Radio Tubes

The Standard Tube of the World for

Radio Reception

The Radio Tube, through radio telephony and public broadcasting, has been largely instrumental in establishing the new and increased interest to humanity attuned to Radio. This tremendous progress in Radio has brought about the development of radio receiving sets resulting in clearer reception of voice and music throughout the broadcast world.

Cunningham Radio Tubes are the product of years of research and experimental work by the engineers of that great scientific organization, the Research Laboratory of the General Electric Company.

There is a Cunningham Radio Tube designed to meet the requirements of your particular set — ask your dealer.

PATENT NOTICE

Cunningham tubes are covered by patents dated 2-18-06, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending. Licensed only for amateur, experimental and entertainment use in radio communication. Any other use will be an infringement.

Cunningham 40-page Data Book fully explaining care and operation of Radio Tubes now available by sending 10¢ in stamps to San Francisco office.

HOME OFFICE: 182 Second Street
SAN FRANCISCO

Branch Office
Chicago

Branch Office
New York

PRICES ON
Cunningham Radio Tubes

Now in Effect
C-299 - 3 Volt 0.6 amp. Filament... $1.00
C-300 - 5 Volt 0.6 amp. Dry Battery Det. and Base... $1.00
C-300 - 3 Volt Gas Detector... $1.00
C-11 - 1.1 Volts 25 amp. Dry Battery Det. and Base... $1.00
C-12 - Similar to C-11 with standard base... $1.00
The Phones with the New Idea

N & K Head Sets mark a new era in radio reproduction—an era of clarity and naturalness. Designed especially for the reception of musical tones, they record the entire range of the human voice and of musical instruments with extreme clarity and freedom from distortion. This is due to mechanical design different from that of any head set produced in America. And to an extremely careful quality of craftsmanship almost impossible to obtain in this country.

Sold on a comparison basis

If, when you use N & K Phones on your own radio set, you do not find that they reproduce all the tones more clearly and naturally than any set you ever used before, and if they do not fit more comfortably, the store where you bought them will refund your money, promptly and cheerfully. We protect dealers and replace any returned phones.

N & K Head Set, Model D, 4000 ohms, has extra large diaphragms and ear caps, insuring better reproduction, better comfort and the exclusion of outside noises. Sanitary, leather-covered head bands. Six feet of stout cord. Retail price $8.50.

Write for "The Phones the Fans Are Talking About," interesting new descriptive folder.

TH. GOLDSCHMIDT CORPORATION
Dept. R7, 15 William St., NEW YORK
Exclusive Distributors for United States, Canada and Mexico

DEALERS: N & K Phones provide the high spot in the radio stocks of dealers all over America. Backed by advertising and strong sales cooperation, they are proving attractive profit-makers. Packed in cartons of ten, with display material and literature.
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CHANGE OF ADDRESS: Notify us as far in advance as possible. It is necessary to send us a change of address on our records. Always write distinctly and remember that if you change your address, you must notify us at least one week before the change is to be effective. Always write distinctly and remember that if you change your address, you must notify us at least one week before the change is to be effective.
"The Sage attends to the inner and not to the outer."  
—Lao Tzu

The wise buyer of a radio receiver is not misled; he looks inside the cabinet.

CLOSE inspection of many receivers reveals but one large shield to prevent body-capacity effects. As a result of research, each tuning control on a GREBE Receiver has its own aluminum shield of special size and shape.

This is just one of many details of craftsmanship which make for the high efficiency of GREBE Receivers.

Ask your Dealer or write us.

A. H. GREBE & CO., Inc.  
Van Wyck Blvd.  Richmond Hill, N. Y.  
Western Branch: 451 East 3rd Street, Los Angeles, Cal.
Radio News for July, 1924

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.

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 advertised in the issue of RADIO NEWS.

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List here specific article on which you wish literature.

If Catalogue of complete line is wanted, check in this column.

If you desire any special information from a manufacturer whose advertisement does not appear in this month's issue, use this space.

Your own name here

Address

City State
YOU SAVE MONEY WHEN YOU BUY FROM US
We Pay Transportation Charges in U.S. East of the Rockies

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must be exactly what you ordered. If not, return them to us, and we will refund the price you paid.

SUPERIOR 180° VARI-COUPLER

2291 Each... $4.10

A wonderful value. Baked in neoprene, resilient, rubber. Green silk wound on heavy rubber tubing. High gain mounting. Proven to be the most efficient ever built. Proven to produce the best results. Each 180° VARI-COUPLER is supplied with a female connector. A 12 month money back guarantee. Write for free sample.

2292 VARIOPLUG—same style. Each $1.10

SUPER MOUNTED VARI-COUPLER

2429 Each... $2.48

A made of rubber and molded, resilient, rubber. Dark blue silk covered wire. Large size green silk wound on heavy rubber tubing. No shorts or opens. Each SUPER MOUNTED VARI-COUPLER is supplied with a female connector. A 12 month money back guarantee. Write for free sample.

EXCEL MOUNTED VARI-COUPLER

2528 Each... $3.95

A made of rubber and molded, resilient, rubber. Dark blue silk covered wire. Large size green silk wound on heavy rubber tubing. No shorts or opens. Each EXCEL MOUNTED VARI-COUPLER is supplied with a female connector. A 12 month money back guarantee. Write for free sample.

SUPER VARI-METER

2529 Each... $5.60

A flexible molded rubber coupling. Light blue silk covered wire. Large size green silk wound on heavy rubber tubing. No shorts or opens. Each SUPER VARI-METER is supplied with a female connector. A 12 month money back guarantee. Write for free sample.

NEUTRODYNE TRANSFORMERS

2521 Each $1.75. Per set of three. $4.95

Excellent for use with any of our varicouplers. A set of three will give you the best results in any radio circuit. Each NEUTRODYNE TRANSFORMER is supplied with a female connector. A 12 month money back guarantee. Write for free sample.

COCKAODAY COILS

2390 Pcs... .00 Pcs... .00

Complete set coils for Cockadoway circuits. Precision calculated and made to give best results on any circuit.

NEUTRALIZING CONDENSERS

2392 Automatically adjustable

Fine, inexpensive, effective precision unit that will give you maximum results. Also suitable for use with our varicouplers. Each 2392 NEUTRALIZING CONDENSER includes 2 Whitehead Neutrodyne, 2 disc condensers, 2 set of instructions and lots of instructions.

STEREO STANDARD NEUTRODYNE PARTS

2393—2395 Two types

Include 2 Second Neutrodyne, 2 disc condensers, 2 set of instructions and lots of instructions.

BUILD YOUR SET BETTER—AT LOWER COST

THE BARAWIK CO.

102 South Canal St., Chicago, Ill.

Radio News for July, 1924
Radio News for July, 1924

WITH BARAWIK QUALITY RADIO GOODS

WE PAY TRANSPORTATION CHARGES IN U. S. EAST of the Rockies

PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY

THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PAYS THE ADDITIONAL COSTS TO THE BEST QUALITY, PERSONALLY TESTED AND OBTAINED by expert radio engineers. You are assured of getting guaranteed appar-atus that will give you full returns. And while our prices are low, our prices are low, our prices are low, your gain is our gain. Our good equal, and the customer is our sponsor. Our reputation is beyond doubt. The goods and our services, delivered by our own cars. Your guarantee is our best asset.

HOW TO ORDER.—Write your Order plainly. State Article Number. Description and Price of Model and Order. Credit Card, Check or Postage Stamp for Refund on Order. Prompt shipment is made when these directions are followed.

BAKELITE TUBE SOCKET
2109 Standard 3-prong. $3.75.
2108 Unplated. $3.50.
2106 BAKELITE TUBE SOCKET
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2102 Unplated. $3.50.
2101 BAKELITE TUBE SOCKET
2100 Standard 3-prong. $3.75.
Nationally Advertised.

RICO

The Mark of Guaranteed Products

THE BEST BY TEST

Sooner or later you will build your own and you will want the best. The "RICO" Kit is made of only the highest grade materials obtainable and manufactured under the supervision of Radio experts. It has been tested by 3 Radio Laboratories and passed by them. You therefore have the opinion of technical men to guide you in your selection. And the cost is not prohibitive—$15.00 complete.

"RICO" STRAIGHT LINE CONDENSER

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<th>All Types</th>
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<tr>
<td>No. 411 - Straight Line Condenser, .005</td>
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<tr>
<td>No. 412 - Straight Line Condenser, .0025</td>
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<tr>
<td>No. 416 - Straight Line Condenser, .001</td>
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Another "RICO" Product to help make a good circuit better. Made of unbreakable parts, Bakedite base, easy to adjust. Simply turn the knob. Extremely low capacity to give the best results. Tried, tested and approved by leading laboratories. This is the same neutralizing condenser contained in the famous RICO Tuned Radio Frequency Kit and is sold separately to meet the popular request of radio fans.

No. 205 Condenser each $0.50

WHEN A BETTER PRODUCT IS MADE, RICO WILL MAKE IT

DEALERS EVERYWHERE:

Consistent advertising in all leading periodicals is creating a tremendous demand for "RICO" Products. Write to us for our complete catalog and proposition of live wire merchandise at money making prices. In line to supply your trade with "RICO," the 100% guaranteed merchandise.

RICO RICO RICO RICO RICO RICO RICO RICO RICO RICO
EVERY STATION
Is Reproduced With Clarity
Tone and Volume
THROUGH THE
MARVELOUS
GRAND OPERA
LOUD SPEAKER
No 120
THE MASTER
OF THEM ALL
Proclaimed by users to be the
wonder of the age. You get so
much for so little when you con-
sider the price of this marvelous
loud speaker. Tunable and adjust-
able by means of the VOLUMETER
(Pat. Dec. 25, 1923) and no metal
can touch the diaphragm.
Like the waters of the brook
flowing gracefully on to the river,
so does the broadcasting come to
you through the throat of the
RICO GRAND OPERA.
No additional batteries are
required. Operates best on
two stages of amplification.
Insist on the GRAND OPERA.
If your dealer cannot supply you,
then order direct with coupon
below.

RICO GRAND OPERA
LOUD SPEAKER
No. 120
BLACK FINISH
24 IN. HIGH
LARGE BELL

WHEN A BETTER PRODUCT CAN BE MADE—RICO WILL MAKE IT!
ANY months of patient experiments and research tests under all possible conditions by masters of radio engineering have at last produced the perfect portable radio receiver—just in time for the out-of-door season.

Now you can have the finest possible radio reception—clear and loud, free from distortion, wherever you may go, best in camp—auto tours—at the seashore—in the mountains—on the lakes—at summer hotels—anywhere. Think of listening to this summer's political speeches while in camp or on your auto trip!

Monodyne PORTABLE Outfits

Technical Description
Model GT-20

The illustration shows the two tube model GT-20 portable Monodyne set. This set with telephone receivers will easily receive all broadcast within a range of 1,000 miles or more. Will operate a loud speaker within a radius of 100 miles with moderate volume. Only one control knob used, under ordinary conditions. New volume control shown in upper left hand corner for very fine regulation when receiving long distance. The outfit does not include phones, tubes or batteries.

The battery compartment is located underneath the instrument board. There is sufficient space to carry telephone receivers and aerial equipment. With the outfit is furnished FREE a complete aerial equipment. On the inside of the cover there is a neat leather holder in which three tubes can be carried. Size of case 7½" x 9" x 14½"; covered with Wairus Grain Fabrikoid. Weight complete with batteries, phones, tubes, aerial, etc., 15 lbs. Solid brass fittings, leather corners—A BEAUTY. Strongly reinforced and braced leather handle.

MONODYNE—the perfect portable radio set, entirely self contained. Concealed dry batteries, only one tuning control, new volume control, nothing to adjust, nothing to get out of order.

MONODYNE Three Tube Portable Set
Model GT-30

This set is full panel mounted, with automatic filament control jacks on each tube and has one vernier tuning dial and volume regulator. Marvelous for volume and loud speaker reception. Extremely sharp tuning, eliminating all interference. The ideal set for the vacationist, tourist or motorist.

Size 11½ x 14 x 6½
GT-30—three tube MONODYNE complete without batteries, tubes or loud speaker, but with complete aerial equipment—$75.00

Order from your dealer, or send postpaid to any address in the United States. Dealers write or wire for exclusive Agency proposition.
Earn $5.00 to $20.00 a Day in RADIO

You can! Hundreds of ambitious men are already earning thousands of dollars in this wonderful new industry—many working only in their spare time. Mail coupon below for Free Book which describes fully the amazing money making opportunities in Radio and tells how YOU can earn from $5,000 to over $10,000 a year!

The astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio—and thousands of young men are needed right now to meet the ever increasing demand of work. Never before has there existed so many and such remarkable opportunities for making money in this wonderful new field.

Men are needed to build, sell and install radio sets—to design, test, repair—as radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities!

**Easy to Learn Radio At Home In Spare Time**

No matter if you know nothing about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date radio apparatus.

Scores of young men who have taken our course are already earning from $75 to over $200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100% *even while taking our course!* Emmett Welch, right after finishing his training, started earning $300 a month and expenses. Another graduate is now an operator of a broadcasting station, PWX of Havana, Cuba, and earns $250 a month.

Still another graduate only 16 years old, is averaging $70 a week in a radio store.

**Wonderful Opportunities**

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer."

"We want men with executive ability in addition to radio knowledge to become our local managers."—"We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

**Send for FREE BOOK**

Learn more about this tremendous new field and its remarkable opportunities. Learn how you can quickly become a radio expert and make big money in Radio. Find out what remarkable successes our graduates have had—even a few weeks after their training finished.

We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio" will be sent to you without the slightest obligation. Mail coupon for it now!

---

**National Radio Institute**

Dept. 1581
Washington, D.C.

---

**Radio News for July, 1924**
Ask your neighbor — he knows

ACME A-2
for volume

A CME Transformers are used by thousands of radio owners to get increased range and louder, clearer radio. Acme Transformers give maximum amplification without distortion. Each transformer is tested and carries a guarantee tag. The name "Acme" is guarantee of best results. Use Acme Transformers in the set you build. Look for them in the set you buy.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Cambridge, Mass.

ACME
~ for amplification
Radio Patents

By HUGO GERNSBACK

LIKE most new industries, radio has its patent phase, but unlike other similar industries, it has not been built up upon a strictly patent foundation. Take, for instance, the moving picture industry, the phonograph industry, and the automobile industry; these have been built up on a patent foundation—broadly speaking. Curiously enough, the radio industry, based upon a revolutionary invention, so to speak, has no patent platform. When Marconi first brought out his wireless apparatus, he did indeed take out a number of patents, not only in his native country—Italy—but subsequently in Great Britain, later in America and still later in all civilized countries. It should be remembered that his patents could not be basic because the real discoverer of wireless, Heinrich Hertz, a German professor did not take out patents on the original idea. If Marconi had made a basic invention, instead of its having been made by Hertz, he would have had the wireless industry in his control for at least 17 years. So the fact remains that his patents did him very little good. Everyone who so desired went into the wireless business, every company in the business had its own system and while there was some radio litigation, it was of no great importance. As far as apparatus was concerned, anyone and everyone could make and sell it, with but few exceptions. This was particularly true of receiving outfits.

This was the situation when broadcasting started. The situation, however, has not changed very greatly, although there are patents on broadcast transmitters. Those patents involved in the broadcasting transmitter practically all center around two pivotal points—the vacuum tube and certain radio circuits. On the other hand, it is possible to construct a broadcast station without infringing any patents.

On the receiving side we find a great many patents which do not seem to do their owners much good. The most famous patent, the Armstrong regenerative circuit—possibly the strongest of the lot—has just now been invalidated in favor of De Forest, who seemed to have conceived the idea before Armstrong. Even De Forest will not be able to enjoy the full fruits of his invention, due to the peculiar workings of the radio art.

In the instance of the Selden automobile patent, the inventor reaped worth-while benefits for the reason that it was practically impossible for a private individual to build a car for himself from parts he could buy in an automobile accessory store. Not so with radio. Despite Armstrong, or now De Forest, the average experimenter can walk into any store and buy the parts for a set which contains the patented regenerative circuit with no law to stop him. It is calculated that of the 3,500,000 outfits in America today, fully one-half are such home made outfits. This is a peculiarity of radio, possibly not found in any other industry.

Not only do the dealers openly encourage the sale of such parts, but are openly selling all the parts sufficient to build a certain patented circuit with impunity. The reason is that as long as the outfit is not sold complete or wired up, it is impossible to prove in any court that such apparatus could not be used in a different circuit from the patented one. The dealer or manufacturer of these goods does, of course, not really infringe a patent any more than does a magazine when it publishes a patented circuit. Therefore, as far as patented circuits are concerned, they produce revenue only when a manufacturer sells a complete outfit, ready wired.

The only other patents of any real value to the owners are those of the vacuum tube. Here we have an instrument that cannot possibly be made at home. It requires expensive machinery, much capital and wide and long experience. Before the Fleming patent expired early this year the vacuum tube situation probably was the strongest in the radio industry. The owners of the vacuum tube patents successfully enjoined infringers from making tubes and this is practically the only case where the owners of a basic radio patent reaped the full benefit of their patents.

With the expiration of the Fleming valve patent, the situation regarding the vacuum tube is no longer strong. Soon anyone with the necessary money will be in a position to make tubes.

It would seem, therefore, that only basic patents are of value in radio and from the very nature of the art there can be only a few such patents. Unless a radio invention is basic, there would appear to be little use for patenting the invention. The owner must be the judge.

On the other hand, what does not seem to be an important invention today may prove so tomorrow. The writer would strongly urge all those who do much experimenting to make careful notes of all their experiments. If you run across something that is new, you should put the data concerning it on paper and have it witnessed by a notary. This only costs a few cents and may prove of tremendous value later.

Then there are, of course, many mechanical patents of high value in the radio industry. There are excellent patents on such items as telephone plugs, head bands, loud speaker construction, detector detail, condenser construction, grid leaks, rheostats, etc.

Some of these have been extremely valuable for their owners. If properly drafted by a competent patent attorney, such patents will effectively protect their owners.

It may be interesting to know that fortunes have been made in articles of this kind which are simply improvements on existing devices and are not at all basic.
Radio to the Rescue

By J. Farrell

The recent succession of mine tragedies has made an indelible impression on the public and the U. S. Bureau of Mines has taken steps to prevent similar occurrences. Mr. Farrell gives an interesting description of the part radio will play in rescuing mine workers in the future.

USH help! Trapped on thousand-foot level near shaft six! The call for aid coming from a group of miners entombed in Mine 7 in the Pennsylvania coal fields was plainly heard at station WWY, the radio laboratory of the Bureau of Mines at Pittsburgh. A fleet of rescue cars was soon racing to the scene of the disaster, and the work of digging out the trapped miners was begun. As the rescue party cut through the wall of the cave-in, the miners inside directed their activities.

No, this is not wholly imaginative. It is a picture of the utilization of radio in mine rescue work, as made possible by recent experiments conducted by the United States Bureau of Mines. Radio, per se, has been found ineffectual in underground communication, but the practicality of a system of line-radio or wired-wireless has been demonstrated.

The Bureau of Mines line-radio system utilizes trolley wires, mine tracks, compressed air and water piping, cables and similar carriers for voice transmission.

In a series of tests a 10-watt telephone transmitting set was mounted on a mine locomotive and the outfit connected to the harp of the locomotive trolley pole. A portable receiving set, detector two-step audio-frequency, was used on the surface and connected to a 50-foot single wire antenna. The mine is a shaft about 400 feet deep. There was no difficulty in picking up the underground moving locomotive station as long as the receiving antenna was placed in the vicinity of any electrical conductor extending into the mine. The signals were picked up readily when the receiving antenna was near the surface trolley wires, power and lighting circuits, telephone lines, and hoisting cables, the relative magnitude of the signals from the different carriers being in the order named.

In a series of tests conducted to determine the transmission range underground, a portable 10-watt transmitter was mounted on a storage battery locomotive. A short three-wire antenna mounted on the top side of the locomotive was used for transmitting. It was found that the range was dependent almost entirely upon the type of conductors present, their electrical constants, and other factors. The transmitting range of the set in the average coal mine was only a few hundred feet when no conductors were present, but several thousand feet when operating in the vicinity of metallic carriers.

Loop Tests

Similar effects were obtained in another series of tests when using a loop aerial for transmission and reception. In practically every case where the receiver was placed at a sufficient distance underground to be shielded, it was found that the loop antenna made for better reception when near metallic carriers. Moving the set to another location in the vicinity often resulted in the loop pointing in a different direction. A study of nearby conductors indicated that when using a capacity type antenna, such as a wire stretched along the mine entry, the loss of directional properties cannot as a rule be noticed.

The tests made by the Bureau indicated that the absorption of radio waves in pene-
trating the earth depends mainly upon the relative conductivity of the strata through which the waves are propagated. The conductivity of the earth depends largely upon the quantity of water present and its sheet distribution and to a somewhat less extent on the type of ore or mineral. Some strata such as coal, shale and some rock formations were found to be good insulators, and often to possess a good dielectric value when dry.

The metals recovered from ores may be excellent conductors, but their ores as they exist in the earth are not necessarily good conductors the tests showed. This is due to the fact that the metallic particles, if existing as such, are separated by the matrix which, as a rule, is a non-conductor. In most ores the metals do not exist as such, but as chemical compounds.

Coal, while often containing as high as 92 per cent. carbon, is usually an excellent insulator. Practically none of the carbon in coal is existent in the free state but is present in the form of a complex bituminous material—a pitch-like material, which is an insulator. Practically all the eastern coals are of such close structure as to contain very little "free" water or moisture. The "combined" water does not affect the electrical conductivity. Many seams both horizontal and vertical between strata contain sheet waters and seepages which prevent transmission of signals through them for any considerable distances.

**SOME CONDUCTORS**

Other minerals such as hematite and certain sulphide ores are conductors even when dry. In all cases, however, the conductivity of beds of ores and minerals is greatly increased by the presence of water. Mine waters containing relatively large quantities of dissolved salts are good electrolytes. There is a high attenuation of the waves in penetrating such waters and when horizontal uniform strata formation exists with numerous sheet waters only a short penetration of the radio waves may be expected. The thickness and number of such sheet water formations limit the penetrating power of the radio signals. Similar effects have been noted in numerous Government tests conducted in submarine signaling. It has been found that even the comparatively high-powered transmitting stations aboard battleships cannot be relied upon for communications with submarines when the latter have submerged to a depth even approaching that of the average shallow coal mine.

The Bureau of Mines tests in receiving from surface stations showed that the signal strength is not greatly affected at a short distance underground, but drops off very rapidly as soon as a depth below the surface is reached approaching that of seepages and the sheet water formations. This holds true when there are no metallic conductors present to act as carriers, but in mines having electric light and power circuits, such conductors carry the signals down from the surface, and often with inappreciable, or but slight diminution in intensity.

The extent to which such conductors act as carriers for the high frequency waves depends upon their electrical characteristics and the frequency of the wave. If the electrical circuits are such as to offer high reactances to the high frequency currents, there is a great loss in signal strength. However, the capacities existing between machine windings, parallel wiring, etc., are often of sufficient magnitude to offer a relatively low reactance by-pass or shunt for the high frequencies.

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We requested Mr. Perry to make a country-wide in-vestigation into the broad-cast problem regarding the much discussed radio applause. Does the performance of broadcasters and radio enthusiasts need it? Is it difficult or easy to get per-formers to broadcast nowadays? Do amateurs need to play their part in this field, or are they amiable they are pleased and encouraged by seeing a large number of letters which contain the proper reference. If they are professionals they realize that there is no form of advertising that brings as quick results as broadcasting. For instance, the leader of a dancing orchestra or the conductor of a string orchestra is well-known and respected, and pays them the respect that they deserve. The best example of this is the case of a small orchestra which is well-known and respected by the public. All of these examples show that there is a great demand for broadcasters and that there are many people who appreciate their work and are willing to pay for it. The majority of the artists enjoy the work and are willing to return at our station which is only too glad to return. In nearly two years I have only had two cases in which artists would not come back a second time. We make it a point of returning the original letters and to keep in touch with the artists. Many of them have obtained engagements by virtue of their appearance at our station. That is our principal means of remunerating them for their services.

A New England pioneer in the broadcasting game reports: "The best applause is that which comes over the telephone during the course of the evening's entertainment. Whenever it is possible we let the artists receive the message. If, for instance, some one calls in, we answer the telephone and as soon as the criticism is found to be favorable, we request the caller to talk with the artist in person. It is the greatest applause I know of. All of our artists are enthusiastic about broadcasting. They are glad to come back whenever we invite them. In many cases they pass the word on to friends who, in their turn, come to our studio to entertain."
Coming back to up-state New York, we read: "So far, we have experienced no difficulty in procuring competent artists to broadcast from this station, and we believe they will be willing to offer their services in the future. The only reward they receive for their efforts is the applause contained in the mail we receive from those who listen in. The mail received by us is continually increasing, and so long as this condition prevails we are sure that the artists will feel that they have been amply paid for their services."

From the coal fields of Pennsylvania a director of broadcasting writes: "Day after day I have to turn down talent. Only once in a while do I use professional talent. Vaudeville artists are anxious to appear for the picture layout and boosting they get in our paper, but I do not use them unless we are in a hole at the last minute."

A New England cotton mill town sent this statement: "As we have a small station, our response, which practically comes from local listeners, has been very good."

Bilingual, Canada finds similar conditions to those on this side of the border. A newspaper station reports: "We do not find it difficult to get competent artists because of the publicity we give them in our paper. Our current radio program is now published by about 800 newspapers in Canada and the United States."

CONSTANT PROCESSION OF APPLICANTS

A banking institution in the Middle West that has taken up broadcasting has no more difficulty in securing talent than newspapers or other stations. The manager of the radio department says: "We do not find it at all hard to secure competent artists. The only difficulty is to select the wheat from the chaff, to pick the good ones out of the constant procession of applicants who come to our station. The more established artists— who would not of their own accord come to us—are able to persuade to go on our programs by a little selling talk concerning the advertising value of radio broadcasting. By endeavoring to get the best available talent which is interested in creating a market for its own abilities—that is, singers who are open for public engagements, orchestras anxious for bookings, and teachers who are anxious for pupils, etc.—we have practically no 'turn-downs' on requests that we make to orchestras or soloists in our city. In short, by showing them that they are getting value received for their services in broadcasting we induce them to perform. Their comments upon broadcasting show that the actual experience has given them the radio fever. They are really more enthusiastic over the fact that they were heard in some small town in Arizona than they are in the verification of the advertising value of radio."

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Radio Experts of the Future

Hundreds of thousands of the youths of our country are now interested and at work on radio problems. We have, then, the future inventive genius of the world already preparing to add to its great contributions. Many of the present great inventions have been made by such young men lured on by the unique and romantic characteristics of their subject.

Boys of today are going to be the radio engineers and experts of the future. The Chicago Boys' Club knows that the little chaps have keen minds, and is doing all it can to encourage them in the study of radio. In the radio department of the Chicago Boys' Club, No. 2, located at 1725 Orchard St., there is a complete radio laboratory and workshop, where the little fellows are given an opportunity to build and test receiving sets and experiment with various parts. The photograph shows some of the boys at work in the laboratory.

Remarkable results have been obtained in this workshop. Quite a number of the boys have developed unusual ability in their new craft. Be it a crystal set, four-circuit tuner or neutrodyne, you will find anywhere from one to dozens of them being constructed in the radio department of the Club.

The Club has now fostered the radio department for two years and has not only turned out hundreds of radio fans, but the sets made would constitute a complete radio show if brought together.
Radio News for July, 1924

Radio Pictorial

Left: Here is Paul Sollenburger, the man who attends to the transmission of the time signals from the U.S. Observatory at Washington, D.C. The signals are relayed from Washington by wire to the transmitting station, NAA, at Arlington, Va., which works on a wave-length of 2,650 meters. This is a very powerful station and the time signals transmitted at noon and at 10 P.M. are heard by ships in both the Atlantic and Pacific oceans. No matter where you live, you have no doubt heard the time signals from NAA re-transmitted from some broadcast station. C. Harris & Ewing

Below: Dr. Thomas broadcasting, from station KDKA at East Pittsburgh, the heart palpitations of the lovers' kiss. These palpitations, as recorded in the ultra-sensitive microphone, were plainly heard by crystal receiving set owners in England.

THE ULTRA-AUDIBLE MICROPHONE

It is rather hard to believe, after hearing the tick of a clock at a broadcast station in a receiving set, that a microphone more sensitive than the type now used by every broadcast station could be devised. Yet Dr. Phillips Thomas of the Westinghouse Electric and Manufacturing Co., is the inventor of an ultra-sensitive microphone, the development of which has opened up a new world of re-

search. With this microphone, in conjunction with some form of reproducer, it is possible to hear sounds inaudible to the natural ear. The noise a fly makes while walking, the thunder of a moth's wings while in flight, the language of the honey bee, all are revealed by the aid of the Thomas microphone. Said Mr. Knat to Mrs. Knat: "Talk low, my dear, else the world hears what you have to say. The ultra-sensitive microphone is near-by and will broadcast your voice via radio to England, France and possibly to the North Pole. Be careful, my dear."

This new invention will also find a place in the doctor's laboratory and in this duty may take the place of the Stethoscope. It will transmit to the doctor's ear, noises that heretofore he has been unable to hear.
Above: The girl pupils of one of Chicago's public schools would not let the boys outdo them. Hence a contest was held for the making of radio sets, and prizes were offered. The girls have shown superior workmanship and attracted the attention of local experts. The above photo shows some of the prize winning sets and their owners. © P & A Photos

Left: William Swackhamer, the Postmaster at Whitehouse Station, New Jersey, sorts the mails to music broadcast by radio. As the melodies are amplified by a loud speaker, waiting for mail is not at all a tiresome task for the villagers. They congregate in the post office when the mail trains are due and listen to what is on the air. © Western Electric Co.

