, which was the most approved for 20 years. (Br. Pat. 20,981/96.)

NOTE.—In this year, also, Professor C. W. Röntgen discovered the X-rays.

(*To be continued*)



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Radio—(Continued)

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It not only keeps out the other station that is causing the interference, but it also seems to act as a clarifier of the incoming station.
(Signed)
W.E.Wiltso.

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EDITORS write: RADIO NEWS: "...should prove of value to fans who wish to keep an accurate record..." RADIO JOURNAL: "...In a word, they have hit upon a way to make a national game out of logging the DX." RADIO DOINGS: "...feel sure that its users will find it of great help in logging stations." Published by RADIO CHART BUREAU, 2nd Floor Patterson Bldg., FRESNO, CALIFORNIA. Dealers' Liberal Discount, from 1 dozen on, C. O. D.

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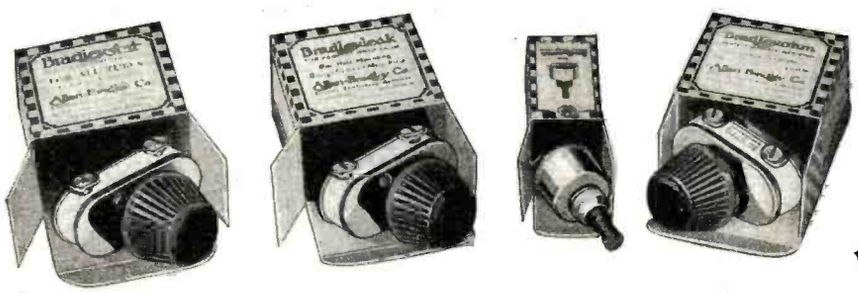

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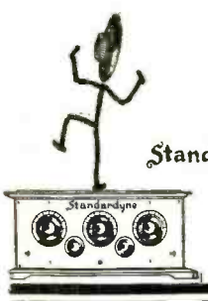

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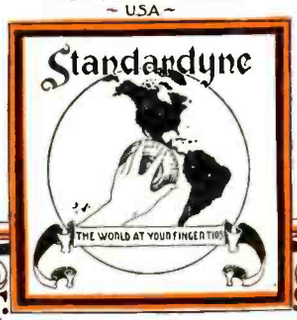

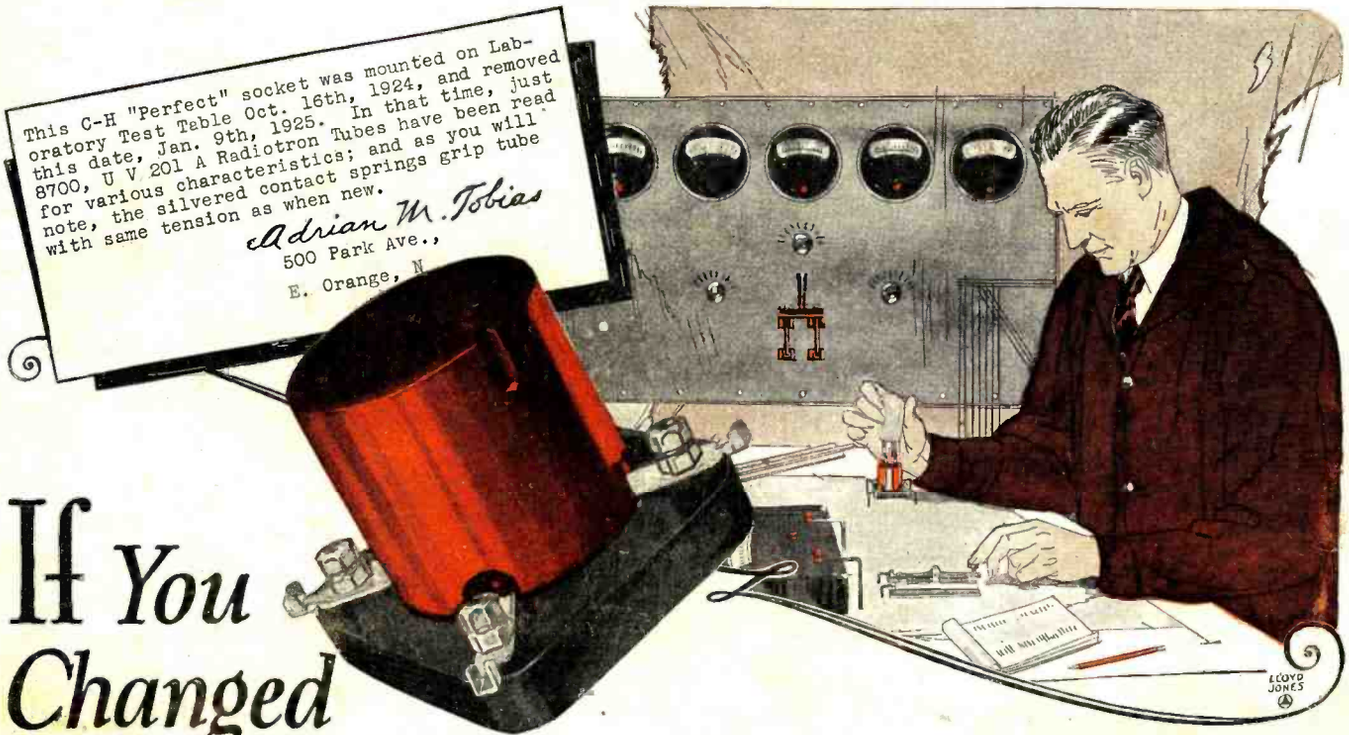

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