Radio works its charms over youngsters. Boys who were in danger of falling prey to bad associates were taken in hand by Capt. H. P. MacDonald of the Salvation Army, who organized a Boys' Club in New York City, and now he has them coming in for instructions in Radio, giving up all ideas of delinquency. © Fotograms, N. Y.

Above: Scotland Yard has just designed and has had built a completely equipped radio car from which communication can be established with Headquarters when it is traveling up to a speed of 40 miles an hour. The photo shows the interior of the car. © Wide World Photos
Above and to the right is shown the orchestra of the Hotel Cecil in London, which has made numerous attempts to broadcast music by radio to the United States. © Keystone Views

Above: A new combination of table lamp and loud speaker which was designed and displayed at a recent radio exhibition held at Leipzig, Germany. © Wide World Photos

Right: Dorothy, the three year old daughter of Mr. and Mrs. Babe Ruth, broadcasts her personal opinions of her celebrated Daddy. © Wide World Photos

Below: The Staccatone, a brand new musical instrument, the idea of which originated with Mr. H. Gernsback, Editor of RADIO NEWS. The one shown, which was recently used in the orchestra of the Rialto Theatre, New York City, was designed by Mr. Clyde J. Pitch.

The Staccatone

Has it ever occurred to you that the squeals and whistling noises which you hear in your radio set while trying to tune in a distant station may be controlled so as to produce pure, musical tones; and that with a vacuum tube, a few coils and condensers a simple musical instrument is easily made, on which any song or tune may be played?

The characteristic squeal rising in pitch from zero to a note beyond the limit of audibility is familiar to all of us. This range of frequencies runs much higher than can be obtained from any known musical instrument. If properly controlled we have a musical instrument that surpasses in tonal range any other musical instrument, and the note is exceptionally pure, practically free from harmonics. Of course, with several vacuum tubes chords could be played. With the single vacuum tube musical chimes and tunes can be played that are very pleasing to the ear when played alone or in connection with an orchestra.

The squeals heard in radio sets are caused by the interference of two waves of different frequency setting up an audible beat-note, and squeals are difficult to

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Right: Keichiro Yonemura, superintendent of the Iwaki Radio Station at Tomioka, Japan, who has been awarded the Radio Corporation of America Medal for his prompt work in flashing the news of the Japanese earthquake to the world from the Iwaki station. He communicated directly with San Francisco, Calif., after all other forms of communication proved hopeless. The medal carries an honorarium of $500 with it.
© Keystone View Co.

Below: The radio has supplanted the one time popular phonograph on board water craft and is effectively employed for furnishing music for dancing. This group of charming maidens is enjoying some popular jazz between swims. © Atlantic Photo Service.
WITH this issue Radio News celebrates its fifth birthday. In the past five years, radio has made tremendous strides. Radio News, although not the oldest radio periodical, today stands first of all the radio magazines of the entire world. Five years ago Radio News started with a circulation of 10,000. Of the last issue more than 355,000 copies were printed and distributed. In point of circulation, in point of advertising, in point of text, contents and illustrations, Radio News today excels any other radio publication.

Every promise that was made by the Editor to his readers, in the first issue of July, 1919, has been kept and fulfilled. During all of this time Radio News has been absolutely independent, it has never been affiliated in any way with stilted commercial radio interests. It started out as a purely radio magazine—100 per cent radio—nothing else. This was the promise made July, 1919, and this promise has been kept.

On its fifth birthday, the Editor wishes to reiterate all of his promises made five years ago and also takes this occasion to thank the multitude of readers through whom it has been possible to build up this magazine. The Editor also wishes to thank all the authors who have, by their articles, made Radio News possible.

A few of the birthday congratulatory messages to the magazine are reproduced on this page.

—The Editor.

Editor, Radio News:
I wish to extend to Radio News on its fifth birthday sincere congratulations on what it has achieved, and confident best wishes for its future usefulness. Its editors, with unusual insight, foresaw, even before the termination of the war, the dawn of popular radio interest. It was, therefore, foremost in the field of radio broadcast journals and has maintained the position which the enterprise of its founders so wisely built for it.

Lee De Forest.

Editor, Radio News:
Radio has made great strides in the last five years, but Radio News has made still greater strides and upon its fifth birthday you are to be congratulated not only upon its remarkable circulation, but upon the character of the technical articles which you publish. My best wishes for the continued success of Radio News.


Editor, Radio News:
Without the proper dissemination of information, without the means for a general exchange of ideas, without the media which registers the economic pulsations, changes and developments of that vast group of people known as the general public, no industry can long endure.

The radio industry can well congratulate itself that in its infancy it has had the great helpful influence of an intelligent and progressive press.

On this occasion, the fifth birthday of Radio News, I extend the sincerest congratulations and best wishes of the Radio Corporation of America. It is a great work that you are doing, and the radio industry anticipates a continuance of your splendid efforts.

J. G. Harbord, President, Radio Corporation of America.

New York, N. Y.

Editor, Radio News:
Hearty congratulations on fifth anniversary of Radio News. You are grown up while others are but beginning school.

Dr. Rottgardt.

Editor, Radio News:

Editor, Radio News:
My congratulations on your fifth birthday. Many happy returns and may you continue the good work which you have done in connection with the building up and the protection of the interests of the finest body of radio men in the world, our U. S. amateurs.

Reginald A. Fessenden.

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Vacation

Some very interesting tests were carried on recently by Boy Scout radio fans in Central Park, New York City, in an attempt to locate "dead areas" and experiment with portable radio receiving sets. The accompanying photographs, taken during their tests in the park, are quite instructive. The photo to the left illustrates a simple manner for erecting a temporary aerial. A stone or some form of weight is attached to the end of the wire to be used as the aerial and thrown over the branch of a tree. The higher the tree the better, of course, and for best results the aerial wire should have an insulation covering so that it does not come in direct contact with the tree. Lamp cord is the most suitable wire for this purpose and a section twenty to forty feet in length will suffice for all purposes.

The photo above shows how a temporary ground connection can be made. In this case bare wire should be used. A stone is tied to the end in the same manner as mentioned before, and thrown in the water. The bare wire makes contact with the water and provides an excellent ground. This wire need not be very long. A section of bare or insulated wire twenty to thirty feet long stretched on the earth will also suffice as a "ground" and should preferably be stretched underneath the aerial wire. If only a short piece of wire is at hand, a small spike driven in the earth with the wire attached to the end of it, will suffice. The photo to the left shows a number of the Boy Scouts tuning in on a local broadcast station and taking notes on the signal auditory.

The photo to the right shows two views of the type of portable set used by the Boy Scouts. The "A" and "B" batteries, the phones and the aerial and ground wire are enclosed in the compartment made by the cover of the cabinet. This is a single tube set of the regenerative type. The control to the right is for tuning and the other control is for regeneration. The small switch in the upper center of the panel allows for a coarse adjustment of wave-length. The head-phones are plugged into the jack situated just above the tuning control. The two binding posts on the left of the panel are for the aerial and ground connections.

©Foto Topics, Inc.
Radio Hints

Below: Who wants to sit in the house listening to radio concerts when it is spring outside? This young boy hooks his set up in the big outdoors and enjoys the programs with plenty of fresh air and sunshine. His aerial runs from a nearby tree to the small branch stuck in the ground near his set. From the expression on his face one might judge that he is getting good results, even though he has only a crystal receiver.

Right: This novel two tube portable reflex set was built by Sidney Kasindorf, owner of station 2A TV. It is built into a small suitcase which holds all the necessary dry batteries, phones, etc. The most interesting feature of the outfit is the fishing line aerial and ground, both being wound on a regular fishing reel. This set employs UV-199 vacuum tubes which require very little filament current. ©Kadel & Herbert

Left: What could be more delightful than floating along in smooth waters with the strains of music from some broadcast station? This could well be called the "Radio Canoe" the way it is outfitted. A bit of paddling on the part of the man in the stern turns the canoe so that the loop aerial points in the direction of the desired broadcast station. Below: This light cruiser is completely equipped with radio apparatus and a broadcast receiver is put to use when the guests lose interest in the vast expanse of water and find life a bit boring.

Something new in the way of kinks, the "Simplefinder." A station is tuned in on the receiver. Using the zero mark on the dial as a pointer, note is made as to what slot it lies over. A small slip of paper, with the call letters of the station tuned in printed on it, is inserted in the slot under the zero mark and is held in place by means of the spokes of the underneath cardboard. This procedure is carried out with all other stations that can be heard with the set. ©Photoneux, N. Y.
A group of engineers and newspapermen at the American Newspaper Publisher's Convention in New York City watched a typewriter being operated by a person who was sitting in the experimental laboratory of the International News Service, more than two miles away. The copy was clicked off at the rate of 65 words a minute with an accuracy of 99½ per cent. The machine operates in conjunction with a short wave tuner ranging from 60 to 150 meters. The radio printer is connected to an "ejector," a device which makes possible reception in the most congested radio centers. The machine has been in experimental operation between New York and Tarrytown since 1921. It is used commercially between San Francisco and Los Angeles, a distance of 350 miles, by the Federal Telephone Company. The photo below shows L. R. J. George Usman and William A. Bruno who have both contributed responsible parts in the development of the machine and William Finch, the inventor, whose patents cover the system. This is the receiving apparatus. The photo to the left shows the operator at the sending end. © Kadel & Herbert.

Left: Jockey Burns tunes in for Thurber just before the races at Belmont Park. The set employs two stages of radio frequency amplification, a detector and two stages of audio frequency amplification. © Foto Topics, Inc.

Right: The man who invented "applause cards" emerges from the shadows at last. Mr. Percy W. Andrews, Manager of the Radio Division of the Dictograph Products Corporation, and the man responsible for this revolutionary radio idea. It all came about on a railroad train as he was musing over a particularly good program he had heard the night before. As he remarked "There I sat thinking what a slacker I was not to have written in at least a post card of appreciation." Then like a flash the idea came. Applause cards!
Above: A new feature in radio sets is this one of Felix, the Movie Cat. The tail forms the tuner and the solitary whisker on the face acts as the "cat whisker" for the crystal. © Keystone View Co. Right: A complete radio receiving set that fits the vest pocket. The crystal detector is mounted on the small panel containing the switch. Below: A miniature honeycomb coil tuner that operates just as well as a large one.

Resembling in outline a Greek vase, and standing over three feet high, this new loud speaker will add to the beauty of the most luxuriously furnished apartment.

CARNEGIE INSTITUTE TO GIVE RADIO COURSE

A six weeks' course in Radio Communication will be featured this year at the Summer School of the Carnegie Institute of Technology in Pittsburgh. According to an announcement, the course in Elementary Principles of Radio Communication will be given in the College of Industries from June 30 to August 8.

Although the course is arranged primarily for the benefit of teachers of industrial arts, the announcement emphasizes the fact that any one interested is eligible. The course will cover the high spots in radio communication, and no special restrictions have been placed on a prospective student's educational training.
The Importance of The Trivial
By SIR OLIVER LODGE, D. Sc., LL.D., F.R.S.

This article contains a number of technical hints from Sir Oliver Lodge's radio writings. They are in his usual lucid, easily understandable style, interesting to all, including the beginner.

High frequency currents such as are employed in radio, travel on the outside of a conductor only. This is well illustrated in the two sketches below of the cross section of a solid wire and a piece of tubing. The shaded portion on the periphery represents the high frequency current flow. This is referred to as the “skin effect.”

SECTION OF TUBE

HIGH FREQUENCY CURRENT TRAVELLING ON THE SURFACE OF THE WIRE ONLY

I AM not sure that amateurs fully realize the importance of perfect metallic connection in every part of a receiving set. When there is plenty of power, as when one is listening to a station in the neighborhood, any kind of contact suffices. But to get the benefit of refined and accurate timing for distant stations, we ought to realize that a tuned response begins with exceedingly small electromotive force. The whole point of tuning is that response begins with infinitesimal surgings, which, if of the right frequency will work up by resonance to a substantial magnitude, and that if the initial infinitesimal surgings cannot occur, there is nothing to work up, and there will be no response.

Whenever we are dealing with very small e. m. f.'s, as for instance in thermo-electric currents, perfect metallic connection is necessary. An e. m. f. of a volt or two is able to break down a thin insulating film, such as an imperceptible coat of oxide, and establish connection after the manner of a coherer, just as an e. m. f. of 100 volts can jump across a microscopic interval, while 3,000 volts can give a millimeter spark—that is, can jump across a coarse interval of anything short of a millimeter. But when we are dealing with a hundredth or a thousandth or even a millionth of a volt, no such facility exists. And yet the initial surgings from a very distant station must begin at even less than a millionth of a volt. The slightest imperfection of contact, therefore, is sufficient to check the initial response. The wonder is that a conductor responds at all to such an extremely minute force. The fact that it does shows that some of its electrons must be free from the atoms and able to be directed by the slightest suggestion of a force, as they are no doubt in a vacuum bulb.

Not only in metals, but even in electrolytes, electrons seem free. Special tests have been made to see whether electrolytes accurately obey Ohm’s Law; and they do. But they could not obey Ohm’s Law if an infinitesimal e. m. f. did not produce a proportional infinitesimal current. The ratio of the e. m. f. to current should be constant, and as far as experiment has gone, it is constant in metals and electrolytes, even for the smallest forces.

But directly we deal with insulators, that is not so. They do not attempt to obey Ohm’s Law. They obstruct altogether until they break down. When broken down, they conduct freely. They are then said to be ionized; that is, their electrons are set free or liberated internally. But there is a critical force necessary to break them down. This applies not only to recognized insulators, but to any kind of a film, a film of oil or grease, for instance or a film of oxide. Such films cannot but exist on anything exposed to the air, where dust is prevalent. It must also exist on any surface touched by the hand, or breathed upon. It is impossible to avoid such films, and if scraped off, they will speedily renew themselves. Sliding contacts, therefore, must always be suspect.

The scraping action of the contact may usually be trusted to remove the film, and may leave the metals in complete contact, but if cohesion is interrupted by a shake, jar, or tremor, it may not so easily renew itself. Hence amalgamated or soldered contacts are safer. Sliding contacts are very convenient, and may often be used; but uncertain joints are always liable to give trouble. Some of the stray noises and capriciousness, from which amateurs are said to suffer, can sometimes be traced to this source. It is really easier to avoid troubles of this kind than to detect them when they occur.

For purposes of sending, there is no such trouble, the e. m. f.'s are all big enough to break down obstacles—but for refined tuning every part of the aerial and every detail of the set should be thoroughly well joined up. And if sliding contacts are used, the binding or clamping should be firm enough to prevent accidental disarrangement. A gentle tap breaks contact in a coherer, as everyone who used to work with such things is well aware; and it takes an electric impulse of finite magnitude to restore connection. No such breaks should be allowed by anyone who desires perfect attunement.

ADVANTAGES OF STRANDED WIRE

In a receiving set intended for the reception and accurate selection of distant stations, the importance of good joints should be supplemented by a recognition of the advantages of low resistance. Persistent oscillation is killed by resistance; if a conductor of infinitesimal resistance could be used, extraordinary results could be attained. Some day, perhaps, something will be done in that direction, byimmersing the set in liquid hydrogen or even helium, for at those low temperatures the resistance of metals almost disappears. Conductors become perfect, and oscillations would work up to almost an infinite value, with small stimuli. Such an arrangement could surely never be more than a curiosity, and even as a curiosity it is hardly feasible at present, but I fully expect that someone will try it in the future.

Meanwhile, we have to do the best we can with ordinary high conductivity copper.
It must be realized, however, that when working with short waves and, therefore, very high frequency, the inner part of a wire of any ordinary thickness takes no part in the conduction. The oscillations have not time to soak or sink into the metal, and only the skin or surface contributes to the conduction. In steady or direct currents every part of the wire conducts equally. The wire acts as a tube does to water or air, except that in the hydraulic case, surface friction retards the flow a little, and leaves the interior of the tube the best and most efficient part. In the electrical case, conditions are just reversed. The outside of the conductor is the best part; the inner portion is almost useless, except as contributing to mechanical strength. When a wire is very thin it may be thought of as all surface. It has no interior. Hence thin wires are more efficient, weight for weight, than thick ones. The resistance of a thick wire is not so much less than that of a thin one, to high frequency currents. At the same time there must be a limit. If a wire is too thin, though it is effective as a conductor, its resistance is unavoidably high, hence the current is somewhat throttled. To circumvent that, we use a stranded wire and the strands must not be in metallic contact; otherwise, the interior is obliterated, since it cannot be got at, except through metal. Slight insulation suffices, a coat of varnish is enough; a very thin coating of silk is amply. The point is that the strands must all of them be bathed in ether, for it is through the ether that the waves can reach them. The propulsion of a current in a wire is effected later-

(Continued on page 132)
Radio, A Leading Industry

By ROGER W. BABSON

Mr. Babson, whose reports guide bond and investment houses, here gives his opinion of the newest of the leading industries, radio. His opinion, from a purely business and industrial point of view, is indeed sanguine.

FIVE years ago business did not consider the radio industry of enough importance in the field to give it a separate classification. It was grouped as a subsidiary of electrical manufacturing and selling, but it not only has a designation of its own, but is among the first thirty-five industries of the United States in point of value of product—the largest period growth of any industry. To those who still consider radio a fad, an examination of the accompanying article will result in a distinct shock. When it is learned that radio's position—as an industry—falls along with furniture, leather and chemicals, and ranks higher than railroad, it is high time to stop considering it a fad, and to think of it as a truly established part of the economic scheme—as a part and parcel of the lines of the industries of the United States with as definite a place in their scheme of things as the very shoes they wear.

This year, according to conservative opinion, more than $350,000,000 will be spent in the radio art. This figure does not include only sales to the general public and does not take into account the huge sums which will be spent by large corporations in the construction of commercial stations, as it does not include the immense costs of investigations and experimental work being carried on continually by manufacturers, in an effort to constantly improve the art.

Truly radio is no fad, but is well established and is here to stay—EDITOR.

To those who think that radio is still a fad, adopted only by a small minority of the public who are experimentally inclined, some figures dealing with the financial proportions of the industry at present may correct that impression. It has been my experience that very few people realize just how important, from a business standpoint, the radio industry has become. Just because an industry is comparatively new is not a reason for assuming that it is unimportant. The radio industry is not new, but it has grown so rapidly in the last two or three years that it compares very favorably with many of the important long-established industries.

On the basis of figures for the year 1921 it is probable that the American people will spend approximately $350,000,000 for radio equipment in the present year. A conservative estimate of the business in vacuum tubes alone is $90,000,000. At five times as much, or $250,000,000, will be spent for radio sets and parts. The sales of batteries, both dry cell and storage batteries, will very likely amount to over 45,000,000. Miscellaneous equipment such as battery chargers, loud speakers and specialities may easily account for $50,000,000 more.

COMPARISONS

One of the best proofs that radio is one of the leading industries, and that it is well established, is the amount of money expended by the general public through the channels of the radio dealer with the sums spent in the same way for sporting goods and cameras. More than double the amount of money goes into the retailer's hands for radio than reaches him through photographic supplies and sporting goods. No one will deny that the latter two industries are well and firmly established. They are founded on a sale idea that is less stable than radio. Radio is universal in scope, its appeal is to all, whereas the other two industries mentioned are not. Is radio not much more well bottomed than either of them? It is interesting to see how the radio industry compares in dollars and cents with other large industries. Available figures on sporting goods, cameras, etc., show a value of about $185,000,000 annually. Sales of radio equipment are running nearly twice as large as all kinds of sporting goods.

The value of the radio business is nearly twice as great as that of the carpet and rug business. For every dollar spent on furniture, 33 cents is spent on radio. For every dollar spent for boots and shoes, 25 cents is spent for radio. For every dollar spent for musical instruments of all kinds, including phonographs, pianos, organs, etc., 75 cents is spent for radio. The value of radio business amounts to nearly three-fourths of the jewelry business as a whole, including clocks, watches and novelties.

I have given you the comparisons in order that I might emphasize the growing importance of radio from a business standpoint. It is not necessary for me to tell you of radio's importance from an educational and social standpoint. I see no reason why the radio industry should not continue to expand. There has been a decided improvement in the character of the broadcast programs, and we may doubtless look forward to still greater improvement in this direction.

GROWTH

From a manufacturer's standpoint, the most probable way of comparing different industries is on the basis of the manufacturer's value of products. Unfortunately the latest data available for this purpose are published by the Department of Commerce for the year 1921. I refer to the Census report on the first two industries, for that is all data have become available which give a satisfactory comparison on this basis.

With this article is a list of the leading industries based on their value of products for 1921. The list includes all industries whose value of products is $300,000 or more.

Such detailed figures were available as for this industry in 1921 show that the products of the radio apparatus and wireless telegraphy supplied amounted to $8,074,636. In 1919, the value of these goods amounted to $8,074,636, but this amount included the value of motor generators, which was not included in the 1921 report.

Furthermore, the number of radio lamps and tubes produced in 1921 was reported as 101,964 at a value of $1,097,968. These statistics show clearly that the radio industry was not considered of enough importance in 1921 to be given a separate rating, but the meagre amount cannot be compared directly to the other listed industries.

The best comparison available is given in a recent survey of this industry made by the Babson organization. The size of the business was compared with other lines on a retail basis. Although the figures were generally small, they give an interesting comparison and show clearly that the industry had had a remarkable growth during the past few years. Let me say that this rapid growth is not in its present pace, a saturation chart is given herewith. Note that there are more available figures within a short period of time than there are without phonographs, automobiles or electric service. It is not necessary to maintain that every family owning a phonograph will some day own a radio.
The above illustrations serve to form a conception of not only the comparison between the radio industry and other kindred services, and the rapid increase in radio sales for the past four years, but the most evident and magnificent future for the entire radio industry. There are years to come before radio sales will reach the saturation point.

The charts are clear and the reader may draw his own conclusions as to whether radio will suffer any great set-back for a number of years.

Another chart shows graphically the growth of the sales for the last five years.

All in all, after a complete examination of the field and its possibilities, a report of other than a favorable nature is hardly possible. The figures given in this article are mere cold, hard, business facts. The reader must consider them and draw his own calculations. Those calculations, I think, must surely be favorable to the constant advance of the radio industry. The future is indeed bright and even though the present rate of increase is maintained for some years to come there is little danger of the industry becoming top-heavy and suffering serious results. It is established in commerce and it has a place in the American home. It will grow, for its future is bright.
Lucy's Radio Present

By WARREN ORDWAY

WHEN the radio craze struck the country it passed around Old Forge; that is, it passed everyone but Bill Shadwell. He caught the fever hard enough to make up for dozens of ordinary cases. His pockets were, most of the time, stuffed with hook-ups, blueprints and magazines; and he wasted a precious lot of the time that he should have given to the business of the Old Forge National Bank, studying his diagrams, and drawing little wiring layouts on the bank's blotters and stationery.

He tried every month or two to get a raise from old Mr. Pulsifer, president of the bank, as he had been engaged to Lucy Hopkiss for over a year, and he wanted enough salary to set up housekeeping. But Old Forge was a dead town, and Mr. Pulsifer was stony. Once, the town had hummed with activity. Its iron mines and blast furnaces had poured wealth into the pockets of its citizens, and into the coffers of the bank; but when the rich vein of ore in the Furnace Hills had petered out, the town collapsed with it. Geologists said that there must be other veins equally rich in the hills, but they had never been found.

Though Bill's prospects for a raise were slight enough, it did not help matters when Mr. Pulsifer caught him making his penciled hook-ups during business hours. Mr. Pulsifer thought radio was an invention of the devil, and he had only recently become reconciled to automobiles. So he showed no great excitement when Bill stormed into his quiet walnut office and announced, "I've got a plan that will make us all rich! I want you to help me out with the money end of it."

The banker glimpsed the corner of a blueprint sticking out of Bill's side pocket, and asked, suspiciously, "Has it anything to do with this radio craze of yours?"

"Yes, sir; and I'll tell you, it's a sure thing."

Mr. Pulsifer cut him off sharply. "No use, Shadwell. I'm simply not interested in any of your radio schemes. To my mind, the world would be much better off without radio. When I was a boy, we used to put our minds on our business, but today, you young fellows seem to think of anything and everything but banking. Radio is turning you from a fairly promising banker into a poor amateur mechanic."

"But this scheme will bring the town back to life. It will make the old mines hum. Your bank will be bulging with money. What better plan for increasing your business do you want than that? It we can make, Old Forge hum, surely the bank will profit."

Mr. Pulsifer remained stony throughout Bill's appeal. "No, I'm not interested in any absurd radio scheme to make the town prosperous."

Bill came up close to Mr. Pulsifer's black walnut desk, and appealed on a new tack. "Well, sir, if you won't help me out on this scheme, will you give me a raise, so I can buy the stuff myself? All I need is a hundred or so, for a portable set with three tubes—"

When he heard the word tubes, Mr. Pulsifer frowned, and broke in angrily, "Perhaps if you would drop all this foolishness about radio, I might consider the subject of more pay. But certainly, while your mind is taken up with radio tubes,—he spat out the word contemptuously,—"I can't do anything for you in the way of added compensation."

Mr. Pulsifer's mouth, compressed into a thin, hard line, should have told Bill that the interview was closed, but he kept on pleading. "If only you'll help me out, I know I can make a lot of money for you. All I want is enough to get married on, but you could make a fortune—"

Mr. Pulsifer significantly began fussing with some papers. "Mr. Shadwell, will you excuse me? Very busy morning."

(Continued on page 117)
A Revolutionary Radio Invention

W

E are pleased to announce that in our next issue, RADIO NEWS will be the first to publish a revolutionary radio invention. RADIO NEWS has secured the exclusive publication rights of the G. V. Downing and K. D. Rogers "Unidyne" principle. The "Unidyne" principle enables vacuum tubes to be operated without 'B' batteries, or with low tension current supply of any kind.

This means that the "impossible" problem—detection and amplification of radio signals without "B" battery—has now been solved.

Once more the impossible has been made possible. This invention probably is the greatest radio advance since the De Forest regeneration principle.

Be sure to reserve your copy at your dealer's. —EDITOR.

The Radio Tax Was Defeated

L

ATE on Friday, May 2, the Senate in a record vote refused to accept the Finance Committee amendments placing a tax of 10 per cent. on all radio sets, parts and accessories. There was considerable debate, a number of senators pointing out the bad features of such a tax.

The Radio Trade Association worked in close harmony with every organization in the trade and was at all times in possession of every available fact about the progress of the campaign. Only through the close cooperation of members out of town was the association able to secure such co-operation in the cities where other organizations existed.

The work of the organization was not realized by many because of the silence with which the campaign was worked, but those in a position to know realize how important their co-operation was. The American Radio Association, through Alfred C. M. Caldwell, executive secretary, was of great assistance in the publicity work of the campaign.

The Associated Radio Manufacturers of Chicago, in co-operation with this association, practically from their organization and a great deal of good obtained by harmony of operation, there being no duplication of effort. Musical Industries Chamber of Commerce was of special aid through their Washington News Reporting Bureau.

$500 Radiation Eliminator Prize Contest

Who Will Make a Radio Muffler?

T

HE radio industry at the present time is confronted with one of the most serious problems it has yet encountered. If you live in a city or other crowded section, it becomes almost impossible to enjoy a radio program. In the midst of a most beautiful violin solo, you will suddenly hear loud whistles, howls and shrieks, which will drown out the melody almost impossible these days.

Receiving outfits would have come to be a solution to this problem. When operated to suppress howls and other radio invention.

There is a considerable debate, to a speech by President Coolidge there were at least a dozen instances where whole words and even sentences were obliterated, due to this radiation interference.

Everyone knows, these whistles and howls are produced by nearby receiving broadcast stations. When operated improperly they send out waves of their own. The minute the broadcast listener starts to twist the dial, he also sends out into the surrounding space waves which produce this interference. Experience has shown that attempts to educate the public as to the correct methods of operating these interference creating sets are futile. The public simply does not understand the interference and the only practical solution seems to be a Radiation Eliminator—a muffler, in other words.

There has been much talk suppressing all the receiving outfits that produce oscillations. If a law were passed today to this effect, fully 95 per cent. of the receiving outfits would have to be junked. At the present time, the condition has become so acute that sooner or later our legislative bodies enact a law to do away with radiation.

It is not possible to produce a radiation eliminator that can be made into the receiving outfit at a small cost. There may be a new circuit, a new hook-up, a new instrument or some new stunt that will do away with the whistles and calls.

RADIO NEWS aims to bring about this solution in a novel manner. In order to encourage experimenters, RADIO NEWS offers $500 in prizes for an efficient radiation eliminator. It should be designed along the following lines:

(a) The device should be as simple as possible and must be adaptable to any standard receiving outfit; the cost of its construction must not be above $3.00.

(b) It should be possible to manufacture the device, not only at a reasonable cost, but it must be possible to install the device without necessitating completely disassembling the receiving set to which it is to be attached.

(c) It should not be necessary to adjust the device when tuning.

In other words the new device should be fixed—not variable; or, if it must be variable, the adjustment must be so that once it is made for a particular aerial it should not have to be touched again thereafter, when tuning.

It should be understood that this contest is conducted by RADIO NEWS merely for the purpose of encouraging research along the lines mentioned. In no cash or prizes will RADIO NEWS derive any financial benefit from the invention. All patent rights, and any and all other rights revert to the inventor.

RADIO NEWS will not grant any rights or exclusive use of the invention. It is hereby declared that no patent rights will be acquired.

RULES OF THE CONTEST

1—A working model of the invention should be sent with the manuscript describing it. Transportation charges will be paid by RADIO NEWS both ways.

2—Schemes using so-called blocking tubes are excluded from this contest.

3—Contestants may enter more than one device in the contest. There is no limit as to number.

4—All manuscripts should be typewritten or written clearly in ink, and all diagrams should be clear enough to show the details of the invention. A photograph of the inventor, if required is as well.

5—All manuscripts not accepted will be returned to the owners at the end of the contest, but the publishers will pay full space rates for all manuscripts published in RADIO NEWS.

6—For the protection of the inventor, he should retain a carbon copy of the manuscript. Both original and duplicate should be witnessed and signed with date, names, etc., before a notary public.

7—All prizes will be paid upon publication.

8—Should two contestants submit identical devices, the inventor will receive the prize, the same will be awarded to both.

9—Excluded from this contest are: Manufacturers and the publishers' employees and members of their families.

10—This contest closes in New York on August 20, 1924.

Address all contributions to Editor, Radiation Eliminator Contest, c/o RADIO NEWS, 53 Park Place, New York City.
The Beginners’ Radio Set

By A. P. PECK

Having described aerials and grounds in his last article, Mr. Peck proceeds with an explanation of the fundamentals of radio and furthermore, gives details for the construction of a complete receiving set of a simple form.

If you have not read the article on “The Antenna System,” which appeared in the June issue of Radio News, it would be advisable to do so before you start this one. It is absolutely necessary that, in order to obtain maximum results, you erect the best type of aerial possible and observe certain precautions.

Prior to building a set, it is well to consider several things: First, your knowledge of radio; second, the amount of money you may spend on it; and third, the best type of set to build which will always be serviceable. Taking the first item into consideration, we will assume that the reader is absolutely new in the game and has never built a radio set before. In regard to the second condition, we will consider that the price is to be kept as low as possible for a good set. The third condition will be met by describing herein a set, the parts of which can practically all be used later on when the receiving set is expanded. Thus the tuning device will be of such a nature that it can always be incorporated, with very few changes, into a larger and more efficient set.

TUNING

Before going into the actual constructional work, let us consider what tuning means. We learned in the preceding article that there is a certain property of radio waves known as wave-length.

When we look at the waves in water, we note that there is a certain distance between the crests of the waves which will vary according to the height of the waves and according to the rapidity with which they go over the surface. We find the same thing to be true in radio. There is a certain distance between the crests of succeeding radio waves and this distance is known as the wave-length. It is measured in meters, the European standard of linear measurement being equivalent to 39.37 inches. It is this property of the waves that enables us to separate one from the other. If these were not true, our concerts and entertainments would come in in an indistinguishable babble, as all stations which were transmitting would be heard at once. However, the character of radio waves eliminates this and we are able, almost always, to separate the waves of two stations so that we can listen to any desired one. To understand this, let us consider two violin strings. They are both of the same length and under exactly the same tension. When one of them is plucked, it sends out a certain musical sound. In reality this sound is a series of waves created in the atmosphere which strikes our ears and affects the ear-drums. Since the other string is of exactly the same tension and length, it will start to vibrate when the waves set out by the first string strike it. The two strings are said to be in tune. In a similar manner, waves of a certain length are sent out by the transmitting station. In order to receive them, the receiving station must be tuned to the same wave-length as the transmitter. This is sometimes done in a very similar manner to the tuning of violin strings. That is, the length of the wire in the circuit is lengthened or shortened as the case may be, until the entire circuit is in tune or, as is sometimes said, in resonance with the transmitting circuit. Then the correct set-up in the aerial circuit, as explained in the article on the antenna system, will pass through our coil and detector and we will hear audible sounds in the telephone receivers.

CONSTRUCTING THE TUNING COIL

Let us now consider the tuning coil to be used with the radio set. The derivation of the name of this coil is obvious from the foregoing paragraphs. It is used for tuning purposes, and in reality gives us a longer aerial, as it adds to the length of the wire in the aerial circuit.

To construct this coil first a core will be necessary which may be a cardboard or bakelite tube, four inches in diameter by four inches long. You will not need a core as large as this for the first set, but it is advisable to buy it this length as it can be used later on with a few changes in another set which will be described in a forthcoming issue. If you decide to buy a cardboard tube which is much cheaper, first give it three or four coats of shellac, allowing each coat to dry thoroughly before applying the next. Some amateurs find it best, instead of using shellac, to coat the tube with a mixture made up as follows:

Break up an old phonograph record into small pieces. Place the pieces in a metal dish and with a hammer, pulverize them, so they will dissolve easily. Then place the fine powder in a glass jar and pour in enough alcohol to cover it. Put a cover on the jar and allow it to stand, shaking occasionally until the solid material is thoroughly dissolved. If the resulting mixture is too thin to use as a paint, allow the jar to remain open for some time until sufficient alcohol has evaporated to bring it to the correct consistency. If the resulting mixture is too thick, add alcohol until it is thin enough to use. Cardboard tubes, when painted with this mixture, are
found to be very satisfactory for tuning coils. They present a neat appearance and the insulating quality of the tube is increased. However, you can afford it, purchase from your radio dealer a bakelite or micarta tube of the dimensions given in Fig. 1. Such a tube will be stronger and will afford excellent insulation. Aside from this, it has an added advantage of not needing any finishing application, such as shellac or the mixture described. It is ready to use as purchased.

When you get the tube, purchase at the same time one-half pound of No. 22 D.C.C. wire. The term D.C.C. denotes "double cotton covered," or in other words, copper wire insulated with a double covering of cotton. Drill four small holes in one end of the tube, 3/4-inch from the end and parallel with the edge. This is illustrated in Fig. 1B. Unless you already have tools, acquire a medium-sized hammer, a screw driver with a 3-inch blade, a square, a steel center punch, which is to be used for locating holes to be drilled, a cross-cut saw, several drills and a small hand drill, a hacksaw with extra blades, a pair of cutting pliers, and a medium-sized vise. When you buy these tools, buy the best for the price that you feel you can invest. Tools are always an asset in any kind of mechanical work and the best are not too good. In this case, you will need all the tools mentioned. As time goes on, you will acquire others which will make your work easier and which will enable you to finish a job at the utmost speed.

**TAPPING THE COIL**

We will consider that the four holes have been drilled as described and illustrated. Push about eight inches of wire into the first hole at the left, out of the second hole back into the third one and out of the fourth one. You will find that this interlacing of wire will hold the end firmly in position so that it will not slip. Wind the wire around the tube nine times. Keep the wire as tight as possible and place the turns as close together as you can. The wire should be kept, at all times free from kinks, as these spoil the appearance of the winding and sometimes cause the wire to break. When you come to the ninth turn, take off a tap. Taps are provided on the coil so that various sections of the wire wound on the tube may be cut in or out of the circuit at will, in order that it may be tuned. There are two good methods of making taps and they are illustrated in Figs. 2A and 2B. The latter is the best method, but it is the most difficult and requires soldering. In regard to Fig. 2A, we see that when the place is reached where a tap is to be made, the wire is scraped at that point and at another point about 10 inches away. A loop is then formed so that the two scraped portions are next to each other, whereupon they are twisted together as shown. Twist tightly enough so that the joint will not become undone when you commence with the winding. It is well to solder the twisted portion of the wire, but if you are not proficient in this line, it need not be done until you have mastered the art of soldering, which will be described in another article. Now commence winding, taking off a tap every nine turns until there is a total of nine taps. Then take a tap every turn until nine more are made. The winding will be finished with the last tap. The end may be fastened in the same manner as the beginning.

In case you should desire to make your winding a little more elaborate and also lighter and more permanent, we will describe the type of tap illustrated in Fig. 2B. Four holes are drilled in a straight line as was done for the beginning and end of the winding. The wire is then cut, allowing about 3 inches more than is necessary to reach the first of the four holes. Push the wire into the first hole and pull it out of the second one. Then push the end of the wire which is still on the spool into the fourth hole and bring it out of the third one. Scrape the ends and twist together. Also solder this possible. At the same time twist, with these two wires, the end of a third piece of wire about five inches long. This is done in order to make connections as described below. This form of making a tap is much better in several ways than that illustrated in Fig. 2A. This coil which we have just described is known by two different names. It is a tuning coil and at the same time it may be called a variable inductance. The term variable, of course comes from the fact that the active amount of wire in the coil may be varied. The term inductance is applied to any coil of wire. The theory of inductance and its use in radio is rather complicated and will not be dealt with at the present time. However, a future article will deal with this and its relation to radio circuits. It is sufficient to say here that the inductance used in this radio set enables you to tune your apparatus to a certain wave-length so as to receive from any particular station which happens to be operating on that wave-length.

**THE COIL MOUNTING**

The next step in the construction of the tuning coil is the mounting of it. For this purpose, a wooden base-board may be used; also, if desired, a wooden panel may be used. Greater efficiency, however, will be realized if the panel, instead of being of wood, is made of a sheet of bakelite or micarta square. Only well seasoned woods which are free from resinous substances and sap may be used. Wood is a fairly good insulator, but when it becomes damp, it allows the minute radio currents to leak off. This is highly undesirable and in order to offset this property, it is a good idea to treat the wood to prevent it from absorbing moisture. The easiest way is to give it three or four coats of orange or white shellac which may be bought at any paint or hardware store. Before putting on the first coat, the wood should be warmed slightly so that the shellac will...
be thoroughly absorbed. For succeeding coats it is not necessary to do this. A second and more efficient manner of making a good insulator of a wooden part is to obtain a pan large enough to hold the largest piece which you are going to use; obtain sufficient paraffin wax so that when it is melted in the pan it will cover all of the wooden parts placed in the pan; melt the paraffin in the containing vessel and bring it almost to the boiling point; place the wood therein. It will be found necessary to hold the wooden parts down below the surface with a stick, as they will tend to float. Hold them there until all bubbling ceases. This will indicate that all the air which is between the fibres of the wood has been driven out and is now replaced with paraffin. The parts may then be removed and allowed to dry. The excess wax should be scraped from the surface with the edge of a straight knife. Parts treated in this manner will be found to possess excellent insulating qualities and will not allow a very great amount of leakage. For the set which is described here, waxing the parts will be found quite sufficient. If it is not possible to obtain a pan of sufficient size, the following procedure may be used, but not with as good results as the one described above. Melt the paraffin in any obtainable vessel and heat the wood to be treated. With a brush, apply the melted wax to all the surfaces of the wooden parts, at the same time keeping the wood warm by working near a stove. Make several applications and if possible, place the parts in a warm oven between the applications so that the wax will be thoroughly absorbed.

After cutting the two squares of wood for your tuning coil and waxing them, obtain two switches of the type illustrated in Fig. 3A, or one as shown in Fig. 3B, which are designed to be mounted in back of the panel. With the former it is only necessary to drill one hole for each, as the points or contacts, as indicated by B in Fig. 3A, are already placed and it is not necessary to drill a number of holes. Another good type of back panel mounted switch is illustrated in Fig. 3B. With this type it is necessary to drill five holes, two for the rods which control the switch levers A, and three for the mounting screws C. Whichever type of switch you get, mount it on the panel, as shown in Figs. 4A and 4B. While drilling the holes for the mounting of the switches, drill two for binding posts and two for mounting screws, as shown in Fig. 4B. Also, in the baseboard, drill two holes for wood screws which are to fasten the base of the tuning coil to the large base illustrated in Fig. 7. The size of these holes will be determined by the sizes of the switches you get, as well as of the binding posts and the wood screws. It is a good idea to purchase a dozen each of two or three sizes of wood screws and machine screws, as well as washers and nuts to fit the machine screws.

THE SWITCHES

Install your switch units in about the relative position shown in Fig. 4B. The upper part of the front panel is left blank as it is to be used for something else when you are ready to expand your set.

If you have picked out the right kind of a switch set, you will find that it will not be necessary to solder the leads from the tuning coil to the switch point. Some of these sets are provided with small chucks on the switch points which grip wires in much the same manner as the chuck on the end of a hand drill grips the drill points. This does away with all soldering and makes a very neat job. These are usually more expensive than the ordinary type, but they are worth the difference. In case you do not get one of this type and still do not want to solder, you will find that there are usually two nuts on each one of the switch points. Draw up the bottom one tightly so that the point is clamped firmly to its mounting, then scrape the insulation from the end of the lead of the tuning coil and place it between the bottom nut and the other one. Draw up the second nut so as to clamp the wire firmly.

When arranging the leads from the tuning coil to the switch sets, keep them in rotation. Keep them in order on the switch so that the top lead goes to the first point, the second lead to the second point and so on. Calibration of your set is possible if this system is followed. In order to facilitate matters, mark on the front of the panel graduations such as is illustrated in Fig. 4B, marking points with numbers so that indications of the positions of the switch arms in the rear of the panel may be obtained. The pointer should be set at some convenient position as the contact arm. Before connecting up the switches notice that a connection is to be made to each of the switch arms. Make this connection first, running a wire from one lever to one of the binding posts and from the other lever to the other binding post. The lever is indicated in Figs. 3A and 3B by the letter A. It is known variously as the switch lever or switch arm. It serves to make connection between the binding post and any one of the taps on the coil which may be desired. After you have completed this assembly, you will have a unit such as is illustrated in Figs. 4A and 4B and the tuning device for your first receiving set will be completed.

THE FIXED CONDENSER

In this article, we will not go into the theory of the actual operation of the various parts of your set, for to do so would take up too much space. The names of the instruments used will be given and their construction described. Then after you have built your set and are receiving messages, you will have more time to study the actual theory. This will be contained in succeeding articles.

The next instrument to be constructed is known as a fixed condenser. This particular type, for the use to which we will put it, is sometimes termed the phone condenser, as it is connected directly across the phones. These condensers can be purchased very cheaply in radio stores, but you will derive a certain satisfaction from making it yourself. The construction is given in Figs. 5A, 5B, 5C, 5D and 5E. In the first place, you will need three strips of paraffin paper or waxed paper 20 inches long by 2 inches wide. This paper must be perfectly free from imperfections and holes. You will also need two strips of tin foil cut to the shape shown in Figs. 5A and 5B. The strips are 1 1/2 inches wide by 19 inches long and are provided at the end with a lug 3/4 inch long by 1/2 inch wide. These lugs are left so that connections can be made thereto. After you have the five parts cut to the correct size and shape, lay a strip of tin foil on a strip of waxed paper, as shown in Fig. 5A. With a warm flat iron run over the surface of the tin foil. Do the same with a strip of tin foil and paraffin paper as laid in Fig. 5B. Then place the latter on the first strip of tin foil and paraffin paper assembled, and place the third strip of paraffin paper over the the entire unit. Press the whole together with a warm flat iron. Cut a piece of cardboard 3/4 inch wide by 2 inches long and roll up the condenser. The assembly is shown in Figs. 5D and 5E. Either coin (Continued on page 132)
Timely Suggestions—

By HOWARD S. PYLE, A.M.I.R.E.

Those of you who are experiencing interference in one form or another will find this article by Mr. Pyle of material benefit. He has described the various forms of interference, how the source may be determined and means to provide for its elimination.

Radio broadcasting has just passed through its third successful year. From a little known mode of entertainment and news dissemination, it has grown to a place in the home that no other invention or discovery has yet equaled. And as yet, we have but scratched the surface. Progress in both the transmission of entertainment and its reception has been phenomenal, and where, three years ago, we were dependent upon the crystal, the regenerative and the non-regenerative vacuum tube receivers, we now have our choice of a myriad of newer circuits; the super-heterodyne, the super-regenerative, the superheterodyne, the reflex and numerous others. Some are logical advancements; others should be looked on with misgiving, for as in any new industry, there are the good and the bad. Discrimination is difficult. Along with the newer developments, we have learned countless new "wrinkles" to improve our old stand-bys. For those whose success has not been all that might be desired, and for those to whom the first apparatus introduced for broadcast reception must still serve its purpose, this article is written.

From countless investigations conducted in connection with the transmission and reception of broadcast programs, the writer has gained considerable data. It has been definitely established that the greatest detriment to the perfect reception of broadcast programs today is the interference problem. This is a broad subject, and under its head may be classed innumerable sources of such interference. Our problem, of course, is how to eliminate this annoyance.

Radio Interferences

The greatest single type of interference as it exists today is that caused by other radio services, such as commercial ships, shore traffic, harmonic radiation from high power stations, oscillating receiving sets and the amateur transmitter. Among the foreign disturbances which are equally annoying if not more so, are X-ray machines, static, violet rays, power line induction and the like.

The interference caused by other radio services can be combated in one of two ways. The receiver can be made more selective, or the constants of the antenna system so adjusted as to provide sharper tuning. The first method is, of course, particularly applicable to the single circuit type of receiver. It is an inherent characteristic of this circuit to be broadly tuned. In other words, not only the desired signals are picked up, but those of neighboring frequencies are unpleasantly audible at the same time. Let us consider a remedy. In Fig. 1, we have a typical single circuit receiver, a so-called "gyro" circuit, direct coupled and tuned爾ly coupled receiver. It is readily seen that any incoming energy affecting the antenna circuit, A, L1, VC, and G, simultaneously affects the grid circuit, provided its frequency is somewhere near the range of the inductance L1. No provision is made for adjusting the frequency of the grid circuit, therefore, it obtains "shock excitation" at any frequency affecting the antenna system. This makes for broad tuning and the consequent lack of selectivity.

By the simple process of adding an extra coil in the form of the inductance L2 in Fig. 2, and changing the condenser constant, the single circuit receiver is improved 50 per cent. as to selectivity. In addition, to a considerable degree, the annoying radiation is reduced. It amounts to manifesting itself upon neighboring receivers as a whistle. Surely it is worth the few extra pennies and 20 minutes’ labor to add this extra coil to your single circuit sets! The tuning is not complicated by such a change—the condenser is used as before for tuning, but it now serves to tune the grid or secondary circuit, whereas in the original connection, it tuned the antenna circuit. It will be found that in the suggested change, the antenna tuning will not be critical, but can be adjusted very satisfactorily by means of taps taken at every 10 turns of the coil. The coil should either be wound on the same tube as the original inductance, spacing it about an inch and a half from the original winding. or it may be on a separate tube, placed in inductive relation to the coil L1, separated from it by an air gap of from one and a half to three inches. Experiments will determine the proper spacing, and it may then be permanently secured.

Antenna Changes

A further considerable gain in selectivity may be made by reducing the length of the antenna system. Many use antennas more than 100 feet in length. This is poor practice for it tends to make interfering signals very difficult of elimination. True, shorterening a wire may be easily done, but it is not so good a method, for it is not a very sure thing for it tends to secure a slightly weaker signal, subject to but a fraction of the interference experienced on the longer antenna, than to get terrific volume, constantly interrupted by interference? Static, too, will be considerably diminished on a shorter antenna. Make the antenna 50 or 60 feet long and sound all joints carefully, leading the wire to the set in as direct a line as possible. Keep it well insulated where it comes in contact with any foreign material. Following these suggestions will considerably diminish interference from commercial ship and shore transmission.

The radiation of harmonics from nearby high power stations is a bit more difficult to eliminate. These should be brought to the attention of the station causing them and public opinion brought to bear so that they may be removed. A fair method of dealing with this interference at the receiver is the addition of a wave-trap.

While wave-traps are very desirable and do reduce interference to a considerable extent, they may not totally eliminate it, as we are often led to believe through advertisements. A wave-trap is often constructed at home, from a coil of wire and a variable condenser. The sizes of both the inductance and capacity must be determined from the frequency which is to be eliminated. Such traps may be connected in the circuit in two ways, both of which are shown in Fig. 3. Method B, while probably causing a greater reduction in signal strength than method A, is the more positive, but where the interference is not external, so that the desired signal none too loud, method A is to be recommended.

The evil of radiating regenerative receivers is a particularly difficult one to combat. There is no practical method by which it may be absorbed or detuned at the receiver. Happily, this annoyance is gradually diminishing as the public begins to grasp the

(Continued on page 105)
The Trouble Corner

By ADSUM

When asked by a beginner what is the most useful instrument to buy, the writer always recommends the purchase of the milliammeter, and strongly advises that it should be kept wired in series with the "B" battery when the set is working, as shown in Fig. 1. If this is done, one has one's finger, so to speak, always on the pulse of the set and one's search for faults when the set is Working perfectly is considerably narrowed down. Take for example the case of a set such as that shown in Fig. 1. The milliammeter reading when the set is working perfectly is taken and noted down for future reference. Let us suppose that it is two milliamperes. If at any time signals become weak the first thing to do is to glance at the pointer of the instrument. Should it still register two milliamperes we know: (a) that there is nothing wrong with the plate circuits; (b) that the tubes are above suspicion as regards at any rate three out of their four connections (filament and plate); (c) that we need not look to batteries or battery connections for the source of the trouble; (d) that there is no short circuit or broken circuit on the high tension side of the high tension transformer. This narrows down the field of the search to quite small dimensions. The fault, if it is not in the phones, must be either in the grid circuits, which include grid condenser, grid-leak, condensers, and transformers, or in what we may call the tuning part of the set. So far as transformers are concerned we are limited to the secondarys, for their primaries are in the plate battery circuit. By the tuning part of the set is meant (1) the antenna; (2) the ground; (3) the antenna inductance and antenna condenser; (4) the closed circuit inductance and closed circuit condenser. The grid circuits can be tested out very easily. Begin with the audio frequency tube. Increase the negative potential of the grid biasing battery and watch the milliammeter. If current passes decreases, this grid circuit is as it should be. If not there is a failure. Test the detector in the same way by removing the grid leak and connecting the grid battery in its place. The radio frequency tube may be tried simply by moving the slider of the potentiometer from end to end. If there is no fault the milliammeter will register an increase as it moves towards the positive end. Moving thus tested all the rest of the set nothing remains but the antenna and ground and the fault will be found in one or other of these.

Uses of the Milliammeter

Besides enabling you to trace faults, the milliammeter will tell you a whole host of things about your set. You wonder perhaps whether oscillation is taking place; watch the pointer of the milliammeter as you tighten couplings or adjust the variable condenser.

It is intended under this heading to deal with various rather out of the way faults which occur in receiving sets. The writer has kept, for some time, a record of those which have happened to himself, and has also noted down such as have been experienced by his friends at various times. Some are fairly straightforward and might have been discovered almost at once if luck had been upon the searcher's side. Others, however, are of quite a different nature and unless one has some idea of what to suspect it will be—indeed it usually is—a long and difficult business to track them down to their sources. It is hoped that readers who are interested will give others the benefit of their experience by sending in brief accounts of such difficulties, giving all the necessary details of the way in which the trouble first manifested itself and of the means whereby it had been eventually traced and cured.

As the oscillation point is approached the needle will begin to fall back a little, and when the set actually oscillates it will drop quite suddenly to something very much below the normal reading. Are you running your filaments too bright? The milliammeter will tell you. If without any increase of plate voltage you find a slightly higher reading than normal shown, then you are obtaining a greater emission by overheating the filaments. In the same way, if the filament voltage remains unchanged the milliammeter will enable you to see whether you are using too high a voltage from the "B" battery. It will tell you better than any voltmeter the condition of either battery. For testing the "A" battery you require a 1,000-ohm resistance. Wire this in series with the "A" battery, as shown in Fig. 2, and take the reading when it is fully charged. If the resistance has its stated value, the reading will be 6 milliamperes; in fact, with a resistance of 1,000 ohms the milliammeter becomes a volt meter, each division representing one volt. If the value is slightly different, you can calculate it at once by

\[
\text{volts} = \frac{\text{ohms}}{1,000} \times \text{milliamperes}
\]

Ohm's Law: \( R = \frac{V}{I} \), or resistance = \( \frac{\text{volts}}{\text{amperes}} \)

(Ohms Law: 

\[
R = \frac{V}{I}
\]

Once the resistance is known exactly, the voltage can be measured at once by the formula

\[
1,000 \times \text{volts} = \text{amperes} \times \text{milliamperes} \times \text{resistance (ohms)}
\]

For example if the reading is 9 milliamperes and the resistance 500 ohms you have

\[
1,000 \times \text{volts} = 9 \times 500
\]

Therefore volts = 4.5

To test the "B" battery it is best to use a resistance such as that employed in plate circuits with a value of about 50,000 ohms. Its true value may be found in the same way as before by actual test with the milliammeter and a new "B" battery. Future readings can be worked out in a similar manner by the formula. This method has the great advantage that it throws only a very small strain upon the high tension battery when the test is made, for the current passed even with a 100 volt battery will not exceed two milliamperes. Milliammeters are not expensive to buy and anyone who requires one will soon find that it is an extremely good bargain. The best type to purchase is one with a scale reading from 0 to 20 or 25.
A CURIOUS CASE

Here is a strange case, liable to happen to anyone, which occurred to the writer some time ago before a milliammeter was fitted to the set. On the previous evening reception had been very good indeed, but this time when the set was switched on signals had fallen off to but a fraction of their proper strength. The set was a four tube one with two radio frequency stages, tuned plate coupled, a detector and a stage of audio. Antenna and ground came through all tests with flying colors, there was nothing wrong with any of the coils or the condensers which tuned them, no loose connections or short circuits could be found in connection with any of the plates or grids. The head phones and transformers were tried and found perfect in order. The batteries were up to their full voltage. All terminals were tested and found properly tightened up. The tubes fitted tightly into their sockets and no grid had sagged on to a plate.

When all tests had been made it seemed as if nothing else was left to be done and the matter might have remained a mystery had it not occurred to the victim to take a new tube (thoriated tubes were being used) and to try the result of using it to replace each of the four in turn. Nothing happened when it was placed in the sockets of the radio frequency tubes or the detector, but when it was employed as an audio amplifier, signals suddenly resumed their wonted strength and clearness. The mystery was solved immediately. The audio frequency tube had suddenly fallen off in its emission either through ageing or because the filament had at some time during the previous reception been worked at rather too high a temperature. This is a fairly common fault with some tubes if one does not exercise extreme care when using them. It can be detected either in the way indicated or by employing the very useful milliammeter.

This particular defaulting tube was cured eventually by being run for a considerable time with the plate current switched off.

A CURIOUS OCCURRENCE

One night the set, when adjusted to the known setting of a local station, responded so weakly that signals were barely audible in the loud speaker though normally they could be heard all over the house. Though usually the particular set in use was so stable that it could not be made to oscillate upon broadcast wave-lengths it was now found to emit squeaks when either the tuning condensers or the coupling between pri-

(Continued on page 121)
The Loop Antenna
By R. H. Langley*

An exceptionally comprehensive and detailed dissertation on loop antennae is required if the beginner is to understand the technical side of their construction and mode of functioning. There are numerous pointers included in this article for the constructor.

The loop antenna is a very interesting device. It is quite different in its method of operation from the outdoor antenna. The outdoor antenna is, in effect, nothing more nor less than a condenser. It is a very large condenser, to be sure, so far as its physical dimensions are concerned, but electrically it is a relatively small condenser. The loop, on the other hand, is an inductance. This fundamental difference between the two is the reason why it is necessary to use different methods of tuning in the two cases.

Let us examine this special form of inductance, which we call a loop, and see why it serves as a pick-up device for radio signals and how it should be made to be effective.

There is a very close parallel between the ordinary direct current generator or dynamo and the loop antenna exposed to passing radio waves. In the dynamo, a number of coils corresponding to the loop antenna are rotated in a powerful magnetic field. The purpose of rotating them is in order that they may move with respect to the field and thus have a voltage generated in them. The amount of this voltage depends, of course, upon the strength of the field and the speed at which the wires are swept through it.

In the radio case, the coil stands still but the field moves swiftly past the coil, thus accomplishing the same result. The speed at which the field moves cannot be varied and is always the speed of light—that is, 186,000 miles per second.

Let us see now what form of loop would have the greatest voltage generated in it by a passing radio wave. Let us think of this radio wave as a very much like great smooth waves on the ocean, which also move forward with a very definite velocity. The turns of wire on the loop antenna are necessarily in series with each other; that is to say, they form a continuous winding. If the maximum voltage is to be generated in any one turn of the loop, then the voltage generated in the two sides of this turn should be of opposite direction, so that they may add and not oppose each other. If the voltage generated in the turns of the loop were in the upward direction at any one instant, then these two voltages would cancel each other, but if the voltage on one side of the turn was up, and on the other side of turn, down, then they would add, and if the loop were connected to a receiver, a current would flow around the turns of the loop. This is, of course, exactly what we wish to have happen.

In order to have the voltage generated on one side of the loop in the opposite direction to that generated on the other side, the loop would have to be one-half a wave-length long; that is, any voltage generated would have to be long enough in the horizontal direction so that one side was in the crest of the wave when the other side was in the trough of the wave. Since the distance between the crests of the wave is the wave-length itself, then the distance from the crest to the trough is one-half the wave-length.

The higher the sides of the loop are—that is, the longer the vertical wires are—the greater will be the voltage generated. But a loop one-half a wave-length long is quite out of the question. It would be as long as a steamship and almost as difficult to handle. The loops which we are using every day are of quite reasonable dimensions. They are only a few hundredths of a wave-length long. How do they function? In order to answer this question, let us ask ourselves how we would build a coil of wire in order that absolutely no voltage should be generated in it by the passing wave. The only way in which this could be accomplished would be to so build the coil that the same voltage would be generated in both sides of it, and the voltages generated in the two sides would be opposed to each other. This would give a complete cancellation and no voltage at all at the terminals of the loop or coil. It is obvious that the only way in which this could be done is by so arranging the loop that it had no length at all. That is to say, arranging it so that the two sides were exactly in the same position in space. This would mean that the horizontal wires across the top and bottom of the loop would cease to exist and the loop would become nothing but a wire laid up and down between pegs on the surface of a board.

If there is any distance at all between the two sides of the loop, there will be some difference, not in the amount of voltage generated in the two sides but in the time at which this voltage is generated (Fig. 1). This means that the greater the voltage at the terminals of the loop, since complete cancellation of voltages cannot occur.

If the loop is rotated so that its horizontal wires are at right angles to the direction in which the signal is coming, then the loop has no length so far as those signals are concerned. The passing wave strikes both sides of each turn in the loop at exactly the same instant and the voltages generated are, therefore, equal and opposed, and there is no terminal voltage (Fig. 2). This is the fact which gives the loop antenna its very useful directional property. It is to be noted, however, that if the loop is turned ever so slightly from this zero position the voltages no longer cancel and there is a voltage at the terminals. This means that the zero position of the loop is very sharp, but the maximum position is very broad.

In applying the loop antenna to an actual radio receiver, it is necessary that provision be made to tune it to resonance with the desired signal. This is accomplished by means of a variable air condenser, and this condenser has a very definite maximum capacity, the amount of inductance which the loop can have is also limited. This maximum inductance with the maximum capacity of the variable condenser, must give resonance to the longest wave to be received.

The specification for the best loop antenna, therefore, is that it shall have just as many turns as possible, each turn being just as long and just as high as possible, and still have no more than the required maximum inductance. The higher the loop is, the greater will be the voltage generated in each side of each turn, and the longer it is, the greater will be the difference in time at which these voltages are generated in the two sides of the loop, and consequently the greater will be the voltage at the terminals, but it must not have an inductance value greater than that required for tuning.

The inductance of a coil of wire increases very rapidly as the turns are wound closer together. The maximum inductance is obtained with the minimum number of turns (Continued on page 70).

Fig. 1
Showing how a difference of potential is induced in a loop aerial by the incoming wave.

Fig. 2
The loop aerial 1 receives maximum energy from the Broadcast Station BS because the magnetic field passes through the plane of the loop while loop 2 receives no energy.

*Radio Engineer, General Electric Co.
DeForest Now Controls Regeneration Patents

By W. B. ARVIN

Never has the radio profession been fed such a sensational piece of news as the report covering Dr. DeForest's success in winning, after a seven-year fight, the patent rights to the oscillating circuit patents. Mr. Arvin gives an interesting and detailed account of the whole affair.

The radio industry was fairly thrown into a state of frenzy early last month when Dr. Lee DeForest was given control of the oscillating vacuum tube, practically every part of the radio industry of the United States. According to the decision handed down, Dr. DeForest gets not only the control of the vacuum tube oscillators as used for transmitting, but also exclusive patent rights over the so-called feed-back circuit, which will bring the tripler feed-back regenerative circuit and the Super-Heterodyne circuits under his control. As a matter of fact, attorneys are well agreed that in any case where a vacuum tube is used as a generator of alternating currents of any frequency, that use will be subject to the DeForest patents.

The effect of this decision is obvious, since, at the present time, all tube transmitting stations, using manufactured and installed in the United States will come under the control of Dr. DeForest's patents. Those firms engaged in the manufacture of transmitting sets, regenerative and Super-Heterodyne receivers, will have to make peace with Dr. DeForest and their further use of the oscillating notions in any form will depend entirely on the Doctor's good-will. Whether they will be granted licenses to continue their manufacture or not, is a question that cannot be answered at present writing. It is positively certain that there will be no end of litigation brought with a view to straighten out this tangled, and it is a tangled, situation of all future vacuum tube transmitters—this includes all broadcast stations—must be made only with the sanction of Dr. DeForest.

HISTORY OF LITIGATION

The history of the litigation which resulted in this decision is by no means uninteresting. The fight started in March, 1919, with the filing of an infringement suit in New York against Dr. DeForest by the Westinghouse company which, at that time, was in control of the Armstrong patents for generating continuous waves by means of a vacuum tube—the patent which was given to Dr. DeForest by the decision. Shortly after this case was filed, a second suit was brought in his own district in New York. The result was that the Commissioner of Patents issued a Writ of Interference which drew a suit from the claimants concerned to take their case to court and obtain a legal decision as to the rightful ownership of the feed-back oscillator idea. These four claimants were Mr. DeForest, Mr. Alexandar Meissner, a German inventor, Mr. Irving Langmuir, of the General Electric Co., and Mr. Edwin H. Armstrong.

The first decision against Dr. DeForest was handed down by Judge Mayer of New York. The case was appealed and Dr. DeForest lost again. It was then taken before the three Patent Office tribunals, from where it was appealed to the Court of final authority which handed down last month's decision.

The question was never one of invention. From the first entry of the litigation it was admitted by all the attorneys concerned that Dr. DeForest had originally discovered the idea. The most important single piece of evidence in the case is the two-page excerpt from the notebook of Dr. DeForest's assistant, Mr. Van Etten, which shows the original circuit and gives the oscillation results obtained from the hook-up. The first of these pages is reproduced at Fig. 1.

The lower courts all maintain that the patent rights should go to Mr. Armstrong, because the lapse of time between Dr. DeForest's original conception of the idea, Aug. 6, 1912, and the time of his filing application for a patent covering it was sufficient proof to establish the fact that he had abandoned the idea. One of the greatest points in favor of Mr. Armstrong seemed to be that Dr. DeForest did not mention the use of the oscillatory circuit for radio work at the time of discovery. Mr. Armstrong's application for patent contains specifically the radio application of the system.

The court who handed down the latest decision, however, took the position that since Dr. DeForest was investigating the use of the vacuum tube as a telephone amplifier and repeater in order to obtain funds to carry on his other research work at the time of his discovery, the lapse of time before the filing of the patent application did not actually constitute abandonment.

DIFFICULTIES

It might be of interest here to relate a few of the Doctor's experiences and some of his difficulties encountered at this period of his experimental work. Other litigations caused the failure of his company and his own financial embarrassment just about the time of the invention in question. He was forced to give up his own laboratory and experiments in order to make a living. He took a post as engineer with the Federal Telephone Co. of California. During the time of his connection with this company, however, he carried on his own experiments with the vacuum tube as a telephone repeater and relay. On several occasions he made attempts to market this idea to some of the large companies and in the face of several failures kept up his work, both along this line and in the investigation of the audion as an oscillator.

(Continued on page 129)
THE rapid advance of radio has no doubt led to many conjectures as to the possible development of a radio telephone system offering the same convenience and efficiency as the wire telephone system of today. Obviously a vital factor to be considered is that of signaling. For radio telephony to be successful, a complex signaling system must be available, whereby any subscriber may signal any other subscriber without making it necessary that the called party listen for the signal with a receiver. It will be interesting for radio fans to learn that an important step in this direction has already been made.

A signaling system has been designed, operating on a signal frequency of 135 cycles, by means of which as many as 78 stations may be signaled individually or simultaneously, with four supplementary stations possible for each main station. Furthermore, by a duplication of apparatus, this scheme need not be confined to one-way operation. It may be made intercommunicative so that any one station may signal any of the others on the same frequency, without calling in stations not desired.

The low signaling frequency permits the use of simple, reliable apparatus, applicable to ordinary radio transmitters and receivers, without requiring modification of the radio equipment, and not high in cost as compared with the remainder of the radio equipment. The low signaling frequency also introduces a high degree of freedom from interference, as brought out by tests made at the Bell System Research Laboratories during the development of this system. It was found that with the interference caused by spark and I.C.W. telegraph, the received speech would become unintelligible when the energy level of the interference was only 20 to 30 per cent. of that required to cause the signaling to fail.

An additional advantage resulting from the use of a low signaling frequency is that the receiving apparatus may be made so sensitive that the energy output from the smallest vacuum tubes obtainable is more than sufficient to operate the relays successfully.

Although quite limited as compared with the extensive wire telephone systems of today, the selectivity, sensitivity, and degree of freedom from interference of this signaling system will undoubtedly cause its immediate application in marine radio telephony, where automatic signaling would greatly reduce the radio operator's duties.

Another application which readily suggests itself would be speech transmission over the ocean, in which case the length of cable and the impossibility of using Fupin coils and repeating amplifiers make wire telephony entirely out of the question. The same is true over a desert or any other undeveloped region, where it would be far more economical to use the radio telephone than the wire telephone.

It is seen that one system may well be used hand in hand with the other, as indeed is now the case in ship to shore communication, the transmission being accomplished by wire over land to a central radio station and from there by radio to the ship.

Automatic signaling, as described below, will show the way to many such applications.

DETAILS

A simplified diagram for this scheme of signaling is shown in Fig. 1. By pressing the ringing key the electromagnet, shown in series with the key and a battery through ground, is excited. Contact is thus made to the 135 cycle supply, the 135 cycle current being thus applied to the radio transmitter in the same manner as speech currents are applied. By magnetic coupling, an alternating e.m.f. of 135 cycle frequency is thereby impressed between the grid and filament of a modulator tube, the plate circuit of which is connected in parallel with the plate circuit of an oscillator, as shown, both circuits being supplied by a plate supply battery. In series with this battery is connected a choke coil of large inductance, which effectively opposes any change of current, and thus keeps the battery current constant even if the resistance of the external circuit is varied.

To fix ideas: At A, Fig. 2, is shown the direct current set up in the key circuit at the time the key is closed.

As explained, this results in the application of 135 cycle current, shown at B, Fig. 2, to the radio transmitter.

Now returning to Fig. 1, suppose that the oscillator generates a wave of, say 450 meters, which is radiated by an antenna inductively coupled to the plate or output circuit of the oscillator. The amplitude of
this wave is proportional to the amount of direct current supplied to the oscillator plate circuit by the plate supply battery. When a 135 cycle alternating e.m.f. is impressed between the grid and filament of the modulator, the current taken by the modulator plate circuit varies periodically. The oscillator plate current, being equal to the constant total current from the plate supply battery minus the modulator plate current, is correspondingly varied. The current radiated by the antenna will obviously have the same variations. Variation or modulation, as it is usually termed, of the radiated wave (assumed 450 meters above) at the signaling frequency is thus effected. The radiated wave will now be of the form shown at C, Fig. 2.

At the receiving end, the current in the receiving loop is of the same form as the current sent out, but of smaller magnitude. See D, Fig. 2. This current is conducted into the grid circuit of a detector, the plate circuit of which gives as one of its components the 135-cycle current shown at E, Fig. 2, which is exactly similar to the original signaling current. The 135-cycle component is now amplified and by magnetic coupling sent into an alternating current relay, Fig. 3, which consists of a mechanically tuned reed set into vibration by the 135-cycle current.

**Vibrating Reed Relay**

The vibrating reed intermittently closes a circuit consisting of two resistances, an electromagnet and a battery connected in series through a ground. A condenser is connected across the larger of the resistances in series with the electromagnet. It is obvious that when the vibrating reed closes the circuit, the electromagnet is excited and closes the local signaling system. The condenser is at the same time being charged. When the vibrating reed opens the circuit, the condenser discharges through the electromagnet. If

The natural frequency of the vibrating reed is made equal to the frequency of the signaling current, the time taken by the condenser to discharge through the inductance of the electromagnet winding will be equal to the time between two successive closings of the circuit by the vibrating reed. The D.C. relay circuit will, therefore, remain closed as long as the reed is vibrating at the signaling frequency. F, Fig. 2, shows the pulsating sensitivity of the system. A very nearly constant frequency is requisite. To this end, a 135-cycle interrupter has been developed which generates a sine wave of nearly unvarying frequency.

Each ringing key shown may be set to produce a series of impulses in the form of a code. For example, if a certain station, whose code signal is 8-5-4, is held, the ringing key corresponding to this code is pressed and a series of impulses suitable for indicating this number is sent out. At the receiving end, after these impulses are detected and amplified, they are sent into the alternating current relay as described above. This relay controls a D.C. relay which in turn controls the local signaling circuit as explained. A selector mechanism is connected in this local signaling circuit and is set to operate a signal only upon the reception of the proper coded impulses.

When this signal rings, the called party presses the answering key and proceeds to tune in to the wave-length radiated by the transmitting station, assumed 420 meters above. In the case of one-way operation, the called party can listen to the calling party, but cannot reply. With two-way operation, as shown above, each party can signal the other party, and when the signal has been answered, each party can talk and listen at the same time as is done in ordinary wire telephony. It is evident that in a system of this kind some scheme must be applied whereby the current induced in the receiving loop by the local transmitting antenna is prevented from interfering with the signal e.m.f.'s from the distant transmitter. This is here accomplished by the balancing network shown.

**NUMBER OF STATIONS**

As noted above, with a multiplication of apparatus, this system has a capacity for a large number of stations on one signaling frequency. It is, of course, understood that in order to prevent interference, each station has its own transmitting wave-length, differing from the transmitting wave-lengths of all the other stations of the system. The

(Continued on page 137)
The Transmitting Station of the Radio Society of Great Britain

By PHILIP R. COURSEY, B.Sc., F. Inst. P., A.M.I.E.E.

The high-tension was obtained from a step-up transformer, fed at 600 cycles from a motor-generator, the signaling key being put in the primary circuit of this transformer. A general view of the interior of the station, showing the receiving position and controls, is reproduced in Fig. 1, and a view of the vacuum tube panel in Fig. 2. The four tubes in a row can be seen in the photograph, with the filament lighting transformers in the background, and the step-up transformers below the tubes.

SERIES FEED

A "series feed" of the high tension between the filaments of the oscillator tubes and the oscillator circuit was used, as shown in Fig. 3, since this arrangement was found somewhat more effective than the conventional "shunt feed" of the tube plates through radio frequency chokes.

The filaments are lighted from the 220-volt 50-cycle mains through step-down transformers in the usual manner, a potentiometer resistance being connected across the filaments of the oscillator tubes to obtain the electrical center of the filaments for the connection of the grid leak and the high tension supply.

As may be seen from the diagram, a loose coupling to the aerial circuit was employed, the main oscillation circuit consisting of a condenser of 0.005 mfd. capacity with a portion of the primary coil. The aerial coil was a flat winding of copper strip, as may be seen in Fig. 4.

FOR the purpose of participating in this season's trans-Atlantic tests, a special station was erected and operated on behalf of the Radio Society of Great Britain under the call sign of G-6XX, the G prefix being added to designate British nationality in accordance with the scheme approved by the British Post Office. A special permit to use an input power of one kilowatt was granted for the purpose of the tests.

The station is situated at Shepherd's Bush, London, W., England, having been erected in a room loaned by the Dubilier Condenser Co., Ltd., which company also greatly assisted in fitting up the apparatus, etc. The aerial, of the inverted L type, is a six-wire cage on 7-foot spreaders, the flat top being about 75 feet long, and the down leads, a six-wire cage on loops of one foot diameter, about 40 feet long. One end of the aerial is supported by a 60-foot mast and the other by a brick chimney stack of about the same height. A six-wire counterpoise is slung beneath the aerial, extending from the window of the operating room to a point just beyond the further end of the aerial.

The vacuum tubes were supplied by the M. O. Valve Co., London, and were each capable of a plate energy dissipation of 450 watts. Two rectifying tubes were used for two-wave rectification at 6,500 volts, and two in parallel as oscillators.

Fig. 1. A general view of the interior of British amateur radio transmitting station G-6XX.

A. E. Trosham, the chief operator, is at the key. This station is located at Shepherd's Bush, London, and was erected in a room loaned by the Dubilier Condenser Co., Ltd. A special permit has been granted to use an input power of one kilowatt.

Fig. 4. A view of the apparatus composing the oscillating and antenna circuit. The antenna is coupled to the oscillating circuit by means of a spiral wound pancake coil. The series antenna condenser can be seen at the left of the second table perched atop a large porcelain insulator.

The radiation ammeter is similarly mounted. Note the bulky aerial change-over switch.
The average aerial current is about 8 amperes at 193 to 200 meters. This current remains quite steady, even when the aerial swings in the wind, as the aerial circuit tuning is rather flat, while the wave-length is controlled almost entirely by the primary circuit, so that aerial changes make only small effects in the radiated wave-length.

The use of 600 cycles as the supply frequency for the rectifying tubes considerably simplifies the smoothing of the rectified current, so that by the use of a simple smoothing condenser the signal appears be pure D.C.C.W. at any distance from the station.

The signals from this station have been reported by about 40 American and Canadian amateurs, as well as by the Bowdoin in the Arctic, and this in spite of the fact that the aerial is very much screened by surrounding buildings, an elevated track and other objects which must decrease the radiation of short wave-length signals.

SHORT WAVES

Experiments have also been made in the transmission of signals on about 120 meters from this station, using for this purpose special coils clipped on to the three feed leads between the tubes and the oscillation circuit. To facilitate such tests, these three leads—plate, grid and high tension positive—are carried along the test bench, overhead supported on porcelain insulators, as may be seen in the photographs, so that any convenient coil can be clipped on these leads in a few seconds.

A special aerial change-over switch is fitted which not only changes over the aerial from "send" to "receive," but also when in the latter position it interrupts either the primary oscillation circuit or the grid lead to the primary coil, as desired. The object of this is to prevent oscillations being set up by the tubes when listening for signals, as it has been found that these tubes oscillate quite strongly without any high tension supply at all, provided the filaments are alight—the pulsating electron emission caused by the 50-cycle heating current of the filaments being sufficient to set the primary circuit oscillating to an extent sufficient to prevent reception on nearby wave-lengths. Interrupting the grid lead to the tubes when the aerial switch is in the "receive" position entirely prevents this trouble.

**Station—4EO—4ZD**

The accompanying cut shows the general layout of station 4EO--4ZD, owned and operated by Paul G. Watson, at 830 East Park Avenue, Savannah, Ga. The transmitter is a 100-watt Reinartz-Hartley set, while the receiver is one of the writer's own design.

The transmitter is built with a Hartley oscillator circuit, and is coupled to the antenna and coupling tank through two variable condensers, in order to work the set below the fundamental frequency of the antenna. At present it is tuned to 215 meters. The idea of enclosing the set in a cabinet is a departure from conventional C.W. design, and requires careful balancing in order to prevent hum from being generated to any appreciable degree. Two UV-203 tubes are used as oscillators. The system of balancing the counter-les and antenna with variable condensers allows a very quick change.
of transmitter wave-length, as they control this to a very large degree. The usual filament voltmeter, radiation meter and milliammeter can be seen on the panel. The parts are home-made.

The receiver circuit is shown in the accompanying diagram, and is worked from a two-foot 12-turn loop. The odd feature of this circuit is the fact the radio-frequency transformer is composed of two coils of the same size, coupled tightly. A tickler can be added to the secondary circuit, as shown by the dotted line, but is not essential to good operation. For BCL reception, two No. 50 coils are used, while two No. 25 coils suffice for amateurs, and are used in connection with a one-foot, 16-turn loop. Many amateurs in all parts of the country have been working on this combination.

During the winter season, when static moderates, this set is connected to the antenna, but as the usual summer static has set in, it is impossible to do any receiving on the antenna. The loop eliminates nearly all the static and gives a very good volume of signals. Potentiometer control is used for regeneration and oscillation control of the loop circuit. The two-step amplifier works very well.

### Calls Heard

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<tr>
<th>Q5P</th>
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<th>GADSDEN, ALA.</th>
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**Spark:**

- 46: I-W: 9DYN: Phone: 9JZD, 9ZOD - Canadian: 9JH
- 9CEN, SEIBERT, COLORADO
- C-W: 9A4C, 9A5M, 9A5U, 5B5, 5E4N, 5L5, 5P5 (5G5)
- Phone: 9A4C, 9A5M, 5B5, 5E4N, 5L5, 5P5 (5G5)

**Super-Heterodyne Circuit:**

- Three stages of intermediate frequency, a second detector and two stages of A, F amplification.
How to Make and Use a Wavemeter

As Mr. Hatry puts it, there is a satisfaction and a feeling of security in knowing that your wave is where it should be. One has no fear then of the inspector. Possibly this reflection inspired Mr. Hatry to write this article.

TAKE a deep breath and plunge again, for here's another article about wavemeters. Much has been said about them in the past and a lot more can still be said about them, but if somebody can only touch the sprig that will make you realize the need of a wavemeter in your station, none of the advice will have been wasted. Indeed, I wonder at my boldness in telling you this, when so many men more able than myself have done so, and have been ignored. Yeah, and I despair at this waste of words, for you will most likely accuse me of "platitudes." However, platitudes are quite often great hunks of the truth—which perhaps explains their standing.

First of all, let's get some doubts out of your mind. A wavemeter is not expensive, is not hard to build, is not difficult to calibrate, and you can do it all without outside assistance, barring the use of your set.

The materials necessary are merely a good .001 mfd. variable condenser and a coil. No crystals, buzzers, meters, phones or other paraphernalia need be attached or purchased. In fact, after you have tried such a meter it is doubtful if you would consider going back to the more familiar type.

Now, my pet. The part that is no doubt bothering you. With this simple wavemeter in hand and a signal coming in, the particular meterage of which you desire, the modus operandi is simple but effective. Place the coil of the wavemeter near to the secondary of your receiver, which should be made to oscillate, and vary the condenser slowly.

At some point along the wavemeter dial reading, the receiver will go out of oscillation, and a little further on it will resume its oscillation. (You might practice finding this point without any signal.) Having found the place on your wavemeter that stops oscillation, it is only necessary to gradually increase the distance between the meter and your receiver until the point that stops oscillation is right on the dot and tones sharply. The meter, so sharply that a fractional variation on either side of the dead spot will let the receiver oscillate. Then you can read your wave direct from the meter scale, for the spot that stops the oscillation is directly in tune with your receiver, presuming, of course, that your meter is calibrated. This action of the meter should immediately suggest to your mind an effective way of calibrating it. Usually the wavemeter coil will have a correct and incorrect polarity. It is not at

WITH TRANSMITTER

The operation to determine your transmitting wave is much the same and acts exactly on the same principle. Place the wavemeter coil close to your aerial feed-in as it goes to your transmitter while the transmitter is in operation and you are watching the ammeter in the antenna. Then vary the variable condenser of your wavemeter slowly, watching for a reduction in the antenna current. Stop when a reduction is apparent and move slowly from your antenna lead with the coil so that you will not produce such a reduction that your transmitter will stop oscillating and thereby throw a healthy load directly on your tubes, that previously chased its way merrily up the antenna. This load can, and possibly will, make a good tube look bad and be bad. (It is necessary to vary the condenser very slowly to have time to notice when the reduction begins, without stopping oscillation.) By moving the meter away and adjusting as you go, you can get a distance where the antenna current only drops a tenth or some such fraction of an ampere, when the resonance point is passed. This, if your wavemeter is calibrated, is your wave-length.

If the wavemeter is not calibrated, it is only necessary for you to take some harm, whom you know is not the highest or lowest in wave-length among those you hear, and getting his reading on the wavemeter from your receiver, you can proceed to tune your transmitter as near to that wavemeter reading as possible. Your transmitter can help you solve the further calibration of the wavemeter by getting into communication with as many hams on different waves as possible and getting them to tell their waves as read by the inspector's meter, or by any meter, for that matter, provided it has been actually measured. With sufficient check on your meter readings, you will have one of the most important conveniences a station can own.

Furthermore, most of the more powerful amateur stations can tell you both your wave-length and their own at any time you happen to communicate with them, and it is easy for you to ask them if it is a measured reading and not a guess: they will gladly do this. Any time anyone cares to call me and can get my answer, I will gladly test with him on a series of different wave-lengths and give him their measured meterage with pleasure. I feel strongly enough on this wavemeter stuff to do my share. By the (Continued on page 109)
A Local V. T. Transmitter

By HOWARD S. PYLE, A. M. I. R. E.

Mr. Pyle points out the importance of employing a low power transmitter for handling local traffic to minimize interference. He describes an easily constructed and inexpensive 5-watt transmitter and gives information on tuning and operating.

In the past year or more complaints against amateur stations which were alleged to be interfering with the reception of broadcast programs were many.

In numerous instances they have not been justified, but nevertheless in several cases investigated in the larger cities, the amateur transmitter was guilty of causing a great deal of unnecessary unpleasantness to the broadcast listening public. In the great majority of cases such interference was traced directly to the use of more power than necessary to carry on the communication at hand. Particularly is this true of local communications—between points in the same city or within a radius of a few miles. The young fellow with the so-called "hundred-watt" transmitter—that is, employing two of the type of vacuum tube rated at 50 watts output in carrying on local communication—rarely ever makes any effort to decrease his power. His three or four or five amperes are pushed into the antenna circuit just as hard as if he were working a thousand miles. If he attempts to reduce his power, it is generally in the most logical form—the reduction of the plate or filament supply potential to the pilotrons. This, though, at best is unsatisfactory, for it is found that the present-day tubes will refuse to oscillate at plate potentials much less than the rated voltage. The same holds true with respect to the filament voltage. The reduction accomplished by such a method, therefore, is hardly satisfactory from the standpoint of the broadcast listener.

Then, too, regardless of the power used, where rectified alternating current supplies the plate potential, nearby receiving sets generally experience an annoying transformer hum. Efforts to eliminate this by the use of filter systems are but makeshifts and do not answer the purpose unless the filter circuit contains 50, 60 or even 100 henries of inductance in the form of iron core choke coils, and enormous amounts of capacity shunt to the supply source. Even then, without an efficient rectifier, such a filter system is far from efficient in itself. The same holds true for motor generator supplies, but to a lesser extent. Often a disagreeable generator hum manifests itself in the receiving equipment located nearby. This, however, is much more easily filtered out than an A.C. ripple.

A SOLUTION

What, then, shall the amateur who is conscientiously trying to cooperate with the broadcast listener do? There is but one answer. For his local and short range communication he had best provide himself with an additional transmitter of extremely low power, and use it in every instance where it will cover the required distance.

This is not an expensive proposition, for in almost every case there are enough parts in the "junk-box" of the average amateur to build a very complete low-powered transmitter. It is not necessary to use even a five-watt power tube, if one is not readily obtainable. An amplifier tube will answer very well. The plate potential may be supplied by four or five of the small "B" batteries, or from the motor generator unit driving the larger tubes used in the DX transmitter, running on reduced potential. The use of alternating current in any form is not recommended for the local transmitter.

Considering the matter further, what should a short range transmitter take into consideration? Should it be pure D.C.C.W., I.C.W. or voice modulated transmission? It has been found difficult to receive pure D.C.C.W. from local stations, and after numerous tests the writer decided in favor of buzzer modulated I.C.W. Many protests will doubtless be made at this, it being alleged that I.C.W. is a greater source of interference than higher powered C.W. Actual experiments have established the fact that this is not so. With key click transformer or generator hum and the general A.C. blanketting effect of higher powered transmitters, the low powered buzzer I.C.W. set will cast the former in the discard in the way of non-interfering characteristics. The writer debated long and earnestly over the subject of whether to include provision for voice transmission or eliminate it entirely. It was

(Continued on page 68)
A Reflex Receiver With Neutrodyne Control

By A. D. Cowper

In this instrument Mr. Cowper displays considerable ingenuity in adapting the Hazeltine Neutrodyne principle to an efficient reflex receiver. There is a marked simplicity in the design and construction of this set making it simple of construction.

In order to obtain the maximum possible signal strength from a single tube crystal circuit, it is desirable to utilize regeneration to a point which is just below actual oscillation, but which is narrowly adjusted to be as near this point as may be safe. This implies a positive and at the same time a smooth and easy control.

Undoubtedly the most efficient mode in which to link the tube, acting as the radio frequency amplifier, and the rectifying crystal, is by placing the latter instrument in shunt with a tuned plate circuit. The subsequent feed-back of rectified audio frequency energy is preferably carried out through a good step-up transformer arranged so as to apply the maximum possible signal voltage on the grid of the tube.

If a small series condenser be inserted in the aerial circuit (as should be done in little damped circuits so as to give a larger signal voltage across the inductance) or if loosely coupled circuits be used together with high plate voltage and a good tube, a critically tuned plate circuit generally means that self oscillation will take place. With the severe damping of the crystal circuit across the plate inductance, this may not be uncontrollable. For instance, in the familiar ST-100 circuit a resistance of some 100,000 ohms is introduced across the grid and filament, which in practice is found to be an adequate control of too exuberant oscillation, while at the same time allowing considerable increase of signal strength.

An exceedingly effective method of control is afforded by the Neutrodyne principle evolved by Professor Hazeltine. This can be used to stabilize a single tube circuit, or to give, at will, the finest possible control over the feed-back effect. In the receiver to be described here, a fixed coupling is utilized between the plate coil and the Neutrodyne coil. For the sake of simplicity, the tiny coupling condenser, which transmits back to the grid of the tube the reversed stabilizing impulses, is made adjustable so that regeneration is controlled entirely by this neutralizing condenser.

Self-oscillation in a tuned plate circuit is generally ascribed to the back coupling effect of the small condenser constituted by the

(Continued on page 116)
Distortionless Broadcast Reception

By H. J. Round, M. C., M.I.E.

Captain H. J. Round, the author of this article, world famous for his radio inventions and discoveries, is the chief of the research department of the Marconi Company. He gives here some very valuable information on amplifiers and how to correct distortion.

Having assured ourselves that all the distortion is either in the transmitter or in the head-phones, let us attack the head-phone question. I have determined that on an average you will get equal voltage produced at the end of your receiver with equal audibility of sound produced at the transmitting end.

An example of this will make the point clear. Suppose a small drum giving a note of 300 vibrations per second and a Piccolo giving, say, 4,000 vibrations, are arranged some distance away from you so that each will be just audible, by arranging that the drummer plays weaker or stronger notes, as required. Then the transmitter will transmit such a modulation that the voltages across the grid of your last tube are equal. So you see that all you now require is a phone which delivers to your ear equal audibility for equal voltages, and to the grid of this last tube. Unfortunately, head-phones do not do this.

Fig. 3 shows approximately what a pair of well known (and considered good) head-phones do. The top notes come out fairly well, the middle ones much too strong, and the bottom ones, below 200 cycles per second, are hardly there at all. You have not noticed this directly because this resonant point is very flat as the scale covers such a big range of frequency, but you have. I expect, noticed it indirectly, and blamed it on the transmission. What you have noticed is:

1. Room echo effects, particularly from large halls.
2. Certain singers’ notes being unpleasant and piercing.
3. Viols being rather flute-like.
4. And this is quite important—if you strengthen your signals more than a certain amount, they jar you, although that strength could not have been greater than that which you would have received directly if you had been listening in the studio.
5. Speeches when very weak, unintelligible.
6. The top notes of the piano are too wooden and the bottom notes are too weak.

(Continued on page 114)
Matching Intermediate Wave Transformers for Super-Heterodynes

By PROFESSOR GROVER IRA MITCHELL*

If maximum radio frequency amplification is to be obtained in a Super-Heterodyne receiver, it is necessary that each intermediate-wave transformer be tuned to the same frequency. Professor Mitchell has described in this article an excellent method of matching these transformers.

The attention which the Super-Heterodyne circuit is receiving at this time has awakened a keen interest in the design of the intermediate-wave transformers used in its amplifying stages. These transformers are now made in two types, the first of which is able to respond to a wide range of frequencies, ranging from 5,000 to 25,000 meters; and the second, to respond to but a very narrow band of frequencies, usually in the neighborhood of 10,000 meters.

The amplifying curves of the two types are shown in Fig. 1. A comparison of the curves shows that the broadly tuned transformer has a relatively low amplification factor, while the sharply peaked transformer has a very high amplification factor for the frequency to which it is able to respond. It is at once realized that the maximum amplification of the heterodyned signal wave will be obtained only when the transformers in the intermediate stages are of the sharply peaked type with the peaks of all the transformers occurring at the same frequency. In order to secure this condition, the builder of a Super-Heterodyne receiver must make certain that the transformers be is tuned to peak at the same frequency. The exact frequency at which the peak occurs is of no particular importance, so long as it is in the neighborhood of 10,000 meters—a frequency which most authorities have accepted.

The sharply peaked transformers have an air core, since the presence of an iron core tends to broaden tuning. Several sets of specifications for building such air-core transformers have appeared in Radio News, and the radio experimenter will have no difficulty in building and winding his own. After such transformers have been constructed, it is necessary to match them so they will respond to the same wave-length if the maximum amplification is to be secured. The author has found that in winding these units, even when the same sized forms are used and the same number of turns employed in each transformer, unless the turns have been very carefully wound into flat layers with the same number of turns in each layer—a very painful and laborious job—the inductance of the windings will vary sufficiently between the different transformers to make their peaks occur at widely different frequencies.

The author has used the method and apparatus, which will be described, to ascertain the point at which each of the several transformers peak and to select transformers for each set to be built which peak at the same point.

The first requirement is a vacuum-tube oscillation circuit, the generator for which is shown at the right of Fig. 2. This circuit must be so adjusted that the oscillations of a wave-length varying between 5,000 and 15,000 meters, or from 20,000 to 60,000 cycles per second, are capable of being varied in such a manner that if the coils L1 and L2 are of 500 turns each, of the honeycomb type, the two coils being mounted side by side with their axes coinciding, taking care that their magnetic fields are "boosting" and not opposing each other, and having the condenser Cw of the 43-plate type, the oscillating frequency of this circuit will be capable of variation within the mentioned limits.

The variable condenser Cw should have its settings carefully calibrated for the frequencies ranging from 8,000 to 12,000 meters, this being the range most apt to be used. The other frequencies between the lower and upper limits may also be calibrated, but this is not so important. The calibration may be done by any one of the many methods described in past issues of Radio News, or the oscillator may be sent to the Bureau of Standards, or to the laboratories of many of our state colleges or universities, to be calibrated.

The remainder of the circuit of Fig. 2 is a straight amplifier circuit, modified to suit the requirements of this particular type of work. The coil L, has but one turn. This coil is very loosely coupled to coils L1 and L2, the coupling factor being variable. By adjusting the amount of energy it picks up. The transformer to be tested is inserted in the circuit as shown at T, its +B terminal being connected to a 45-volt block of "B" battery and its F terminal is connected to the center terminal of a 400-ohm potentiometer P, placed across the B+ battery as shown.

This battery should consist of about six standard dry cells. This battery is connected to the positive terminal of the "A" battery supplying the filament of the amplifying tubes. The voltmeter V is connected between the center terminal of the potentiometer and the positive "A" battery terminal, as shown. The fixed condenser C should be of about .0005 mfd. capacity and is inserted as shown to serve as a by-pass to the potentiometer winding for the radio frequency. The plate circuit of the tube to the right of Fig. 2 contains two milliammeters, MA1 and MA2, each of which can be short-circuited by a switch. MA1 should be capable of reading the maximum plate current, about 15 milliamperes, and MA2 should be a very low reading instrument capable of giving a large deflection for currents as low as 0.1 milliamperes.

The use of this apparatus for measuring the amplification of the transformers under test is as follows:

**METHOD OF MEASUREMENT**

The oscillator is set for the frequency desired by means of the calibrated dial of Cw. Its filament switch should then be opened to render it inactive. The tubes T1 and T2 should then be lighted with the transformer T in place. The potentiometer arm should be placed over to the positive side as far as it will go. The switch S, which short-circuits the high-range milliammeter, should then be opened. MA1 will indicate several milliamperes of current flowing through the plate circuit of T2. The movable contact of the potentiometer should then be moved toward its negative terminal, thus placing an increasing negative bias on the grid of T2. The reading of MA2 will gradu-

(Continued on page 66)
NOT every amateur or radio fan is in a position to expend money enough to purchase a loud speaker costing $25 or $50. Also, true is the fact that the market today is flooded with so many types of loud speakers, good and bad, that the average person is easily misled to the extent of spending his hard-earned money on an inferior article.

Many of these so-called loud speakers are nothing more than poor horns, having cheap phones attached. These combinations can hardly be classed as loud speakers; the name “loud squawker” would be more appropriate. With this in mind, I have prepared the following suggestions, which, if followed out carefully, will, without doubt, produce a very good loud speaking unit comparable with any.

The perfect loud speaker has yet to be developed. Many are good, but very few approach perfect reproduction. The big difficulty lies, however, not in producing an electrically perfect piece of apparatus, but in producing an acoustically correct unit. It is common knowledge that the science of acoustics has not developed to the extent that electrical science has. Therefore, only such companies that have conducted researches along the combined lines of the above can hope to develop an instrument approaching perfection.

Let us consider the requirements of a good loud speaking unit:

1. It must be designed to prevent electrical losses.
2. It must be adapted to strong or weak voice currents.
3. It must perform faithfully over a range of 60 to 3,000 cycles per second.
4. It must be rugged in construction.
5. The diaphragm should not be metallic.
6. It should operate with permanent magnets to avoid the use of a separately excited field. (That is, not requiring the use of a storage battery to excite the field.)

One unit that meets most of these requirements is the Baldwin type C. Since it is equipped with a non-metallic diaphragm, certain alterations are necessary, however. Any phone with a good non-metallic diaphragm and the other qualifications may be used.

The electrical part of the Baldwin unit should not be changed. However, for best results the following changes should be made in the vibrating mechanism and diaphragm. It can plainly be seen from Fig. 1 that in the commercial unit the diaphragm is in contact with the metal frame supporting it. When used as a phone, this is permissible, but in use as a loud speaker unit this metallic contact allows the diaphragm to vibrate to and fro against the metal frame, introducing distortion and noise. This is especially true where heavy voice currents are present.

To overcome this defect the phone is held vertically, as in Fig. 1, and a fillet of beeswax is carefully melted into the corner by the aid of a small pointed rod or a clean soldering iron. This rod or iron should be just warm enough to cause the beeswax to run in under the diaphragm, as well as to make a fillet on the outside corner. After the beeswax has cooled, the diaphragm will be securely held in place in the retaining seat by a wax gasket. This simple operation will improve the tone quality wonderfully, and also permit the use of a greater amount of amplifier energy than is otherwise possible. Experiment has proven that ordinary waxes—paraffin, sealing wax, etc.—may not be used with success. Use a good grade beeswax, which can be procured at any good hardware store for a few cents.

Superfluous wax can be removed with a little gasoline or turpentine applied with a small cloth, care being taken not to scratch or damage the lacquer.

Another decided improvement is the button B. (See Fig. 2.) Its use prevents excessive vibration and the formation of harmonics, which occur when the diaphragm vibrates, not as a whole surface but at the center only. This reinforcement at the center of the diaphragm causes a greater area of the diaphragm to vibrate, thereby broadening and increasing the volume of the unit as a whole.

Dimensions for constructing the button are given in Fig. 2. It is applied at the center of the diaphragm concentrically with the aid of a little beeswax and a warm iron. The warm iron in this case is held lightly on top of the button until heat enough is transmitted to warm the film of wax that has previously been applied to the center of the diaphragm. This button may be constructed of bone, ivory or celluloid and should be hollowed out enough that the underside center will clear the unit on the end of the armature rod R. Do not overload the button with wax. Too much wax at the center of the diaphragm will retard rather than improve the action.

One thing particularly noticeable in the design of loud speakers on the market today is the trend toward the use of horns—a type that was long ago discarded by prominent phonograph concerns. These horns in general would produce very poor music on a phonograph, and, as the experienced radio man knows, do produce poor music on a radio loud speaking unit.

If you have a good phonograph, take advantage of its acoustical value and use it. Adapt your unit to it; it will give better results than a horn, generally speaking.

The value of the unit will be depreciated considerably if it is not fitted to the sound chamber correctly. Hit-or-miss methods of coupling the two will not give maximum results.

Figs. 3 and 4 give the constructional details for making an adapter for the Edison and Victor phonographs. Adapters for other types will be simply adaptations of these two. The shape of the iron in front of the adapter casting is very important, and if the shape is not followed closely the results will be impaired.

The adapter casting may be of aluminum, brass, hard rubber or steel, and should not cost more than a dollar or two. Any machine shop will make one very reasonably.

Referring again to Fig. 1, a drop of wax applied at point O and P will improve the action of the entire unit, particularly when the signals are of considerable volume, as these two joints are apt to rattle under such conditions. Great care must be exercised in applying this wax as the receiver is a very delicate mechanism and a slight bend in the armature rod or the connection will destroy the sensitiveness.

In closing, remember to reverse the phone tips to get the best polarity, if there is any choice, and also see that there is no dirt in the armature to hinder its action. If these suggestions are carried out carefully a loud speaker will result, which will be comparable with the best.
An Efficient Untuned Primary Coupler

By W. L. PEARCE

Two views of the untuned primary coupler showing all three windings. On the left, T is the tickler, S the secondary and P the primary. On the right, P and S show the primary and secondary terminals respectively.

THE case of adjustment of a single circuit receiver and the selectivity of the two circuit tuner may be had by using an untuned primary coupler. A receiver using this coupler has only one control for tuning and one for regeneration. It is nearly one control receiver, as the regeneration remains almost at maximum for all wavelengths at a certain setting. If the tickler is set for maximum regeneration at the low wavelengths, it need be varied only a few degrees for the higher waves.

The coupler is very easy to construct and may be made by anyone. A standard 180-degree variocoupler similar to the one in the photograph should be obtained. The primary winding should be removed from the stator and a new winding consisting of 42 turns of No. 20 S.C.C. wire substituted. A little collodion may be applied to the outside turns to keep them in place. This winding, well be used as the secondary of the coupler. A strip of flexible cardboard, three-quarters inch wide and just long enough for the ends to meet is wrapped around the new winding and secured in this position by a strip of adhesive tape. Eight small blocks of hard wood or some other good insulator, measuring ½ x ⅛ x ⅛ inch are procured and are secured at their edges, at equal distances, on the strip of cardboard. Collodion should be used for this purpose, as it dries in two minutes and will hold the blocks securely. The primary winding consists of 10 turns of No. 18 S.C.C. wire wound over the secondary winding on the edges of the wooden blocks. The beginning of this winding is secured by means of a piece of strong cloth tape about ⅛ inches long and ¾ inch wide. This is folded over the beginning of the wire and laid flat on one of the wooden blocks. As the primary is wound, each turn passes over the tape and holds it in place. Before the first turn is completed, a second piece of tape, folded in the same manner, is placed on the block directly in front of the other so that the looped end of the tape points in the opposite direction from that of the first. The first turn is then passed over this piece of tape and the rest of the winding is continued over both tapes. The last turn of the winding is passed through the loop of the second piece of tape and the other end is pulled until the wire is tight up against the rest of the winding. This method of securing the ends is plainly shown in Fig. 1. A light coat of collodion may be applied to this winding to keep it in place.

This coupler makes a very efficient regenerative receiver and will tune to all broadcast wave-lengths when the secondary is shunted by a variable condenser of .0005 mfd. capacity. If amateur wave-lengths are to be received, the primary may consist of five turns and the secondary 20 turns.

The circuit diagram for this coupler is shown in Fig. 2. Usually, when a new circuit is wired, it is necessary to change the connections on the tickler coil to determine which gives best results. This is unnecessary if, when the tickler is parallel to the secondary, the plate lead is connected to the end of the tickler coil that is furthest away from the grid coil end connected to the grid. The windings must, of course, be wound in the same direction on all coils.

American Broadcasting At 5,000 Miles

By JOHN ENGLISH

URING last year some experiments were being carried on in South America by myself to determine the possibility of receiving radio signals from the United States. A location was selected on the Transandine railway at a small village called Puente Del Inca, 9,000 feet above sea level.

It was not desirable to employ a supersensitive receiving set, but rather one of a common type, consequently an ordinary Armstrong regenerative set with a detector and two steps of audio frequency amplification was utilized. We were relying considerably on our advantageous location. On one evening of the test during April, at approximately 2 a.m. the set was picked up at a time when the local broadcast stations had ceased operations. There are so few broadcast stations in South America that the word "local" here means those of Chile, the Argentine and Uruguay. Hence local reception covers a radius of approximately a thousand miles. The set was being operated at the zero beat point and no difficulty was experienced in holding this adjustment which is usually very critical. At the termination of the musical concert being rendered an announcement was made in English. No further identification at that time could be obtained. Later on, in September, the design of the receiver was changed to incorporate one stage of tuned radio frequency amplification, a detector and one stage of audio frequency amplification. The set was moved to Los Andes, a small town in Chile on the western slopes of the Andes mountains. The atmospheric conditions were very poor for radio reception, there being heavy static practically every evening.

Our first success was on the evening of October 30, at which time the complete program from station KDKA, East Pittsburgh, was heard.
Awards of the $50 Radio Wrinkle Contest

First Prize
UV-199 CUSHION AND SOCKET ADAPTER
By W. T. R. Price

Most of us have found by experience, or otherwise, that soldered connections are more satisfactory than unsoldered connections. Yet we have no compunction as to pushing a dry-cell tube into an adapter, and then pushing the adapter into a standard tube socket, thus making eight connections which are not only unsoldered, but are not even as good as the average binding-post connection. In a three-tube set there would be 24 of these doubtful connections, 12 of which would be in the grid and plate circuits.

The home-made adapter described here, not only eliminates half of these poor connec-

tions, but also provides a perfect cushion support for the tube. The adapter can be made in about 15 minutes, and at no cost whatever.

First procure a burned out or broken tube with standard base and break away the glass and the cement which holds it in place. Then heat the terminals sufficiently to melt the solder, and withdraw the element wires. To each terminal of the UV-199 or C-299, solder 2 inches of rubber insulated No. 18 stranded wire, bared for ½ inch at the lower end. Introduce these bared ends to the hollow terminals of the standard base and solder in place, clipping off any excess wire which may protrude. (See Fig. 1.) The tube may now be pressed down within the standard base, which will double up the wire and form a spring, stiff enough to hold the tube in place, but much more resilient than a solid rubber base. (See Fig. 2.) The terminals of the UV-199 and C-299 are not arranged as in the standard tube. Placing the locking pins relatively as shown, wires from terminals No. 1 and No. 2 should lead to the corresponding terminals of the standard base. Nos. 3 and 4, however, should be crossed.

Second Prize
AN EMERGENCY SOLDERING FLAME
By Dr. William H. McKie

A tablet of Hexamethylenamine, or to use an easier name, Urotropin, will furnish an ideal soldering flame in an emergency. A five-grain tablet when lighted with a match, will burn for two or three minutes with a steady, pointed, smokeless, sootless, colorless, blue flame of an intense degree of heat. The seven and ten grain tablets will burn proportionately longer.

Go to the store and get five cents worth of five-grain Urotropin tablets and put them in your tool kit. Then when you break a wire or want to make a new connection, and your soldering iron is holed or is out of commission, or you do not want to start the blow torch, just take a tablet, lay it on a piece of metal or a spoon, put your solder and flux on the piece to be soldered, light the tablet, and you would a candle and hold it under the work. You will be surprised how quickly the solder will run and will be delighted at the clean, perfect joint.

When soldering in this manner, care should be taken that too much flux is not used, as it might drop into and put out or dim the soldering flame.

Third Prize
AN EXCELLENT BACK PANEL SWITCH
By Harold Hubbard

Do you need a good back panel switch? Here is one that can be made from an old rheostat and will prove as good as any on the market. The resistance wire should be removed and holes of the correct size drilled through the rheostat form at regular intervals for the switch points. These switch points should be of the kind that are almost flush with the surface. The usual rheostat shaft is not long enough to bar of the same diameter and three inches long should be obtained. The regular rheostat contact lever is slipped on the shaft to about the center and fastened by means of the set screw. The shaft should now be inserted so that the lever is on the same side as the switch points. A spring is placed on the end of the shaft protruding on the opposite side and compressed by the shaft collar, as shown in the sketch. This collar is secured by tightening the set screw in such a position that the spring exerts sufficient pressure to keep the lever snugly against the switch points. The switch is secured to the panel by means of the two screws that were originally employed as the rheostat binding posts. A knob and pointer, or a dial may be used as desired. This switch, if carefully constructed, will be smooth running and will eliminate switch points on the panel.

AUTOMATIC "B" BATTERY CUT-OFF

With vacuum tubes at $5 each, it would seem worth while that the owner of a multi-tube set take precaution to see that the "B" battery voltage is not accidentally applied to the filament circuit. When the modern bare bus-bar wiring is used in a set, it is highly important that the "B" battery be disconnected while changing tubes or making adjustments, for the slip of a screw-driver or pliers can cause a short circuit that may cost the owner several new tubes. No protective method was followed by the writer, until one day it was forgotten, with the result that two tubes went west. Since then, a set is now equipped with the automatic "B" battery cut-off, as illustrated. A few pieces of spring brass and a little time was all that was necessary, and I can now change tubes or make adjustments without fear of endangering the tubes, for the act of opening the cabinet automatically disconnects the "B" battery, while upon closing it the set is again ready for action. The diagram should be self-explanatory. Two small brass plates are screwed to the back of the cabinet. They are spaced about ¼ inch apart, the one being connected to the "B" battery, while the other is wired to the "B" battery binding post of the set. A spring brass strip of the shape shown is fastened to the hinged lid in such a position that when the lid is closed it will close the...
circuit between the two brass strips. All of the parts may be small and run and mounted near the corner of the cabinet are not in the way. The owner of a set so equipped need no longer be in fear of burned out tubes.

Contributed by John J. Carl.

ELIMINATING INDUCTION HUM

If you are troubled by induction from a nearby high tension power line, this plan can be followed with gratifying results. The plan is used to eliminate induction from power lines when they run parallel to telephone wires, and when used with an antenna proves of great advantage. A two-wire antenna must be used as arranged as shown in the diagram. It will be seen that the two wires cross each other in the middle of the span and end on the side of the spreader and opposite to that which they started. The wires must not come in contact with each other where they cross. They are kept apart by a long insulator.

This arrangement was proved particularly useful where the antenna can only be erected in a position which brings it parallel to a power line. It will be found that about 90 per cent of all induction hum will be eliminated with this antenna. The reason for this is that the two fields of the two wires are attracting each other at one end and are opposing at the other, thus neutralizing any induction hum that otherwise might be heard.

Contributed by Otto E. Steinberger.

A MUSIC ROLL SWITCH KNOB

Having required a switch knob in building a set, and unable to procure one without some delay, I looked around for a substitute and finally hit upon the following idea. I secured an old player piano roll and removed the composition end pieces, which have the same shape and appearance as a regular switch knob. The tubular end of this knob is too long, so about three-quarters of an inch must be cut off, as shown in the drawing. A hole is drilled through the center, through which a brass bolt is inserted and secured with a nut. The blade may be cut from spring sheet brass of the desired shape, and placed on the shaft, being held by a thick washer "A," which is threaded to fit the bolt. Various methods may be used to fasten this switch knob to the panel but the plan shown in the drawing is recommended as giving exceptional results. A piece of spring brass is bent to the shape shown and slipped over the shaft through a hole drilled in it for this purpose. A nut is screwed down on the shaft until the right tension on the piece of spring brass is obtained. Another nut is also used as a lock nut so the original adjustment can be maintained. This switch knob looks very neat and will not detract from the appearance of any set.

Contributed by William G. Roth.

AN IMPROVISED "A" BATTERY SWITCH

Having immediate need for an "A" battery switch, and not wishing to wait until I could get a switch from the wholesale house, I utilized a single circuit jack for this purpose. The accompanying drawing shows the method of use very clearly and little explanation is needed.

I used the rheostats in the negative lead in this case and carried the positive lead from the "A" battery direct to the bottom lug of the jack, and the lead from the spring to the positive terminals of the sockets.

I had a short brass rod of the proper size to fit the hole for a standard plug, and I threaded this to fit a round button taken from an old snap switch. While not as good as the manufactured switches on the market, it answered the purpose and the black switch button did not detract from the appearance of the set.

Contributed by G. B. Brumbaugh.

AN INEXPENSIVE LOUD SPEAKER

Any loud speaker consists of two fundamental units: First, a means of changing electrical energy into sound; and second, a means of amplifying the sound so produced. The first unit is, in most cases, an electromagnetic telephone or other device operating on similar principles such as an electrodynamic or moving coil instrument. The amplifying member is, almost universally, some form of horn.

In an instrument where low cost of construction is to be considered a phone should be selected which is well adapted for the sound producing mechanism. It should be a modified electromagnetic device that is capable of clear reproduction, and can handle all the energy from an ordinary receiving set without distortion.

The horn can easily be constructed at home. A square horn was selected in the present case because it was easily made and gave best results. No greater endorsement for the square horn is necessary, considering that some of the best phonographs on the market are using it. The pattern is shown in Fig. 1. It can be made of fibre or cardboard about 3/8 to 1/2 inch in thickness. The top, bottom and two sides are cut out as indicated and are fastened together on the outside with gummed art tape. This tape has great adhesive qualities and makes the horn look attractive when finished. It can be secured 1/2 inch or more in width and comes in black and other colors. The cardboard can be bought in various shades and can be made to harmonize with the color scheme of the room.

The connection between the phone and horn must be air tight or the volume of the loud speaker will be greatly reduced. To secure this, a single phone-adapter, of which there are many on the market, is used. The author used a rubber adapter equipped with a brass insert, which is fastened in the horn with a mixture of paraffin and sealing wax. Then the phone with the rubber part can be taken off if desired.

The tone chamber of this horn is about two feet long. This is about as small as can be used with safety. A horn of this size will respond to all tones and will provide ample volume, whereas a smaller one will not function on low notes and will give the music a sharp ring instead of the natural mellow sound.

With this loud speaker the author has brought in Los Angeles stations here in San Francisco (400 miles) with sufficient audibility to be heard all over a five-room house on two stages of audio frequency amplification. The locals come in fine on only one stage.

Contributed by Harry Lubeck.

A TUBE PROTECTOR

Have you ever finished a new set, inserted the tubes, connected the "B" battery and immediately turned off the (Continued on page 72)
The need for applause cards

In your issue for April, page 1388, you mentioned that you ordered the BCL to send more applause cards. I feel that you are right and that we should do this, and in fact I already have a packet of post cards on hand, and I couldn't buy them. There are programs that money would not admit one to, and it comes to the question of the day: Who shall pay, and who shall get? Personally, I believe that every owner of a receiving set would willingly contribute a given amount, if they knew the broadcasters were getting it. The Federal Government has never acted as a collector for a private concern, but couldn't a workable plan be found wherein the National Association of Broadcasters could be made an arm of the Federal or Government radio division and an appropriation made to that body, the same as to other Government agencies and departments? This

H. W. Webb
Columbus, Ohio.

Another broadcast review

Editor, Radio News:

After reading Mr. Earley's letter and your remarks concerning it, I cannot help but add a bit of contentment on my own account.

We live in a smallish town, only 87 miles from Chicago, but nevertheless it might as well be 1,000 so far as that goes. The kids listen to "Uncle Bob" from KFYW, and when the radio weather is good, to "Daddy" WDAF, in fact both belong to the Jack and Jill club. Then we usually see what they have to offer, going over to that incomparable voice of the "Atalanta Journal, Atalanta, Gawgaw." Wouldn't miss that for anything. And who can pass up KDKA, or WBB and that Trio? This season we have taken in President Coolidge's Washington's Birthday talk, grand opera, William Jennings Bryan, Dave Garroway (from three different stations in the United States), to say nothing of the banquets, shows, organ recitals and popular programs. We enjoyed immensely "Auntie Irish Rose" as broadcast by KFYW recently. As soon as the roads are good we are going in to see some of these, and we are regular Friday night visitors to the Hoot Owls at KGW; we took in the concert by the Fairbanks Trio assisted by KJH's cajun, I heard a program last week in St. Paul. The Skinner organ recitals are always good. The Fort Worth Star Telegram is another very good one to tune in. WOAI, the "Winter Playground," has had some interesting programs, as has WLAG. We usually poke around to see what WHAS has, and never fail to listen to PAX, and, by the way that clock ticking between numbers is a nice thing, as with the neutralode using the long aerial I always make sure whether I have PAX, or WHAS, as they are both on the same wave-length, but the clock tick sets us right always. The "Nighthawks" are always right as well, and the midnight revues of KFYW are something worth staying up to hear. WTAS has some mighty entertaining programs and they may be better heard after free days, because on Sunday afternoons they are the only ones on the air who are not either preaching or putting on something, which we do not want to hear that is, all the afternoons. We like a good sermon, and Rev. Shannon of the Central Church, Chicago, puts a good one over. The dance band from Orchestra Hall is also very interesting. Both of these features are put out through KFYW.

Taking it all in all, we have listened to about every 500-watt station in the United States, the winter, and what we have heard and enjoyed coming out of that little box with a bunch of light bulbs behind it, couldn't buy. There are programs that money would not admit one to, and it comes to the question of the day: Who shall pay, and who shall get? Personally, I believe that every owner of a receiving set would willingly contribute a given amount, if they knew the broadcasters were getting it. The Federal Government has never acted as a collector for a private concern, but couldn't a workable plan be found wherein the National Association of Broadcasters could be made an arm of the Federal or Government radio division and an appropriation made to that body, the same as to other Government agencies and departments? This

Radio News for July, 1924

Interesting articles to appear in July issue of "Practical Electrics"

Electricity Whales
By H. Gernsback, Member American Physical Society.

The Rain Maker
By J. Kay London.

Comic Picture Projector
By Harold Jackson.

Omn's Law
By F. S. Yamamoto.

Uses for Spark Plugs
By Jacob E. Raible.

Electric Insects

The Gate for Your Voice Highway
By Paul B. Findley.

An SOS from Washington

Editor, Radio News:

Have just finished reading article in the most valuable Radio magazine, Radio News, written by Mr. Glenn H. Putnam, of Rochester, and will say that "them's my sentiments.

I numbered among the thousands of the "radio infants," am at sea, adrift in an open boat, without compass or rudder and blowing a solid gale, when it comes to figuring the fine points and intricacies of a "wiring diagram," similar to a Sanskrit thesis written by a scowling Hindu, in a Chinese graveyard, at the sufferings of a tombstone rabbit. I became a bug a little while back, and since then my one desire has been to build, manage, or run a three-tube set, but the "black magic" prohibits, and I

ere long I will be in the long line of men, with little boxes under their arms, at Mat-tewan or elsewhere, giving up the idea that I may be a Marconi or a De Forest. Soon after my inoculation with the "radiivirus," and before I became violent, I made my first single shot, and during several occasions and plans given in a small publication, and in place of the usual wiring diagram, painted with the aid of a pocket watch, which, for a novice at the game, was a revelation: but, like others of the fraternity, I wanted the DX record of the world, and I still do, but I am still striving for that end, without success.

Of the many dealers in and about Washington, D. C. (averaging two or more to a business block) and from whom I have purchased many dollars' worth of supplies, none of them are able to give information relative to break-ups and behavior of guaranteed materials, and when the brains of the firm was asked for, he was either "OLT" or getting over the effects of a "grid and plate phlobute" debauch, somewhere south of the varieton regions, west of the first step, (A. F. or K. F.), but, after many efforts and many offers of far superior substitutions, I managed to get the articles desired, and while I stumble across, or catch unnumbered, some other (not the radio bug) I will use either a purchased tube set, or a crystal outfit.

Radio News is offering a great fund of information each month to the listeners, and it is well appreciated, and though not a subscriber, I get it each month, but must say if the different sets were authenticated in pictures diagrams, or even schematic drawings, it would not only be of greater value to me, but to thousands of others in the same boat, and I would be willing to pay double for the service, or as a suggestion, have copies of the different sets made in pictures and sold separately, directly from publishers.

The Radio Sea is a wide expanse of uncharted knowledge, and the Radio Editor is bothered enough as it is, but to spare me, give 'em pictures, or something understand-able.

A boy in High School, talking to me a few days ago, was wondering why radio diagrams were not lithographed, and answered, "that they might be traced without trouble; not a bad suggestion at that.

This letter is publishable, if you see fit, and it will get to Radio News first, last and all the time, even if I cannot savvey the traffic lines in a modern radio circuit, and am baffled out by the traffic cop's juice, when I cut a corner too sharp or disregard the plus and minus signs.

M. A. P. Roux, 48 G Street, W., Washington, D. C.

Interesting notes on static

Editor, Radio News:

In your editorial of April, 1924, you say that we don't own a captain (not an expert or a scien-tist), a radio fan to the extent of having a De Forest D-10 Reflex set, which helps me more than anything else I am regularly listening to KDKA and other stations.

Static in the Gulf of Mexico, which I hap-pen to be experiencing as I write this, and in the Caribbean Sea, is very bad, and I became interested as to its cause. At sea, where one is not shut in by houses and trees as on shore, it is easier to make careful observation of clouds and atmospheric conditions.

(Continued on page 74)
By JOHN B. BRADY*

TENNA AND CIRCUIT, in which one of the loops in the system is connected with the grid electrode of a receiving vacuum tube and more loops are directly connected in the plate circuit of the tube forming the receiving system.

TUBE CONSTRUCTION


VACUUM TUBE DEVICE, showing a construction wherein the plate electrode is formed in two parallel planes, the material of one plane being supported by metallic members which extend out from the other plane which in turn is substantially supported within the tube.

TUBE CONSTRUCTION


ELECTRON DISCHARGE DEVICE, in which the anodes are supported in the tube by forked metallic members mounted on the periphery. The tube structure also includes a block of insulating material supported by the anode which insulating material in turn includes supporting connections for the grid and cathode.

TUBE CONSTRUCTION


VACUUM TUBE, in which the filament electrode is supported by a spring suspension device where the filament is supported from the glass press of the tube.

IMPEDANCE DEVICE


IMPEDANCE ELEMENT, for use in high frequency alternating current circuits, the construction of the element is such that the value of its impedance may be accurately adjusted. An electrostatic shield is provided for the winding in the element.

ARC OSCILLATOR


OSCILLATOR for arc circuits in which the arc is formed between a pair of tungsten metal electrodes submerged in distilled water.

VARIOCOUPLER


VARIOCOUPLER, having extremely small electrostatic coupling between the windings. The vario coupler has a cylindrical stator and a flat rotor on which the secondary winding is arranged in such manner that the conductors are at all times approximately in a diametrical line through the cylindrical stator. Sufficient electromagnetic coupling may be introduced to neutralise the effects of capacity coupling to substantially zero coupling.

(Continued on page 102)
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, for the 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 Laboratories tests it will be returned to the manufacturers with suggestions for improvement. "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 submitted be first tested elsewhere. They cannot be accepted by the Laboratories. Address all communications and all parcels to Radio News Laboratories, 53 Park Place, New York City.

Apparatus Awarded Certificates

Ace 45-Volt "B" Battery

The battery, shown in the illustration, comprises 59 of 250-milliamperes cells. This battery has a five taps taken from 1650 to 2209 volts so as to give the voltage variation required by some detector tubes. The cells are secured in place with parafin wax so that should one cell become damaged or leaky it will not short circuit any of the others. This battery is manufactured by the Carbon Products Co., Lancaster, Ohio.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 441.

De-Tec-Tone Crystal Detector

This crystal detector, as the illustration shows, is very compact and of novel design. It is designed for mounting on a base or front of a panel and the adjustment is obtained by means of the knob attached to the shaft on which the cut whisker is mounted. The crystal is enclosed inside the tube and is well protected. It is manufactured by the Pyramidal Products, 117 N. Dearborn Street, Chicago, Ill.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 411.

Dinfillan Switch Lever

This switch lever is of very rugged construction and of pleasing appearance. It has a double contact blade insuring positive contact with the switch points. It is manufactured by the United Switch Co. and is used on their Type R-255 switch lever.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 393.

Receiving Set

The dependence of the Depauville Research Corp., Medford Hillside, Mass., on its Model 2530J, Inductorell receiving set. This is an ideal broadcast receiver, and it is complete in itself and is contained in a cabinet 12 by 15 by 14 inches, having separate compartments for the "A" and "B" batteries, as shown in the illustration. This receiver has a one-stage frequency amplifier, detector, and a two-stage audio frequency amplifier. The tuning units are the slider wound variometers described elsewhere in these columns. By means of a two-point switch, the circuit is changed from single to double, thus changing from single dial control to double dial control and facilitating the tuning. Excellent results were obtained from this receiver throughout the broadcast wave-length range.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 447.

Perfection Battery Hydrometer

The battery hydrometer is a practical device for determining the condition of the battery at any time. The hydrometer shown in the illustration is of very good construction and is accurate in reading. It is manufactured by the Denver Mfg. Co., 243 W. 55th Street, New York, N. Y.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 407.

Amlion Loud Speaker

The illustration shows the Amplion loud speaker. Much care was taken in the construction and design of this instrument. The phone unit is fitted to the tone arm by means of a rubber gasket and the wooden bellow. The horn is also fitted to the tone arm with a rubber gasket so that vibrations of the horn may be modified and will not interfere with the quality of the reproduced musical program. The phone unit is adjustable and employs a large diaphragm which makes the instrument more efficient on the lower notes than any other types of loudspeakers. The resistance of the unit is 123 ohms.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 451.

Semipermanent Crystal Detector

The adjustment of this detector is obtained by simply turning the knob until the stations are heard at their maximum. The instrument is designed for both of single- and double-dial mounting and the control lever is located under the knob. When turning the control knob the cut whisker contact is moved across the crystal by the action of the screw thread on the shaft and at the same time it is raised and lowered from the surface of the faces of each revolution by means of a square cam on the shaft. Thus the knob only needs to be turned very little in order to obtain a sensitive adjustment. The detector is manufactured by the Harvey & Walter Mfg. Co., 22 Front Street, Cincinnati, Ohio.

Arrived in excellent packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 438.

Ball Bearing Switch

The illustration shows a switch that is somewhat different in construction from the usual type of inductance tap switch. This switch, type S-3, is equipped with a ball bearing of very accurate mechanical construction that makes it exceptionally smooth running. Good electrical contact is also insured. The switch arm radius is 1'/2 inches and the diameter of the knob is 1'/2 inches. It is manufactured by G. F. Frentzlenaker, Lancaster, Pa.

Arrived in good packing;
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 409.

Work Rite Neutrodyne Kit

The Work Rite De Luxe Model Neutrodyne Kit comprises three plate variable condensers with special- type, three radio frequency transformers and two neutralizing condensers. The parts are of excellent construction, and the tuned radio frequency transformers or neutralizing condensers are arranged in the entire broadcast wave-length range without regard to volt or circuit frequencies. The circuit is properly neutralized with the transformers or condensers. This kit is manufactured by the Work Rite Manufacturing Co., Cleveland, Ohio. The illustration shows one of the transformers mounted on the condenser.

The Standard Radio Co. of Hoboken, N. J., submitted for testing one of its 6E6m vacuum tube rheostat. This instrument is very carefully constructed, is smooth running and safely carries the current at an angle, so as to give a 15-degree variation. The instrument
is arranged for both base and panel mounting. Arrived in excellent packing, with hook-up.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 448.

PICO HEAD PHONES

The Pico Model 1924 head-set has a resistance of 2,057 ohms and an impedance at 2,000 cycles of 19,380 ohms. The phones are of unusual construction, having moulded shells in which are placed two small electro-magnets, each having a round core 1/4 inch in diameter. These are mounted on the poles of the permanent magnet. This head-set is very sensitive and reproduces speech and music with a minimum of distortion. It is manufactured by the Pico Head Phones, 1242 Holden Ave., Detroit, Mich. Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 449.

VARIOMETER

The No. 3650 variometers manufactured by the American Radio and Research Corp., Medford Hillside, Mass., are designed to cover the broadcast wave-length range. These variometers, as the illustration shows, are of the bar or push-pull web type, thus reducing the distributed capacity of the winding to a minimum. Very little insulating material is required to support the windings of this type of variometer. The instrument is light in weight and has low dielectric losses. Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 450.

MARLE AUDIO TRANSFORMERS

The Marle audio frequency amplifying transformer is of the standard shell design and has a very high voltage amplification factor throughout practically the entire audio range. The construction of the instrument is very simple. The transformer unit is simply placed in two bakelite moulds on which are placed the four terminals and also the mounting holes. These moulds are clamped together and hold the transformer in place. This transformer, Type A-19, is manufactured by the Marle Engineering Co., Orange, N. J.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 451.

CONNECTICUT HEAD-SET

The Type 1-123 sample head-set submitted by the Connecticut Telephone and Electric Co., New Haven, Conn., has a resistance of 3,886 ohms and an impedance at 1,000 cycles of 23,000 ohms. This head-set is of the conventional two-pole construction and is very sensitive and reproduces speech with good quality. Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 444.

ROYALTRON TYPE 201-A TUBE

The Royaltron type 201-A vacuum tube is of the standard design and has a rated filament consumption of 0.8 ampere at 6.3 volts. The model 201-A was given very good results as detector, oscillator, and amplifier, and its characteristics were very close to their rated values. This tube is guaranteed by the above company.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 445.

AJAX BINDING POST

This binding post, as the illustration shows, is of the usual construction with an insulated cap, except that an additional washer is provided. This washer is bent in such a way that telephone cord tip or large wires may be securely clamped. It will also accommodate jags and small wires. These posts are manufactured by the Ajax Electric Specialty Co., 1011 Market St., St. Louis, Mo.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 452.

DETECTRON RADIO CRYSTAL

The Detectron Sales Co., 907 Secunda Bldg., St. Louis, Missouri, submitted samples of its detectron radio crystals. These crystals were found to be very sensitive and are furnished mounted in metal to fit the standard 5/16-inch detector. Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 396.

K-E LOUD SPEAKER

The K-E Loud Speaker employs a gracefully shaped metal horn tightly fitted to an adjustable loud speaking unit. The instrument is very sensitive and reproduces musical programs and speech with excellent quality. The maximum efficiency of the instrument is in the neighborhood of 630 cycles. It has a resistance of 1,007 ohms and an impedance at 1,000 cycles of 10,200 ohms, manufactured by the Kirkman Engineering Corp., 484 Broome Street, New York, N. Y.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 453.

BENJAMIN CUSHIONED SOCKET

The Benjamin Cushioned Socket shown in the illustration is of very ingenious construction. The socket is made of two moulds held together by the same metal springs that form the contact springs. The base is fitted with mounting holes so that when the socket is mounted the tube is supported by the springs and thus vibration of the tube eliminated is reduced to a minimum. This socket is known as the anti-capacity type and is manufactured by the Benjamin Electric Mfg. Co., 800 Jackson Blvd., Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 446.

PRECISE TRANSFORMER

Although the model 285-A audio transformer shown in the illustration is of small size, it was found to possess a very flat characteristic curve covering practically the entire audio frequency range encountered in broadcast reception. High order amplification is also obtained from this transformer. It is of the shielded type, as shown. Manufactured by the Price Manufacturing Co., Rochester, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 436.

BRANSTON HEAD-SET

The Branstom standard 2,500-ohm head-set is of the usual two-pole construction with metal shells and insulated ear cups. This head-set is of excellent mechanical construction and was found to be very sensitive to weak signals. The resistance of the sample head-set tested was 2,417 ohms and the impedance at 1,000 cycles is 22,500 ohms. This head-set is manufactured by the Mors Cherry Mfg. Co., Inc., 2911 Franklin St., Detroit, Mich. This is very sensitive and reproduces with good quality.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 445.

BERWICK LOUD SPEAKER

The Berwick adjustable loud speaker is a very attractive form of unit and reproduces speech and music with little distortion. The phone is adjustable so that the instrument may be adopted for use under all conditions. It has a resistance of 1,416 ohms and an impedance at 1,000 cycles of 10,000 ohms. It has a fibre horn. It is manufactured by the Triangle Electro Trading Co., Inc., 61 Broadway, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 450.

HARMONIZED HEAD PHONES

The Harmonized Radio Head Phones, manufactured by Hamburg Bros., 624 Grant St., Pittsburgh, Pa., are of the standard two-pole construction with metal shells and insulated ear cups. The resistance of the head-set submitted is 2,391 ohms and the impedance at 1,000 cycles is 25,000 ohms. This head-set is very sensitive to weak signals and reproduces with little distortion.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 444.
I Want to Know

This Department is conducted for the benefit of our Radio Experimenters. We shall be glad to answer here questions for 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.

SECOND HARMONIC SUPER-HETERODYNE

Q. 1. What is the general principle of the second harmonic in the new Armstrong Super-Heterodyne?
A. 1. Instead of using the major vibrations of the oscillator, the second harmonic is used to produce the beat note that is amplified by the intermediate-frequency amplifiers.

Q. 2. What is the advantage of this system?
A. 2. By using this system it is possible to incorporate the oscillator and detector in one tube, thus eliminating the need for another tube.

ZENITH RECEIVER

Q. 1. What wave-length will be had when using a primary honeycomb of 1,500 turns and a secondary honeycomb of 1,250 turns?
A. 1. A 23-plate condenser will be required to tune the secondary. This secondary will respond between 1,000 and 14,000 meters. The primary, may use the same size condenser connected in series with the serial, but .001 mfd. will be better.

Q. 2. Is there a way to prevent the oscillations of a single circuit receiving set from being transmitted?
A. 2. A practical method is to employ radio frequency before the detector. A unit developed for this purpose is described in the June issue of RADIO NEWS.

Q. 3. Can a buzzer be used to supply the plate voltage for a 6-watt transmitter?
A. 3. A buzzer of special design would be required in order to supply a sufficiently high voltage, and current for a 5-watt tube.

"B" BATTERIES AND BALKITE CHARGER

Q. 1. How can radio "B" batteries be charged with a Balkite charger?
A. 1. The Balkite battery charger, while designed primarily for the purpose of charging 6-volt "A" filament batteries may be used if desired for charging radio "B" storage batteries. For charging one of these batteries with the Balkite charger the "plug" terminal of the battery is connected to the positive terminal of the charger. (The red tip is positive.) The other lead is connected to the negative side of the battery, that is, between the 6th and 7th cell. By turning on charging current, this section of the battery will charge at the proper rate.

SUPER-PLIODYNE

Q. 1. Please show the Super-Pliodyne circuit.
A. 1. We are showing the circuit in these columns. Since this system is used so very broadly, it is much easier to extend this method of amplification to include many tubes, and control all the stages with one or two diads, than it would be with the usual multipliode system, which is very sharply at each stage.

Q. 2. How are the transformers for this circuit made?
A. 2. The secondaries of the transformers consist of 100 turns of No. 26 D.C.C. wire wound on a 1-inch tube. The primaries consist of 25 turns wound on a 1/4-inch tube. The primary winding has the space of three turns between each turn. The primary fits inside of the secondary. The primaries are wound in a reversed direction to that of the secondaries.

Q. 3. What is the correct value for the neutralizing resistances?
A. 3. All the values (R) are the same and must be determined by experiment, as the value is different for the different types of tubes. It will range between 20,000 and 120,000 ohms. The condenser value (C) is not critical.

BATTERY CHARGERS

Q. 1. Is it possible to recharge a 6-volt 60-ampere-hour radio battery from a 24-volt automobile battery, and how?
A. 1. It is possible to charge a radio battery from a 24-volt, D.C. source, by connecting the positive leads of both batteries together and the negative leads of both batteries together. A resistance must be inserted in series with either the positive or negative lead of the six-volt battery. The value of this resistance must be sufficient to permit not more than five amperes to pass through the circuit.

Q. 2. What would be the lowest specific gravity allowable for the radio battery?
A. 2. The specific gravity should not drop lower than 1.200.

Q. 3. Could this radio battery be connected so as to charge from the automobile charger?
A. 3. If the same charger is used as is used with the 24-volt battery, this could not be done without special wiring.

This Super-Pliodyne illustrates the Ferrand system for controlling the oscillations in radio frequency amplifiers. A special switching system is used which eliminates the usual jack-and-plug method.
Radio News for July, 1924

After charging the first section, the "plus" red clip is placed where the negative clip was, that is, at the midpoint of the battery, and the "minus" clip put in the negative terminal of the battery.

Q. 2. When using this charger, can the "B" batteries be charged in units of more than six cells?

A. 2. No.

PATENT LICENSES

(964) Mr. M. C. Spence, Bangor, Maine, asks:
q. 1. Who controls the Neotrodyne patents?

Q. 2. Who controls the regenerative patents?

Q. 3. Who controls the crystal detector patents?
A. 2. The Western Specialty Appliance Co., Boston, Mass., control the original detector patents.

LOOP LEADS

(965) Mr. Philip Matthews, Tufts, Ind., writes:
Q. 1. Is it necessary to obtain permission to construct radio sets?
A. 1. It would be necessary to make contracts with the companies holding the patents on the type of receiver you wish to make. See answers to questions 964, above.

Q. 2. Should loop wires be to a set run parallel and clipped together?
A. 2. This will result in broad tuning and reduced volume. Use two separate leads and do not run them close together.

AIRIALS FOR SUMMER USE

(966) Mr. A. Valverde, Havana, Cuba, requests:
Q. 1. Is it better to use aerial sets less during the summer than during the winter?
A. 2. Yes.

Q. 2. Is the "static" level greater during the summer than during the winter?
A. 2. Yes.

Q. 3. What would be the best aerial system for summer use?
A. 1. A low aerial will pick up less static, in proportion to the signals, than a high aerial. A short aerial is better than a loop one, for summer use. A loop aerial is best of all.

M. P. M. REFLEX CIRCUIT

(967) Mr. E. S. Brady, Fostburg, Md., writes:
Q. 1. The stage shown one stage frequency amplification added to the M. P. M. reflex circuits.
A. 1. We are showing this circuit in this column.

Q. 2. Is galena a good crystal to use in multitudinous sets?
A. 2. Galena is usually a very sensitive detector mineral, but silicon is almost twice as sensitive and seems to work more efficiently where several tubes are used, in either standard or reflex circuits.

RADIOLA, SUPER-HETERODYNES

(968) Mr. F. W. Smith, Duda, Ohio, asks:
Q. 1. Please publish full details for the construction of the Radiola, Super-Heterodyne.
A. 1. The Radiola Corporation of America does not make this information public.

Q. 2. Can UV-201A tubes be used with the Radiola Super-Heterodyne?
A. 2. These sets are designed to use UV-199 tubes only.

Q. 3. Will the Ultradrome operate a loud speaker from coast to coast?
A. 3. It has been done.

SIMPLEST GRID LEAK

(969) Mr. Jarrey Rohr, Vandalia, Mo., writes:
Q. 1. If the "A" battery is turned entirely off, and the "B" battery is left connected to the plates of the tubes, would there be any "B" battery consumption?
A. 1. There would be no consumption whatever.

Q. 2. Would there be any electrical discharge from the positive terminals of the "B" batteries, where graduated voltages are applied to the various stages of amplification, if the negative lead is brought to a point of transmission, on commercial wave-lengths may be done at any hour of the day or night. Amateur transmitting may be done on the proper wave-length, by permission of the Government at any hour of the day or night, except the period set aside and designated as the "quiet hour." The quiet hours are from 8:00 P.M. to 10:00 P.M.

IN-DOOR AERIAL, LIGHTING PROTECTION

(970) Mr. Raymond Keister, Chicago, Ill., requests:
Q. 1. What method is required for lighting protection, when an attic aerial is used?
A. 1. There is no danger from an in-door aerial and no protective measure need be taken.

Q. 2. When the aerial is made a lead a pump in the receivers when bringing the aerial and other aerial, together, will it be necessary to have a separate aerial for the receiver, and the aerial which is the original detector?
A. 2. The occurrence you mention was due to the presence of atmospheric electricity. It is called "static." The same effects will be noticed whenever an electric storm is within a few miles of the receiving set.

12-VOLT "A" BATTERY

(971) Mr. Walter S. Bell, Jr., Catolet, N. Y., writes:
Q. 1. Is there any way to use a 12-volt storage battery as a radio "A" battery?
A. 1. The most efficient way of doing this, without changing the connections on the battery, would be to connect the battery up in the regular way, but putting resistance in one lead. The value of this resistance would be about 128 ohms. When high resistance wire will be necessary, a wire 1000 ohms per mile for 1/4 amperes is required if a UV-201A tube is used.

Q. 2. Would it be correct to use three cells at a time?
A. 2. This would be very injurious to the battery. One or two of the cells will probably never be charged to the full amount, if this system is used, and the battery will be useless in a short time.

Q. 3. Could the above mentioned battery be used as a "B" battery?
A. 3. It could be used very well. It would be advisable to connect a potentiometer across this battery and the meter readings on the potentiometer-wire lengths may be done at any hour of the day or night. Amateur transmitting may be done, on the proper wave-length, by permission of the Government at any hour of the day or night, except the period set aside and designated as the "quiet hour." The quiet hours are from 8:00 P.M. to 10:00 P.M.

POTENTIOMETERS

(974) Mr. W. L. Wilson, Atlanta, Ga., asks:
Q. 1. Is it necessary to use a potentiometer in a tuner for radio equipment? A. 1. The Neotrodyne, for one, uses negative feedback, eliminating the need for a potentiometer.

ANTENNA WAVE-LENGTHS

(975) Mr. Theo. W. Everhart, Strasburg, Ohio, writes:
Q. 1. What would be the procedure for tuning and antenna transmitting placed set having low losses, with one stage of audio frequency amplification?
A. 1. In these column, we are showing the circuit. Coll. No. 4 is used to cover the range of 110 to 220 meters. It consists of 50 turns on the same size tube as the coil No. 3.

Q. 2. Can this receiver be used for broadcast reception?
A. 2. For receiving broadcast signals it will be necessary to change coil No. 4. The value of coil No. 4 may be determined by experiment. The variable condenser will have to be charged.

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By M. A. Luyke
A Combination Variometer and Variable Coupler
By Kenneth B. Murray

**How to Build Radio Cabinets**
By William Butterfield
An Efficient Loud Speaker Horn

**Soldering in the Radio Laboratory**
By Horace Porter

**A Three Circuit Coupler**
By C. B. Kramer, Sr.

**Radio Questions and Answers**
News of Radio Organizations
Photos and Description of Latest Radio Apparatus

**Radio Wrinkles**
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Numerous other Radio Instruments and Hook-ups Illustrated Especially for the

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<td>KDHO</td>
<td>H. Everett cottage, 430 W. Roach St., Denver, Colo.</td>
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<tr>
<td>KDIA</td>
<td>Bullock's Hard Ware &amp; Sporting Goods, Boise, Idaho.</td>
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<tr>
<td>KDIB</td>
<td>Gilbreth &amp; Stinson, Fayetteville, Ark.</td>
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<td>KDIC</td>
<td>First Baptist Church, Shreveport, La.</td>
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<td>KDID</td>
<td>South Dakota State College, Brookings, S. D.</td>
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<td>KDIE</td>
<td>Harry O. Ivenson, 2109 Thomas Ave., Minneapolis, Minn.</td>
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<td>KFM</td>
<td>&amp; &amp; Frank &amp; Co., Portland, Ore.</td>
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<td>KFEI</td>
<td>Guy Gammon, 1724 S. Jay St., Comus, Wash.</td>
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<tr>
<td>KFF</td>
<td>Winner Radio Corp., 1435 Welton St., Denver, Colo.</td>
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<td>KFG</td>
<td>J. L. Sewgaih, Oak, Neb.</td>
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<tr>
<td>KFGE</td>
<td>F. E. &amp; &amp; F. E. &amp; Corrington, Fort Dodge, Iowa</td>
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<td>KFII</td>
<td>Fellows Automatic Radio Shop, Casper, Wyo.</td>
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<td>KFJK</td>
<td>American Seminar, Minneapolis, Minn.</td>
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<tr>
<td>KFJL</td>
<td>Filer Hall &amp; Johnston, &amp; &amp; &amp; Contracting Co., Kewanee, Ill.</td>
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<td>KFL</td>
<td>American Society of Mechanical Engi-</td>
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<td>KFLA</td>
<td>Jenkins Furniture Co., Boise, Idaho</td>
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<td>KFLB</td>
<td>Eastern Electric Co., Flushing, N. Y.</td>
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<td>KFLC</td>
<td>Eggleston &amp; &amp; &amp; Chas., Seattle, Wash.</td>
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<tr>
<td>KFLD</td>
<td>Fitch &amp; Eggleston, Milwaukee, Wis.</td>
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<td>KFLE</td>
<td>First Baptist Church, Moberly, Mo.</td>
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<td>KFLF</td>
<td>Meyers &amp; Co., Denver, Colo.</td>
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<td>KFLG</td>
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<td>KFK</td>
<td>Gezaclang School, London, Iowa.</td>
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<td>KFKL</td>
<td>McGraw Co., Omaha, Neb.</td>
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<td>KFKO</td>
<td>Al. G. Barnes Assurance Co., Dal-</td>
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<td>KFJH</td>
<td>Falloon &amp; Co., Santa Barbara, Cal.</td>
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<td>KFJF</td>
<td>Sherman Electric Co., Sherman, Wash.</td>
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<td>KFJG</td>
<td>J. D. Jones, Lincoln, Neb.</td>
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<td>KFJH</td>
<td>Robert W. Nelson, 407 E. First St., Hutchinson, Kan.</td>
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<td>KFJ</td>
<td>Eyebrows, Anthony, Inc., Tenness and</td>
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<td>KFJO</td>
<td>Hope Sts., Los Angeles, Calif.</td>
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<td>KFJP</td>
<td>Robert F. Jones, 246 W. Thirteenth St., St. Louis, Mo.</td>
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<td>KFJK</td>
<td>Bronson Polytechnic Institute, Port-</td>
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<td>KFJL</td>
<td>Windisch Electrical Farm Equipment,</td>
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<td>KFJL</td>
<td>Central High School, Spokane, Wash.</td>
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<td>KFJ</td>
<td>Yakima Valley Radio Broadcasting Asso-</td>
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<tr>
<td>KFJ</td>
<td>Alaska Electric Light &amp; Power Co., Juneau, Alaska</td>
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<td>KFJS</td>
<td>Reorganization of Church of Latter Day Saints, Independence, Iowa</td>
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<td>KFJF</td>
<td>Daji Commonwealth and Oscar A. Hiltunen, Pond Hill, Wis.</td>
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<tr>
<td>KFJJ</td>
<td>Marshall Electric Co., Marshalltown, Iowa</td>
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<tr>
<td>KFJG</td>
<td>Seattle Post-Intelligencer, Seattle, Wash.</td>
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<td>KFJF</td>
<td>National Radio Manufacturing Co., Okla-</td>
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<td>KFJL</td>
<td>Delano Radio &amp; Electric Co., Brattle-</td>
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<td>KFJF</td>
<td>Hardfcc Manufacturing Co., Oak-</td>
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<td>KFJF</td>
<td>University of North Dakota, Grand Forks, N. D.</td>
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<td>KFJ</td>
<td>Electric Construction Co., Valley Hi-</td>
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<tr>
<td>KFJS</td>
<td>Arch C. Dixon &amp; Son, Stevensville, Mont. (inter.)</td>
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<td>KFJU</td>
<td>Thomas &amp; Son, Dallas, Tex.</td>
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<td>KFJL</td>
<td>Le Grand Radio Co., Topeka, Kan.</td>
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<td>KFJX</td>
<td>B. F. Cotton, 640 S. Main St., Salt Lake City, Utah</td>
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<tr>
<td>KFJZ</td>
<td>Floyd Williams, 2085 S. 5th St., Des Moines, Iowa</td>
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(Continued on page 88)
Improved Radio Programs
～this summer!

Millions of homes will be enlivened
by stirring sports, important news
and gay music—via Radio

Plug in your headset or your Table-Talker. You’re in the
midst of a season of keenest enjoyment. More interesting
programs than ever before—crammed with a diversity of
vital events and artistic treats. And stronger sending and
clearer reception to help you get the very best out of your set.

The Presidential Campaign
is being waged right in your home. You can follow the important messages
of all parties. You can be part of the
stirring battle—not just an outsider
wondering what is going on. You’ll
know the candidates—and their pla-
tforms. You will vote with keener in-
terest—this year.

The Churches, Too,
are promising to be generous in the broad-
casting of their services. Off in the woods—
down at the shore—or right in the city when
you cannot attend you may have the word
and the inspiration of your particular faith.

Tremendous Improvements
in broadcasting and receiving assure you a full
quota of pleasure. Stronger sending stations—
the telephonic connection of distant stations
—broadcasting over a waveband rather than
a single wave length. Sets of greater selec-
tivity, improved tubes and circuits and loud-
speakers. Lowered prices. All these will con-
tribute to making this a real radio season!

All Brandes Prod-
ucts are sold under a
money back guaran-
tee by reliable dealers
everywhere.

Brandes
The name to know in Radio
Matching Intermediate Wave Transformers for Super-Heterodynes

(Continued from page 51)

ally fall off as the potentiometer arm is moved, since a negative bias on the grid reduces the plate current of the vacuum tube. When the plate current is reduced to the point of the limit of MA, the switch S may be opened to place this instrument in the circuit. Adjustment of the potentiometer should not be continued until the reading of MA is reduced practically to zero. The reading of the voltmeter V should then be noted, calling this reading Vr.

The adjustments already made should now be left as they are and the filament of the oscillator tube lighted to the point where oscillations begin. This will cause an oscillating potential to be impressed on the grid of tube Te and will cause an oscillating ripple to be impressed on the plate current to that tube. The transformer windings transmit this oscillation to tube Te. This oscillating ripple in the grid circuit of tube Te is superimposed on the steady grid potential maintained by the battery Bb and the potentiometer P, as indicated in Fig. 3. It is now seen that the potential of the grid tube Te is not maintained at the point Vr, required to block the action of the tube, but rises above this value part of the time as at A, Fig. 3. This causes some plate current to again flow through the milliammeters and a further adjustment of the potentiometer will now be needed to again reduce the plate current of tube Te to zero. The reading of the voltmeter V should now be noted, calling this reading Vc.

The quantity Vr-Vc is an indication of the amplification constant of the transformer under test at the frequency for which the oscillator was set. The amplification curve plotted from these determinations will have the general appearance of Fig. 4. By inspection of this curve, the best frequency for use with this transformer will be learned. In Fig. 4, this optimum frequency is 9,600 meters, or 31.800 cycles per second.

The amplification curves for the other transformers to be used in the set should now be plotted in the same way. It will usually be found that transformers are manufactured to the same specifications, the peaks will not occur at exactly the same frequency. The different transformers may often be made to perform better by the closely determined re-moving or adding turns to both the primary and secondary windings. This adjustment should be made by trial, adding or removing turns until the desired peak is obtained.

The results secured by this test are sufficiently close to secure a high efficiency in the selection of a set of matched transformers. The increased efficiency in reception will usually be free for the efforts required for testing and matching the transformers. Many manufacturers are now offering sets of matched transformers which have been matched by a method very similar to that described.

The test outlined may be improved by placing a buzzer in the grid circuit of the oscillator and using a headset in connection with an audibility meter to replace the milliammeters. The modulated continuous wave from the oscillator will cause the sound of the buzzer to be heard in the headset. The audibility meter should then be adjusted until the sound is reduced to the proper standard. The data so obtained will permit the optimum frequency for the transformer under test to be more closely determined, thus improving the efficiency of the test.

Super Heterodyne

We specialize in super heterodyne receivers and after making exhaustive tests find the circuits and parts designed by THE EXPERI-
MEN TER S INFORMATION SERVICE to be the best known to the art today.

THEREFORE WE OFFER

Complete model "C" super heterodyne parts including panel, cabinet and con-
struction drawings......$108.15

FEATURES VERY DESIRABLE

But Not Essential

Drilling and Engraving Panel... $10.40
Special model "C" voltmeter, reading all tubes and battery... 7.50
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8-Tube Super making a 16-Tube Set... 67.00
Incl. Eng. Panel, Cab. and Drawings.

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We Offer Separate Parts

Oscillator Coupler... $35.00
E. F. Coupler (Filters), 10,000 M. 5.00
E. T. S. Improved 10,000 M. Transformer... 7.50
21 K. W. E. Bypass Condensers... 1.75
Standard R. C. A. Looms, 30Ω... 22.00
Western Electric 1050 Loud Speaker... 40.00
Selected R. C. A. Tubes, 191A or 191A (or equivalent)... 40.00
Electrostatic Microphone... 8.00
Wire, Tubing, Sockets, Jacks, Audio Transformers, etc., also... 4.25
Model "C" Sets Rewired according to standard by... 60.00
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Describes the Best in Radio

20 Latest Circuits
in Blue in New 64 Page Book
These include the Standard, Neute-
dyne, Grimes Inverted, Colpitts, Flawelling,
Reinartz, Push Amplifier, Double, Super Regenerative and many others

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The TELMACO catalog has become the standard guide for thousands of radio users in their selection of quality radio. Besides blue prints, it describes and illustrates the best products of America's leading radio manufacturers. Sent postpaid for 50c. Each circuit worth double. Send for your copy today.

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T E L M A C O

Quality Radio Exclusively Est. 1918

Hammarlund Condensers
Grounded Rotor—Brass Plates
Increase Your Volume and Distance!
WRITE FOR FREE DESCRIPTIVE CIRCULAR AND PRICES

H A M M A R L U N D MFG. CO., 144 W. 16th St. N. Y. C.

"Built First to Last!"

COTO GUARANTEED RADIO PRODUCTS
Coto-Coil Co.
Providence, R. I.
MacMillan Listens to Honolulu and New Zealand "Tunes In" California
Using
Zenith Radio

From a little ice-bound schooner—eleven degrees from the North Pole—comes this message:

"Am very thankful that Arctic Exploring Ship Bowdoin is equipped with complete Zenith radio apparatus. Here at top of world, in darkness of great Arctic night, we have already listened to stations practically all over United States, from Europe, and even from far away Honolulu. Zenith has united the ends of the earth."

—"MacMillan"

Again, from far-off New Zealand comes a report of radio reception even more startling:

"It may interest you to know that the writer last evening landed KGO, Oakland, California, between 6:45 and 7:30 P.M. Heard his call four or five times distinctly, and jazz music. The music was not as clear as the voice, but one could pick up the tune all right. As San Francisco is 6,300 miles from New Plymouth, and only one tube was used, we think this is a very fair performance."

—(signed) H. Charles Collier.

The sets used by Captain MacMillan and Mr. Collier are earlier models—since improved by the addition of a third stage of audio frequency. These new models, described at the right, represent an achievement in radio construction not duplicated in any other set on the market. A demonstration will convince you.

Write today for full particulars and name of nearest dealer.

Zenith Radio Corporation
McCORMICK BUILDING, CHICAGO
A Local V.T. Transmitter
(Continued from page 48)

...finally decided to incorporate a microphone circuit in the transmitter in view of the fact that, unfortunately, many amateurs prefer to communicate over short distances by voice. I say unfortunately because, in the opinion of the writer, if the amateur would continue, to a large extent, the practice of using telephony for his communication purposes, he would be much better off. It does not require any particular skill to talk over a radio telephone, but it does require application and perseverance to communicate by means of the telegraphic codes. However, it appears that the amateur must have provision for telephone communication, therefore it has been incorporated in the small transmitter described herewith.

THE CIRCUIT

Consideration of available circuits disclosed the fact that for ease of operation and adjustment, a general all-round satisfactory results, the Colpitts circuit was probably the most desirable. It was decided to modulate with the buzzer in the ground lead and use an absorption loop for voice modulation. Accordingly, it was found that the panel face should contain 2 inductance switches of 10 turns each, a jack for the microphone, rheostat for the tube, the radiation ammeter and the buzzer, with the necessary binding posts. The layout of the panel face is clearly indicated in the accompanying photo. A panel of 6 x 12 inches was found ample.

The panel is attached to a rigid base board by means of two small brass angles. A cabinet may be easily constructed, as indicated, to fit snugly over the base. A radio frequency ammeter was used for the current indicating device, such meter being convenient. Obviously any make of equipment may be used throughout. Small mica receiving condensers were found entirely satisfactory for the grid and antenna circuits, and no difficulty was experienced from breakdowns, even at potentials of 300 volts. The inductance must be carefully constructed and well made, for it is here that much loss is liable to occur if careless construction is adopted. About 55 turns of No. 16 double cotton covered magnet wire is about right for transmission on the average amateur antenna on wave-lengths within the allotted band of from 170 to 200 meters. A threecinch form is used, preferably of forrnica, bakelite, radionic, micarta or a similar insulating substance. A heater bulb will result if the form is threaded to the wire, but this may be eliminated if care is used in winding. Taps to provide for adjustment of the radiated wave are taken every third turn from one end of the inductance, while the grid coil is adjustable in steps of one turn at a time from the opposite end. The coil may be secured in any favorable position on the rear...
Announcing:

A new Magnavox that will broadcast satisfaction to the radio world
Here's big news "on the air"

The supreme achievement of Magnavox engineers represented in a reproducer of truly exquisite tone quality.

The efficiency, the appearance and the price of this new instrument clearly reflect the research and production facilities of The Magnavox Company, largest builders of radio reproducing equipment in the world.

Its exquisite tone quality results from a further perfecting of the Magnavox semi-dynamic operating principle—magnetically balanced armature, improved diaphragm and extremely high resistance winding.

Beautifully finished in dark enamel with gold high lighting, the graceful appearance of M4 suggests its use in the most dignified surroundings.

The amazingly low price of this Magnavox Reproducer establishes an absolutely new standard of value in the radio industry.

THE MAGNAVOX CO., OAKLAND, CALIF.
New York Office: 350 West 31st Street
Canadian Distributors—Perkins Electric Limited, Toronto, Montreal, Winnipeg

M 4
$25.00
Requires no Battery

MAGNAVOX
The Reproducer Supreme
of the pane, to provide short leads to the switch points. The writer mounted his inductance directly over the wave-length switch points; this results in very short leads for both controls.

It is often desirable, for various reasons, to light the filament of the vacuum tube with alternating current. In this event, the filament supply transformer may be mounted between the inductance and socket, there being ample room provided. Or this space may be used for suitable choke coils and filter condensers. The writer purposely left this space for the addition of another tube at a later date, should this be found desirable.

A good power rheostat of about two amperes carrying capacity should be provided as well as a standard socket of reliable make. A radio frequency choke coil should be inserted in the positive high voltage lead, and may consist of a 200-turn honeycomb coil or a hand-wound inductance of similar characteristics.

The assembly and wiring of such a transmitter is by no means difficult, being simpler in construction than the majority of broadcast receivers. The wiring should be of at least the same size wire as that used in the inductance, although No. 14 bus wire, covered with “spaghetti” tubing is preferable. All joints should be carefully soldered, and superfluous soldering acid or paste wiped away.

**TUNING**

In connecting the transmitter for operation, the tube should be lighted with the high voltage leads disconnected to be sure there has been no error made in wiring. The high voltage may then be connected and the set tuned. This is accomplished by turning up the filament to the point of normal operation and setting the wave-length switch on some arbitrary point. The grid switch is then varied until the greatest radiation is shown. A reading is then taken with a reliable wave-meter and the wave-length switch adjusted to the proper tap. A readjustment of the grid switch will then be necessary for maximum radiation. The plate of the tube should at no time become brighter than a dull cherry red.

At 180 meters, using a standard five-watt tube and 300 volts of plate potential, the writer obtained seven-tenths of an ampere radiation and worked close to 200 miles with the huzzers system. The telephony connection gave an antenna current of .4 ampere, and the voice was reported good at a distance of 18 miles. A radiation ammeter, with a scale reading 0 to 1 ampere, and a normal antenna current of from .4 to .8 ampere should be obtained. This will fall slightly when modulating, which is an indication of normal functioning.

The writer firmly believes that if more amateur stations would adopt a low power transmitter, such as the one described here, and use it for all communication where it would serve, his feud with the broadcast listening public would soon dwindle and more amicable relations would be established. Try it!
Every radio user should have these books

They contain battery facts that it is important for you to know. They are not catalogs, not advertising pamphlets, but each one tells the story of one kind of battery, what it is, what it does, how to connect it, how to get the most satisfaction and service out of it.

Do you know why a "B" Battery is necessary? Do you know how much "B" Battery current your tubes use? Do you know what a "C" Battery can do for you? All these things and many more are told in these informative booklets. Many of these facts you can secure elsewhere only by digging through several different works on radio engineering. These booklets present battery facts, in plain language, with a few simple diagrams.

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Headquarters for Radio Battery Information

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LOST AND FOUND BY RADIO

Many persons annually drop from urban centers, and frantic and sorrowful relatives and friends in their desire to find them, have had to depend entirely on the police and the newspapers.

Now radio has been brought into use for their service by the Meier and Frank Co., a large department store of Portland, Oregon, which recently inaugurated a lost and found service to aid in locating lost articles and getting in touch with missing persons.

All that is necessary is to write KFEC, Meier and Frank Co., printing the names legibly and always being sure to give such essential information as will serve to identify the missing person or the article wanted. The service is free.

A Tube Protector
(Continued from page 57)

if not, you always have this pleasure in store unless some precaution is taken to prevent such an occurrence. If you mistake the "B" battery circuit mixed with the "A." An old burned out tube is obtained, and the glass and elements are removed and the base is thoroughly cleaned. The prongs of the tube are heated by a soldering iron or a blow-torch until the solder melts. Then the wires are withdrawn. A small porcelain socket designed for flashlight bulbs is obtained and wires are soldered to the contacts. These wires are run through the filament tube prongs and soldered so that the top of the flashlight socket is level with the top of the tube base. Melted sealing wax should be poured in the tube base until it is level with the top of the socket, and when it has hardened, the small socket will be firmly fixed.

A flashlight bulb of the desired voltage to correspond with the voltage of the tube can be screwed in this test socket and the device inserted in the regular tube socket before the tube. If the "B" battery has been accidentally connected to the "A" battery leads, the flashlight bulb will go out, thereby serving as a danger signal. When one flashlight bulb is burned out, a new one can be screwed in, and the tester is ready for service again.

Contributed by John J. Strawyer.

RE-BROADCASTING RADIO RECORDED BROADCAST RECORDS

Station WGN has succeeded in broadcasting phonograph records of its opening program, which were recorded in New York, and they were sufficiently clear to make it possible to re-record the disks.

When WGN went on the air with its inaugural program Saturday night, March 29, Mr. Frank Hoyt, inventor of a new method of recording broadcast reception, tuned in at his laboratories in New York and re-recorded his reception of the program on aluminum disks. He succeeded in recording all of the program, which continued from 6 p. m. Saturday evening to 6 a. m. Sunday morning.

A part of these records were brought to Chicago by him and under his supervision were re-broadcast Thursday morning, April 10, as a part of the regular program for Dr. Donald B. McMillan, using, as always in the McMillan programs, the experimental call letters 9XN.

Arrangements were made for a recording of this broadcast of a previous recording, and both in Chicago and New York the broadcasts were received with sufficient clarity and volume to be recorded again, together with announcements about the experiment.

Save 1/2 Cost of New Tube
GUARANTEED VACUUM TUBE REPAIRS AT POPULAR PRICES.

We try to maintain 24-hour service.
All repairs guaranteed.
Tubes satisfactory or money refunded.
Special discounts to dealers.
Send broken and burned-out tubes parcel post.
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HARVARD RADIO LABORATORIES
200 OLD COLONY AV. SO. BOSTON, MASS.

for Super Heterodyne

Ultradyne and all straight radio frequency and reflex circuits. Truly the Masterpiece of Amplification! Could not be made better if it sold for ten times its price of six dollars. Built to uphold our good name, as nearly three-quarter million All-American Audio Frequency and Power Amplifying Transformers already are doing. Watch for the new All-American Low Wave Radio Frequency Transformer.

RAULAND MFG. CO., 2646 Coyne St., Chicago
Pioneers in the Industry.

Radio News for July, 1924
Better Results for Them
Better Results for You ~

VOICE amplification requires batteries that give clear, quiet operation.

That is why 122 Broadcasting Stations use Willard B's in preference to other batteries. During the past thirty days 18 additional Broadcasting Stations have substituted Willard B Batteries for other equipment. The list grows daily.

Besides giving you better reception, Willard B's are the most economical batteries you can own. They can be recharged at any time and they last for several years.

This booklet tells how to get better reception.
Ask your local Willard Service Station or Radio Dealer for copy, or write Willard Storage Battery Company, Cleveland, Ohio. (In Canada, Willard Storage Battery Company of Canada, Limited, Toronto, Ont.)
I noticed, and I fancy that all others have noticed, that static usually starts shortly after sundown and continues, until about 2 A.M., it then ceases. I was on a voyage to Los Angeles from New York, and on the Pacific Coast the sea was smooth and the horizon very clear of clouds. A cloud overhead was floating about 3,000 feet up. As the sun went below the western horizon, it threw a clear-cut shadow on this cloud, and as it did so, the cloud, which was now being chilled by the night air, began to shrink visibly—the static starting instantly, from a dead silence. I saw then what was taking place and why static starts up shortly after sundown. It was clear to me also why the sunset and sunrise lines affect receiving and sending. As soon as the shadow of the earth falls on the cloud overhead, it is chilled and starts at once to shrink. The electricity it contains has no alternative, but to get back to earth. This it does, causing tiny flashes of electricity—so tiny that the miniature waves caused by their passage are only audible in a radio set. It is evident that only those waves that touch the antenna are heard at all. This condition continues as long as the cloud continues to shrink, which is generally about 2 A.M. Then the sunrise line begins to warm up the eastern horizon and the clouds start silently to expand, and static ceases as the day begins.

Cold air currents will, of course, start cloud shrinkage in the daytime, but the principle is the same. Cloud shrinkage causes what we call static, and when I say cloud shrinkage I include humidity shrinkage also.

I find that at sea static is apparently not directional—it shoots straight downward. On shore, however, there are places on the earth's surface more attractive than others. It is, therefore, natural that the tiny flashes of lightning called static by radio listeners are deflected diagonally towards this sensitive spot. In the winter, conditions are as poor for static as they are for lightning, which is all that static is anyhow. Cold air has pretty well squeezed out the electricity from the clouds—they have shrunk to a standstill.

The Gulf of Mexico has a bad name for static, but it is only owing to the fact that the sea is about 84 degrees F. and the humidity is enormous. Cold winds from the north, called Northers, chill and shrink this mass of vapor, precipitating its electrical contents to the sea below. The hotter a cloud is, the more it will shrink when chilled, and the more it shrinks, the less electricity it contains, and the precipitation to the earth is consequently greater, causing more of a rumble.

In very dry climates, like in California, there is very little static. I notice that during very heavy tropical rains, there are not as many static noises as one would expect. The electricity is coming down in the rain drops and does it silently.

Hugh L. Mason,
Master S.S. Jones McGee, S. O. Co.

HAWAII—U. S. A.

Editor, Radio News:

I would appreciate it very much if you would broadcast through Radio News a word or two about Hawaii. There seems to be a general idea through the East that Hawaii is some kind of a foreign country.

Frequently people whom I know have sent to some of the Eastern cities for articles to be sent by parcel post C.O.D., as per the ads in Radio News and electrical magazines, and invariably, after waiting a month or more, get a
"GOLDEN-LEUTZ"

"SUPER-PLIODYNE 9"

Size 40 x 8 x 8

Weight 65 Lbs.

MANUFACTURED UNDER FARRAND LICENSE

A New Broadcast Receiver having 6 Stages of Tuned Neutralized Radio Frequency Amplification, Detector and 2 Stages of Audio Frequency Amplification

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476 BROADWAY

NEW YORK CITY
 kindly advise them that Hawaii is just as much a part of the U. S. A. as the Battery or Brooklyn Bridge, and they could see by the stamps and post marks on the letters that it came from a territory of the U. S. A.

Only a few months ago I sent to a well-known Brooklyn firm making a line of radio goods, asking for one of their catalogs. I received it O.K. in the course of time, and in about two weeks received another one, including numerous folders, all printed in Spanish. Evidently, they are under the impression this is a Spanish country.

HOMER D. JAGGERS,
Kahuku, Oahu, T. H.

FROM A SLIGHTLY DIFFERENT ANGLE

Editor, Radio News:

Having held out for a long time, an impulse finally forces me to pass up (with your kind permission) one of your columns, incidentally writing my first letter to any magazine.

My subject is the cry of the "Cost of Broadcasting," the last straw being a letter in the April issue where Mr. A. B. Curtis says:

"We take too much for granted . . . never stop to think . . . cost real money," etc., etc., until I felt sick reading it. Have people ever stopped to think that all broadcasting is advertising—direct or indirect? That by broadcasting they created the demand for radio receivers; that the listener did not create a demand for broadcasting? That the Ham was very well satisfied to listen to signs, and to send them out until radio corporations saw a big clean-up possible? Suppose we refuse to help support the broadcast stations; does any thinking person believe for one second that the big stations will be abandoned? I do not. Can we think that the people who are making millions of dollars worth of radio goods will let their market go, when supporting their stations they keep up the market? I do not think so.

Therefore, in my opinion it is up to them to maintain these stations, good ones, too, and pay the artists out of their own profits, and keep silent about it. They reap all of the material benefit. and the artists, of course, are entitled to payment for their services. The listener-in pays his share when he buys his set or the material for the construction of it, and, to my way of thinking as a mechanic, makes his contribution right there, and not to off end. I write, as someone has said, "from the heart."

H. MORTIMER,
Outlook, Sask., Can.

LOOK FOR THE SILVER LINING

Editor, Radio News:

I have been a regular reader of your most estimable publication for over a year. I was impelled to buy it for the first time purely by chance. Having been something of a newspaper man of past experience, I picked up a copy on a newsstand, curious to see if it was any improvement to the ordinary newspaper and curious to note the changes that had taken place since I had read the game. It satisfied me so well that I read it. I liked it so well I felt obligated to read at least the things the editor had to say. This matter had to do with the occasionally well written items the editor sees fit to send in, and I am still to read about it. They reappear every week.

I am writing to you, as a newspaper man, to say that I like the improvements you have made. I do not think you need to go back. I have never heard of a newspaper man who wanted to go back in a field of business, and I do not think you would either.

R. W. BUTLER,
Cleveland, Ohio.
"Simply Divine"—Tamaki Miura

The golden witchery of Tamaki Miura's internationally famous art finds ideal counterpart in the marvelous purity and tone quality of Erla Duo-Reflex reception. "Never have I heard anything so beautiful," concludes the eulogy of the Japanese nightingale upon the supreme flawlessness of Erla reproduction. "The tone is simply divine, so pure, so perfectly natural."

Foremost musical authorities of all nations acclaim the exquisitely true, rich tone exclusive to Erla receivers as the ultimate in radio achievement.

Responsible for this unique excellence are Erla radio and audio transformers, synchronizing perfectly received and reflexed radio, as well as rectified radio and reflexed audio currents, in their simultaneous passage through amplifying tubes, with consequent unprecedented elimination of distortion.

You, too, can enjoy outstanding Erla superiority, at minimum effort and cost. Complete Erla parts, for sale by leading dealers, are assembled into the most modern and efficient of receivers in a few hours' time. Easily understood blueprints guide every step.

Ask your dealer; or write, giving your dealer's name. Electrical Research Laboratories, Dept. C, Chicago
BATTLE OF TRAFALGAR

O n October 21, 1805, Nelson's great naval victory of Trafalgar definitely ended Napoleon's scheme for the invasion of the British Isles. Although in a light breeze the English fleet maneuvered successfully in response to the signals from Nelson's flagship "Victory".

Modern fleets are not dependent upon the uncertainties and limited range of visual signals. Radio, which gives unlimited entertainment through broadcasting also is the modern agency, which controls the movements of vessels in battle. Holtzer-Cabot Radio apparatus has added greatly to the development of Radio. Holtzer-Cabot Headsets, Loud Speakers and Phonograph Attachments contain the perfection of design and care in manufacture to enable perfect reception of Radio.

Holtzer-Cabot Loud Speaker .......... $25.00
Load Speaker Phonograph Attachment .......... 10.00
No. 2 Universal Headphones .......... 9.50
No. 4 National Headphones .......... 6.00

Write for booklet explaining how the exclusive features of these instruments enable you to enjoy the wonders of Radio.

THE HOLTZER-CABOT ELECTRIC CO.
125 Albany Street, Boston, Mass.

Radio News for July, 1924

and sinner, and probably would have bitten off half the mythical pole as well, had it been possible.

Since then, it has been a crystal, single circuit (gold dust two), single-tube super, three circuit Armstrong, reflex, inverse duplex, two-tube super, various additions of radio frequency and what not. Now it's a Neutrodyne, and if the Lord is willing and lets me live long enough to raise the tariff for a Super-Het. I will have one this fall. For all of which you are responsible. It has crept much more than good reason would dictate, viewed from my financial platform, but. Sweet William, I have been happy; almost as happy and just as easy as a one-eyed kid at a three-ringed circus. You have made me spend a lot of money, but you have also given me the pleasant moments. Not to mention those enjoyed by an 83-year-old grandma, who, convalescing from a broken hip, can listen in as often as she pleases and who goes to church regularly now without leaving the house. The other night she listened in to a three-hour concert from WTAM. It was composed almost entirely of old-time songs, songs she knew in early childhood. Right then and there every nickel I had spent previously paid super-dividends.

She talked of that for three days. She didn't know of anything anybody ever enjoyed quite as much as that experience. And our pleasure came through her enjoyment of the concert. So you see, in interesting me you have done a lot of good to this household. More power to your typewriter.

I read the article from the pen of the West Virginia contributor to your magazine, in the last copy. I echo every sentiment he proclaims. We are all remiss in letting the stations know just how much good we get from what they send. On a money basis I could never have paid for one-tenth the good or pleasure I have had from every single station I have ever listened to. For the end of a perfect day comes with the signing off to go to bed. I have no criticisms to offer. None but thanks for each and every one of them. If I feel that COW takes too long to make his announcements identifying his station, I have the privilege of either tuning in someone else or patiently waiting for him to tell me who he is, never forgetting that I am getting all of this for nothing. Some are not as good as others, but my objections do not necessarily coincide. Perhaps I am not a judge of that form of entertainment. Who knows? The variety, however, is such, that everybody should be satisfied, or can be if they care to meet the question fairly. Whenever I read of some one, or hear someone razzing a station or performer, it strikes me that someone is looking a gift-horse in the mouth.

As for myself, I can say I have no high coming. I have had lots of fun and real downright pleasure through my radio experience. I wouldn't take much money for my little range of equipment if no other could be had. My year's collection of Radio News numbers occupy the same monetary status. I have no interest in material to offer the stations except when they need it, if that time comes, but my thanks for every angle of the broadcasting field are profound. And help your- self to a generous portion of the same.

The amateur is a pretty decent fellow, I find, after a year's association with him. My experience has been that more trouble has been caused by commercial stations and whistling single circuit and double circuit stations than by the fellow who simply the atmosphere with a 10-ton crusher. I am surrounded by a herd of them, but only one has ever been guilty of hustling the implied law. He plays some nasty tricks at, especially when notified that he wasn't a licensed sender. So beyond that I have found them a mighty fine set of fellows, who are ever
Crosley Trirdyn
$65.00

Approved By Over 200 Experts
New Crosley Engineering Achievement

A three tube set with five tube efficiency—the greatest selectivity with the minimum effort—positive calibration to any wave length between 200 and 600 meters. These are only a few of the many advantages offered in the remarkable new Crosley Trirdyn Radio Receiver.

It was only after a year of constant experimenting, that our engineering department perfected this exceptional receiver. Thorough tests proved to us that it would out-perform any receiver ever before produced. But we were not satisfied with our own opinion. So we shipped out 200 of these sets to experts in every part of the United States. Their criticisms are one and the same—"tried out your new Trirdyn Receiver Saturday night and logged 13 stations, among them Cuba, New York and Omaha, between 9 and 10 o'clock. The set was very selective. During the time this test was on local station KSD was operating and we went through them without any difficulty or interference whatever. The range of the local station was not more than three points variation in the dial setting."

"Triied one of these sets out and obtained wonderful results. Were able to log all stations which we heard very successfully. This set should go over big." "The set has wonderful volume and is selective"—etc.

This new Crosley triumph is called the Trirdyn because of its original combination of the three "R's"—Radio frequency amplification, Regeneration and Reflex. The first tube incorporates non-oscillating, non-radiating tuned radio frequency amplification; the second tube, a regenerative detector is reflexed back on the first tube for one stage of audio frequency amplification. Then it has a third tube which acts as a straight audio frequency amplifier. It uses the ultra selective aperiodic antenna circuit and external selector coil, which adds to its wonderful selectivity.

The Crosley Trirdyn in range, volume and selectivity is the equal of any five tube receiver on the market. Greater volume will of course, be obtained through the use of storage battery tubes, but it will function well with any type and can be used with either indoor or outdoor antenna.

The opinions of many experts have convinced us that the Trirdyn is the best receiver ever offered the public regardless of price.

Practically every radio dealer can furnish you Crosley Radio Sets including not only the Trirdyn, but the Model 51, a two tube set for only $18.50; the Model V, a single tube receiver at $16.00; the Model VI at $24.00; the Super VI at $29.00; the Model X-J at $55.00 and the Super X-J at $65.00.

All Crosley regenerative sets are licensed under Armstrong U. S. Patent No. 1,115,149

Crosley Builds More Radio Receiving Sets than any other Manufacturer in the World.

CROSELY
Better-Cost Less
Radio Products

SEE THIS NEW WONDER AT YOUR DEALERS

THE CROSLEY RADIO CORPORATION
POWEL CROSLEY, Jr., President
Formerly The Precision Equipment Company and Crosley Manufacturing Company
722 ALFRED STREET
CINCINNATI, OHIO
ready to help out when trouble knocks on the panel door. And they know a lot about your troubles when your set gets to fouling. One of them heard my regenerative set whistling louder than the ten o'clock local. His method of taking up the question with me and bringing about proper results has led me to believe that he is an amateur operator that young man makes a first-class diplomat. He was 17 and I am old enough to be his grandfather. Still, he showed me how to tune it right, and shades of Major Armstrong the little stunt lie did with my one-tube set, and one stage of anemic amplification, was to turn in PXW and 6KW: Here Comes Brinkley, Montreal and divers other DX points. Since then I have had the same kind of help which to the comfort of my filament batteries and tubes. Yes verily, that kid was up to something I see where I am going to have some fun with all that kid and the prospective super I hope to build.

Altogether, I feel I owe the radio fraternity quite a bit. Much pleasure has been mine, also my family. We look for the evening concerts with the pleasure that comes to a kid who knows the next day will be Saturday and there will be no ashes to carry to out. It is one round of pleasure, with just as much fun building the sets. Perhaps the A.T.T. is assuming a monomaniac attitude. Also they furnish a fine variety of entertainment. We can’t forget that. That capable gent by the name of Howard will, no doubt, find some way to curb that tendency, but let us hope it won’t interfere with the excellent programs their chain of stations broadcast. As for the Authors, Composers and What Not Association, there must be a binge loose somewhere in their collective mental organism. Since radio hit my message, I have bought more records and sheet music in one year than in any other five. If they won’t believe me, I agree to play the finest collection of recent records and sheet music any one owns who is working on a budget as close to the handle as mine.

ARTHUR J. HIRSCH, Akron, Ohio.

WHO CAN HELP?

Editor, Radio News:

Although but 15 years of age, I have taken a very great interest in radio for some time. I began before the war—a bad time to be sure. My interest was aroused by a ham who lived nearby. The purpose of this letter is to try and find an obliging amateur who will give me some inside dope on amateur life. I have expectation of becoming a ham some day, but living in a rural district as I do, and there being no O.M. near me to my knowledge, I am unable to obtain the information I seek. When it comes to the code, I can send at fair speed, but cannot receive because every time I have attempted to get code practice from some station I have heard “DINNER.” Grab is O.K. at the right time.

I have been reading, with interest, the “Correspondence From Readers” section of your magazine, and have found particular interest in the letters of Mr. Aldeman, and the answers—they took the bun.

MORTON BARTLETT, Norwell, Mass.

FACTS ON SPARK INTERFERENCE

Editor, Radio News:

I have been a constant reader of your magazine for several years, and so far have never taken up any appreciable space in your columns, so I would not assert myself at present on the two things through this medium. I have read a great many articles in the radio magazines, and particularly in Radio News, written evidently by imaginative BCL’s who thought they had a case against the commercial spark stations because they...
Get a "close up" of the radio stage with Murdock Radio Phones

Headphones are your ticket to the Theatre of the Air. If you make a poor selection, you'll find yourself in the rear row of the balcony, straining to catch the fun on the radio stage. Voices and music sound "over the hill and far away."

Plug in a pair of Murdock Radio Phones—and note the difference. It's just like being in fifth row center. High and low notes, loud and soft tones—come in round, mellow and true.

High Efficiency

The fine acoustical qualities embodied in Murdocks permit the user to receive distant signals with great volume and clearness. Powerful magnets and sensitive diaphragms—correctly seated and clamped—are important factors in the success of Murdock Radio Phones.

Light and Comfortable

Murdocks are noted for their comfort. They are very light in weight. The new improved flat headband does not bind the head. Ear caps cover the ears and exclude outside noises. As a result of these features, you can wear Murdocks for hours without discomfort or fatigue.

When you compare the high efficiency of Murdocks, with their very moderate price, you'll be convinced that they are the best phone value on the market. Get a pair of Murdocks today and test them out. They are fully guaranteed.

Murdock Neutrodyne

Licensed by Independent Radio Manufacturers, Inc., under Hazeltine patent. Assures the utmost in selectivity, distance, volume and clarity. See this beautiful set at your dealer's. (Illustrated above.)
How You Can Know Latest Facts about RADIO

The one best way is with Lefax Perpetual Radio Handbook. Grows with every new discovery about Radio. Cannot become out-of-date. Gives all known facts and new ones as they are learned. The authors are Dr. J. H. Dellingger, Chief of the Radio Laboratory, U. S. Bureau of Standards, and L. E. Whittemore, Department of Commerce, Washington, D. C.

As a purchaser of the Lefax Radio Handbook you receive complete information on new Radio developments every month free for one year. This information comes to you on printed, punched, page form. You add the pages instantly, easily. Includes a complete list of broadcasting stations and full information about every one. No Radio Book is or can be like

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Pocket size, loose leaf, flexible Morocco grained fabrakoid binder, fine looking, long wearing. Type clear, sharp. Illustrations clean, fine, easy to understand. Index tabs of linen—tough, strong—penny marked.

You get the complete Lefax Radio Handbook for $5.00, and all new, useful, authentic information free every month. It comes to you automatically. Ask your Radio supply man, stationer or bookseller. If this stock is depleted we will send you a Handbook upon receipt of price or C. O. D., subject to return if you are not entirely satisfied.

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The ACME DUO POWER UNIT

is a high grade charger and battery combined in one cabinet, thereby eliminating the possibility of incorrectly connecting battery wires to charger, the usual mess of unsightly wires, cables, clips, etc., and the carrying to battery to charger or charger to battery for use.

Three Sizes
80
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Ampere Hour Capacity

CHOICE ANY TYPE CHARGER

Bulb Vibrator
or ACME Super-Silent—whichever you prefer

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Depending on type charger and capacity of battery

THIS DUO-POWER UNIT can be used while set is in operation; charger or battery can be used separately. All parts are easily accessible should adjustments or repairs ever become necessary. Will also charge your WET "B" BATTERIES.

Wire or write for full details on this and other ACME products—"For Better Results."

The ACME ENGINEERING CO., Inc.

Louisville, Ky.

Radio News for July, 1924

occasionally broke in on their evening's broadcast entertainment. From the attitude of a number of these writers, it is evident they are under the impression that shipboard and coastal stations have no business on the air and are installed expressly for the purpose of interfering with the broadcast programs.

If the broadcast public continues to take this hostile attitude toward the code stations, I have my doubts if anything ever will be done to clear up the interference question. If there were less barking on the part of the BCLs and a little more co-operation and patience, perhaps better results would be accomplished.

Radio apparatus is installed aboard ships to call assistance should any serious accident befal the vessel while at sea and to keep in touch with the offices of the owning companies in order to handle whatever business they may have pertaining to shipping, etc., with their vessels. In the case of passenger ships, the radio apparatus is for the convenience of the passengers as well, and many take advantage of it. Business men in particular who make frequent trips use it as means of keeping in touch with their home offices.

It can be plainly seen that the work handled by the code stations is of much greater importance than the reception of broadcast programs. It is a case of business versus pleasure, and the old adage of "Business before pleasure" should be observed here as well as any other place. Should any of the bolsterers referred above have occasion to make an ocean trip, and while on vessels find it necessary to send a message to someone, and discovered that the vessel carried no wireless because it was declared a nuisance by the BCLs, he would naturally kick up some dust and condemn the company for rendering such poor service. Yet this same man makes a terrible spatter because others expect and make use of this service, which results in occasional interference with his evening's entertainment. This is pure selfishness, nothing else.

During the first year or so when broadcasting became so popular, there was much less interference caused by ships, due to the fact that the broadcast waves were considerably lower then than they are at present. Later the Government boosted the broadcast waves up into the midst of the commercial waves, i. e., 450, 600 meters. Nothing but interference could result; not much, possibly, on the latter wave, but plenty on the other. I have heard music more than once come filtering through the mattress of commercial code hash just a little below 600.

No doubt the broadcast tuning qualities or non-qualities of many BCL receivers are responsible for much of the interference. But the fact remains that the broadcasters want to move the commercial waves moved out of their way because they settle down in their midst. Wouldn't it be just as easy—in fact, easier—to move the broadcast waves, since there are a great many more commercial stations concerned than broadcast stations?

However, much could be done to improve the situation by the adoption of tube transmitters for all ships and coast stations. The advantages of the efficient little tube over the spark are well known by most everyone who has had any experience with them as generators of radio frequency oscillations. Much greater distances can be covered with less interference, due to the fact that a pure continuous wave has no decrement, and consequently tunes very well. BCLs could be handled on approximately the same wave-length with less jamming. In addition, the note emitted by a tube set is much easier to read through static and interference than that of the spark.

The truth of my statements are well borne out by the results the amateurs have accomplished since they gave up the spark. Hundreds of records have been set, only to be
SUPER-HETEROODYNE
The World's Best Radio Receiver

BY PERFORMANCE

ADVANTAGES NO OTHER RECEIVER CAN EQUAL

1. UNIFORM EFFICIENCY over the entire wavelength range of 160 to 850 meters. This means that all stations, Radio-phone Broadcasting, Amateur and Commercial within this wavelength range, will be received with maximum intensity. This very desirable feature is not obtainable by any other practical method using Radio Frequency amplification.

2. SELECTIVITY by this system, greatly exceeds that obtained in all other methods of reception. Using the Model “C” with a loop in the Suburbs of New York, WOR 15 miles distance, operating on 405 meters, can be completely eliminated, and PWX 1300 miles distance operating on 400, can be received on a loud speaker. This holds true on an average cool night. There is no telegraphic interference from 200 meter amateur stations or 600 meter ship stations.

3. SIMPLICITY to change from one station to another, there are only two dials to vary. The two dials can be calibrated for all the various stations, as there is only one best position for each station.

4. AMPLIFICATION is much greater than obtainable in any other standard receiver. Total is as follows: 1st the Heterodyne Amplification in the 1st Detector; 2nd, the Regenerative Amplification in the 1st Detector; 3rd the 3 stages of Tuned Regenerative Radio Frequency Amplification; working at a low advantageous frequency; 4th, the second Detector action, and 5th, the two stages of low ratio distortionless audio frequency amplification.

5. RECEIVING RANGE other factors correct, the receiving range is in proportion to the effective radio frequency amplification applied. As this receiver has much greater effective radio frequency amplification than all others, the range is proportionally greater.

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Experimenters Information Service 476 Broadway :: :: :: New York City
Look for the socket board

In leading radio stores you will find the Na-ald Socket Board, displaying the five standard Na-ald Sockets: For the 200 and 201 tubes, the De Luxe at $1.75; and also the Small Space at $1.50 for the UV 199, No. 499 at 50c and adapter at 75c; for W. D. 11, No. 411 at 75c.

Ask your dealer to show you the self-cleaning arrangement of contacts in Na-ald De Luxe, No. 400. These dual-pressure contact strips cut into the sides of tube terminals, keeping their surface clean and bright, and resulting in perfect contact. These sockets have the highest dielectric properties, obtained by the thorough cure of the Bakelite used, and made possible by uniform cross-section.

There can be no noisy circuits due to poor contact with these sockets in use.

At your dealer's

At Last! a real SILENT-super BATTERY CHARGER

At a price every fan can afford

Only $10.50

Charges BOTH "A" and "B" Storage Batteries

FULLY GUARANTEED

Dealers: This charger is truly a smash hit. With so many sets now on the market, and with the necessity for power direct from the battery, the Na-ald charger is a needed accessory.

The Acme Battery Charger contains no bulbs, no glass, no contacts, no moving parts. It never needs adjustment, is fool proof, silent and practically indestructible. Charges both "A" and "B" Batteries properly without overheating or overcharging. Stops charging automatically when your battery reaches full strength. Simple and efficient—absolutely the last word in battery charging.

ACME ENGINEERING CO., Dept. 3, Louisville, Ky.

broken again and again by their efficient tube sets. Distances were covered that could not be touched had they used spark equipment instead. Would it have been possible for them to exchange messages with Europe had they used the latter? So it can be seen that by the adoption of this type of transmitter it would be of material benefit to the broadcast public, as well as the commercial companies.

No doubt it would be necessary to go to a great deal of expense in order to make all these changes. However, this item would not present such a huge expense as one would first believe, as much of the spark equipment in use today could still be used. All parts constituting the primary oscillating circuits could be removed, leaving the panels, mountings, tuning units, switches, sockets, and starters. The tubes and other parts associated with a tube set could then be substituted and fitted into the old mountings. The secondary side of the motor generator and the primary side would merely be connected to a generator to produce the necessary high voltage D.C. supply for the plates, leaving the motor as it is. Easier said than done perhaps, but still possible, although it might be an expensive operation.

Some will say that, due to the sharpness of the wave emitted by a tube set, it would present a danger rather than an improvement, as the possibilities of hearing a vessel in distress would be slight unless someone were particularly tuning for him. This could be taken care of very easily by providing a chopper for the grid circuit, which would give the note a modulated effect and at the same time broaden the wave. The chopper could also be used in cases where difficulty was experienced in raising a certain station. The use of tube transmitting equipment in a certain station, coastal and shipboard, as well as others, is bound to come sooner or later. Its greater efficiency over the spark is being realized now and more every day, and the doom of the crashing spark is not far off.

Before signing off, there is one more thing I wish to say, and that is to commend the article written by Mr. A. J. Charters, Radio KUVB, in the March issue of Radio News. Although I haven't experienced all the troubles he complains about, but I heartily agree with him regarding a commercial operators' organization. Why not? It would serve to band them together closer for legislative protection. Why shouldn't the commercial operators be united? It would be for their own protection and would serve, as Mr. Charters states, to help in retaining their old place on shipboard. I'm sure every op. would be willing to contribute a few cents each month for its support. Practically all other trades are organized, and have been for many years. Why not follow suit? Let's hear from others in this respect. How about you, Miss Sparks? R. C. Walker, Radio KIBD ex SZAK.

PLAIN TALK

Editor, Radio News:

I have been in the radio game since long before broadcasting began, and when it did begin, I was for it from the start. I am, principally, just a listener, but there is no one who is more interested in the future of the science and the success of radio than myself.

When broadcasting began, I was a subscriber to several radio magazines, and usually bought several, each month, to which I did not subscribe. As the business began to boom, at first I was amused at the new concerns which were starting to get into it by making sets to supply the sudden demand; then I was amused at the claims they made for their sets. As the big boom got
March 31, 1924

Mr. R. E. Lacault,

Dear Sir:

The Ultradyne has brought everything from the West Coast to the locals on a loop. It also does a mighty good job with no loop or aerial up to 1,000 miles. I logged 156 stations in fifteen days. The tone quality is A-1 and there is no distortion.

Sincerely,

J. C. Barbour.

PENACOOK, N. H.
63 Water Street

March 31, 1924

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J. C. Barbour.

Ultradynne Performance is the Envy of the Radio Industry

This envy is well justified, for the Ultradyne is fundamentally a decided advance in radio reception. The Ultradyne employs the "Modulation System" of radio reception, an entirely new development by R. E. Lacault, A.M.I.E.E., formerly radio research engineer with the French Signal Corps Research Laboratories.

It is this exclusive feature that established the Ultradyne as the first receiver to officially report reception of the first concert program ever broadcast from London to America. The "Modulation System" increases the sensitiveness over that of any known receiver. Weakest signals are made to operate the loud speaker. Results exceed by far those secured by Reflex, Super-regenerative, Neutrodyne and the well-known Super-Heterodyne.

In addition the Ultradyne incorporates every good feature of the famous Super-Heterodyne.

An Ultra receiver for those who want Ultra performance with greatest ease of operation.

Write for descriptive circular

Efficient operation of the Ultradyne Receiver depends principally upon the use of proper transformers. The Ultraformer, types A and B, are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, A.M.I.E.E., radio engineer of this company and inventor of the Ultradyne.

The Ultraformer (Type B) may be successfully employed in any circuit where long wave radio frequency transformers are essential.

To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers.

$5.00

S. P. 576

Write for descriptive circular

PHENIX RADIO CORPORATION

37 BEEKMAN STREET

NEW YORK
well under way, and radio began to be more and more popular, my amusement gradually turned to disgust, until now, it is well nigh exasperation, every time I look through the advertising section of any radio magazine or paper. Radio is new. There are millions who know nothing about it, and the advertisers are preying upon them. From reading the advertisements, one who is familiar with radio is immediately forced to the conclusion that the purpose of many of the advertisers is simply the sale of their apparatus, with not one thought about the satisfaction of the purchaser, and it is killing the business. As we look through the advertisements, we come on things like this: "And such a set gets 'em 3,000 miles on one tube." "No need to use tubes at all. Use our crystals." "The one tube set that works a loud speaker." "Our loud speaker received signals from China."

Naturally the man who knows nothing about radio, who is intending to buy a set, wants to buy the set that will accomplish the most for the least outlay of money, and looks through the ads to find the one that seems to be that set. He picks up a 3,000 mile, one tube, loud speaker operating set, buys it, finds out that it will not do it, gets disgusted, and radio has another enemy.

A man cannot ride in the Rolls-Royce class for the price of a Ford. Everyone knows it, and the consequence is that the Ford Company does not advertise that their car is as good as the Rolls-Royce, because everyone would know that they were crazy; but in radio the poor gullible public does not know that the one tube set will not work like the super-heterodyne. It is very true that it is possible to get 3,000 miles with a one tube set, but from the time of the advertising, one would think it could be done all the time, at will, and perfectly, if only one will buy this particular set. Personally, I have one set received from a distance of 3,000 miles with one tube, and that with very good volume and clarity, and I have heard stations as far as 500 or 600 miles on a crystal, but for some peculiar, silly reason, I use an eight tube super-heterodyne, which runs my "V" battery down in no time, and uses up "B" batteries with almost unreasonable rapidity, but still I use it.

Every time an enthusiast buys a wildly advertised set, and it fails to live up to the claims made, radio has another enemy who might have been a friend. The man who pays out $30 or $40, on a little two or three tube set, buys it on a false advertising, that set will not work, and he has thrown his money away, and will have to spend $250 at least, to get the results which he expected in the first place, and is then there disgusted at the truth.

If it is possible to do what some advertise with their five or six tubes, who is the largest company of all making a super-heterodyne? Surely, if there were anything to these marvelous one-tube sets, and so on, there would be no multi-tube sets made.

It is high time that the people who are really interested in radio get together and put an end to his wildcat business. The public can be instructed if time is given, but in the meanwhile radio is getting a black eye. My own personal idea is that the radio magazines could do nothing better for the general good of radio than to get together and decide that they will publish nothing which is not true. When a manufacturer wants to advertise his set, force him to advertise that his one-tube set is good for 1,000 or 1,500 miles with interfering stations, and a loud speaker is a good one, but that it depends on the set to give it the signals which the super-heterodyne is good for across country on a loop, and then when
BASEBALLSCORESBYRADIO

SAY THE RADIO BUGS

BASEBALL fans the country over will be counting on Radio this year more than ever before. Most Radio fans are baseball fans. Every one of them should see that his new set of Kellogg radio parts is ready in time for the baseball scores.

Get the Spring records and scores quickest by Radio—build your set of Kellogg radio parts for dependability and economy.

There is a certainty of satisfaction with Kellogg as shown by records of this equipment in use. Kellogg transformers rank among the best. To hear them in operation is to want them. Kellogg tube sockets give the utmost of service, while Kellogg switch arms and knobs are in a class by themselves for quick assembly, low resistance and satisfying operation.

Kellogg variable and fixed condensers, variometers and vario-couplers are all designed and built to give the satisfaction which the word Kellogg expresses in the electrical apparatus field. Kellogg rheostats have but one movable part. They come in six and twenty-five ohm resistances, easily interchangeable. They are simple, yet vary in control on the half turn of the resistance element. Kellogg DX head sets are known wherever radio is in the air. They are built mechanically and electrically for long service, sensitiveness, extreme lightness in wearing, and handling does not affect their tuning. They have Kellogg solid bakelite shells and are furnished with the Kellogg famous receiver cords of which many hundreds or thousands are in use day in the telephone field. Kellogg radio parts are especially suitable n portable sets because of their strength and high class manufacture. They will stand rough handling as will no other radio equipment and yet have the range and afford the selectivity, in the limits of the circuits used, surpassed by none.

If you don't want to bother to pick out the parts for your favorite hookup buy one of our Radio Kits which include all the necessary and suitable parts including two stages of audio amplification; you can select the tuning units, as you desire.

This summer as never before radio will be heard in every summer resort and camp. See that your set is made of Kellogg radio parts.

Specify Kellogg Radio—

Use—Is the Test

KELLOGG SWITCHBOARD
& SUPPLY COMPANY
1066 West Adams St., CHICAGO, ILL.
The Super-De Luxe Dial

The Na-aldo Super-De Luxe Dial is the crowning achievement of dial design and manufacture. It is a truly beautiful creation, which gives that final touch of dignity and attractiveness to the quality set.

All Na-aldo dials express beauty. They have generous knobs which fit fingers perfectly and help to tune. Graduations, placed on the level of Na-aldo dials, are even, and marked with a permanent, brilliant white.

Na-aldo dials are made of genuine Bakelite, with patented construction. They are trued with a diamond and provided with a generous-sized, positive-gripping set screw. No special screwdriver is required for setting.

Na-aldo Super-De Luxe Dial (with large knob)............. $1.00
Na-aldo "A" Dial........................................... 75
Na-aldo "B" Dial........................................... 75
Na-aldo "C" Dial........................................... 75
Na-aldo "D" Dial........................................... 75

The new reproducer booklet, "What to Build" now packed with each Na-aldo product. If your dealer's stock hasn't this, send cover of any Na-aldo carton or 15¢ for it.

ALDEN MANUFACTURING COMPANY
DEPARTMENT K, SPRINGFIELD, MASS.

Jumbo

"A" Battery for WD12 or UV201A Tubes

Instantly Recharged Without Electrical Equipment

The single Jumbo for WD12 tubes, the double Jumbo for UV201A tubes will each operate 3 tubes 4 hours daily for 40 days—renewal cost 65¢ and 95¢, respectively, including free home delivery service within Greater New York.

Outside of New York Jumbo Batteries can be recharged at the same rates by any Jumbo service dealer WHILE YOU WAIT—or in your own home without electrical equipment.

30 Day Trial

AND 5 Year Guarantee

Write or phone for our 30-day trial plan, which permits you at moderate cost to rest Jumbo performance. Our guarantee, together with the unique method of recharging Jumbo Batteries, protects you against heavy depreciation and costly repairs common to other types of storage batteries.

Single Cell, 55.25. Double Cell, $10

Capacity: 100 amp. hours

Primary Manufacturing Corp.
442 West 42nd Street, New York
TELEPHONE LONGACRE 1317-6765

Complete List of Broadcast Stations

(Continued from page 64)
Supremacy Proven by Every Test

The scientifically correct radio rheostat

FIL-KO-STAT

Increases Reception in Any Set
In Any Circuit with Any Tubes

The last control you touch to clear a distant station is your rheostat. WHY? Because the most important tuning unit in your set is—your tube.

WHAT FIL-KO-STAT DOES

1. Brings in DX stations you never heard before.
3. Controls tubes at oscillating points.
4. Permits maximum signal regeneration.
5. Heats filaments suddenly, preventing crystallizing.
7. Operates tubes at minimum voltage. Reduces drain on "A" battery.

FIL-KO-STAT assures micrometer control of electronic flow—and all its benefits.

MANUFACTURED AND GUARANTEED BY DX INSTRUMENT CO.

HARRISBURG PENNSYLVANIA

Write For This Free Booklet

Improved Radio Reception Through Scientific Tube Tuning

Write Today

Address

Distr. RN274

Radio News for July, 1924
TW"  STAGES  OF  TUNED  RADIO  FREQUENCY  AMPLIFICATION
Without  Oscillation

Makes  your  regenerative  set  super-sensitive.  Can  be  added  to  any  standard  receiving  set.  All  tuning  done  with  the  three  Phusiformers.

"The  Year's  Greatest  Development."—N.  Y.  Evening  Mail.

COSMOPOLITAN  PHUSIFORMER
"The  First  and  Original"
A  tuned  Radio  Frequency  Transformer  that  cannot  oscillate.  Look  for  the  Mahogany  Block

PRICE  with  handsome  $9.50

Cosmopolitan  Phusifermer  Corp.,
15-17  WEST  18th  ST.,  NEW  YORK
123  WEST  MADISON  ST.,  CHICAGO
Send  50c  for  Manual  of  Phusiformer  Possibilities

A  $200,000.00  COMPANY  stands  squarely  back  of  the  guarantee  on  EVERY  SCIENTIFIC  HEADSET

SEND  NO  MONEY!  Order  Today

PHONE  IT  TOOK  A  SOLID  YEAR  TO  DESIGN

$2.95  PP"PLD  S  SPEAKER  UNIT  115  "5

We  Guarantee  The  Scientific  Headset  to  be  the  greatest  value  on  the  market.  Try  it  for  five  days.  If  not  satisfactory  send  it  back  and  your  money  will  be  refunded  immediately.  Circular  on  request.  Dealers  wanted.

THE  SCIENTIFIC  ELECTRIC  WORKS
98  Brookline  Ave.
BOSTON,  MASS.

MAKE  MONEY  AS  A  RADIO  DEMONSTRATOR
Big  opportunity  now  to  everyone  who  knows  how  to  set  up  and  operate  a  radio  set—waits  to  take  orders  at  a  price  and  terms  usually  more  favorable  than  regular  dealers  can  offer.  Your  chance  to  get  into  the  Radio  business.  Open  a  set  or  not,  as  you  choose.  Give  all  or  part  time  in  this  work.

WRITE  AT  ONCE  and  give  us  this  information:  Are  you  familiar  with  a  Radio  Set?  What  kind?  How  much  time  do  you  want  to  spend  in  this  work?

MARSHALL  RADIO  PRODUCTS,  Inc.
Marshall  Blvd.  &  19th  St.,  Dept.  B-190  Chicago,  Ill.
The leading radio insulation—
For good reasons:

FORMICA has earned a larger share of the business on radio insulation than any other maker by providing a uniformly better material, backed by uniformly better service.

Formica provides panels of superior finish, entirely free from pit marks. It has the finest, most realistic mahogany finish panel that is available today. It supplies high gloss tubes of handsome appearance in greater quantity than any other maker.

The careful control of processes in the Formica factory has maintained a uniform high quality. You know Formica will always be right. That is why 125 leading manufacturers of radio sets have standardized on Formica panels and tubes.

They find the mechanical qualities of Formica even more important than its high and uniform dielectric strength. Formica will not cold flow. It does not give under a tight binding post and cause it to loosen up. It does not sag from summer heat. It does not turn color from sunlight. It does not absorb water, or deteriorate with age.

The Formica plant has the largest capacity of any in its line. Its shipments are prompt, and its treatment of customers unusually satisfactory.

Insist on Formica and get the best.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Sales Offices
50 Church St., New York, N. Y.
412 First Ave., Pittsburgh, Pa.
1142 Granite Bldg., Rochester, N. Y.
419 Ohio Bldg., Toledo, Ohio
1216 Arch St., Philadelphia, Pa.
1026 Second Ave., S. Minneapolis, Minn.
285 Mission St., San Francisco, California
Whitney Central Bldg., New Orleans, La.
516 Caxton Bldg., Cleveland, Ohio
9 S. Clinton St., Chicago, Ill.
708 Title Bldg., Baltimore, Md.
47 King St., Toronto, Ontario

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS
Always a Contact—But It Turns so Easily!

If you didn’t know that the Pacent Rheostat had a contact arm—you’d never guess it by its operation. From zero resistance to high, there isn’t a place that sticks or binds.

Look at that dial! Beautifully finished in silver, it lends distinction to any radio set, whether factory made or home built.

A quality product—for it’s one of the well-known Pacent Radio Essentials

PACENT ELECTRIC CO.
22 Park Place
New York City

Improve your set
with an AmerTran

— and enjoy radio this summer as never before.

Type AF-6 (Turn ratio 6)
Type AF-7 (Turn ratio 7)
Price, either type, $7
At your Dealer’s. Send for Circular.

American Transformer Company, 177 Emmet St., Newark, N. J.
Designers and builders of radio transformers for over 23 years.

Special Library of Information on RADIO PATENTS and TRADE MARKS

JOHN B. BRADY
Patent Lawyer
575 Evers Building
Washington, D. C.

Phone: RO 4066

RAY-O-VAC
The most satisfactory batteries you can buy. There is a style for every radio use and need.

RAY-O-VAC Radio’s Best Batteries

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Radio News for July, 1924

<table>
<thead>
<tr>
<th>Call</th>
<th>Owner</th>
<th>Location</th>
<th>Wave-lengths in Meters</th>
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<td>Purdue University, West Lafayette, Ind.</td>
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<td>Sterling Electric Co., 31 S. Fifth St., Minneapolis, Minn.</td>
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<td>The Dayton Co., 707 S. 6th St., Minneapolis, Minn.</td>
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<td>Wireless Phone Corporation, 1913 S. Center St., St. Petersburg, Fla.</td>
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<td>WBAV</td>
<td>Erper &amp; Hopkins Co., 146 N. Third St., Columbus, Ohio</td>
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<td>John J. Stearns, 66 Glade St., Wilkes-Barre, Pa.</td>
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<td>Newark Radiant Laboratories, Newark, Ohio</td>
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<td>Barber Battery Service, Fourth and Walnut Sts., Reading, Pa.</td>
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<td>Alfred R. May, 112 W. Raymond Ave., Syracuse, N. Y.</td>
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<td>Georgia School of Technology, Atlanta, Ga.</td>
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<td>Irving F. Wallis, 104 Verona St., Mattapan, Mass.</td>
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<td>Edward J. Gart, 1311 Gordon St., Port Huron, Mich.</td>
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<td>Indianapolis Radio Club, 2721 N. Somerset St., Indianapolis, Ind.</td>
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<td>Need Electric Co., West Palm Beach, Fla.</td>
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<td>Grace Covenant Church, Richmond, Va.</td>
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<td>Frank Adams Piano Co., 110 Park Pl., Larchmont, N. Y.</td>
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<td>A. B. Blake, 425 N. Front St., Wilmington, N. C.</td>
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<td>First Baptist Church, New Orleans, La.</td>
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<td>John B. Boll, 1317 Franklin Ave., Philadelphia, Pa.</td>
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<td>Johnstown Radio Co., 334 Market St., Johnstown, Pa.</td>
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<td>Ruttiefer Junior High School, Norfolk, Va.</td>
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<td>WCBG</td>
<td>Howard S. Williams, Paseagoula, Miss. (portable)</td>
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<td>WCBI</td>
<td>University of Mississippi, Oxford, Miss. (portable)</td>
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<td>WCBK</td>
<td>E. Richard Hall, St. Petersburg, Fla.</td>
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</tbody>
</table>
Apex Audiotron Guarantee

All Apex Audiotron tubes are guaranteed, and Dealers, as well as the manufacturers, will make replacement on all tubes that prove unsatisfactory in any way. The only requirement is that the tube must not have been burned out.

All tubes are Guaranteed to work in radio frequency. Especially adapted for neutrodyne sets.

The Following Tubes are Now on Sale

- Type 201A—5 volts, .25 amperes...$4.00
  Amplifier and Detector
- Type 199—3 volts, .06 amperes...$1.00
  Amplifier and Detector
- Type 199A Same as 199 $1.00
  with Standard Base
- Type 12—1.5 volts, .25 amperes...$4.00
  Platinum Filament — Amplifier and Detector
- Type 200 — 5 volts, 1 amper...$4.00
  Detector Tubes

For Freedom of the Air, Use

APEX AUDIOTRON TUBES

"ATTENTION DEALERS" and "DISTRIBUTORS"

If your local dealer cannot supply you, order direct.

RADIO TUBE CORPORATION
671 Broad Street Newark, N. J.
Better Distance—Longer Tube Life
with this Filament Voltmeter

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Radio News for July, 1924

Call Owner Location Length-in

WCBP Northern Radio Mfg. Co., Lincoln, 300

WCRM Charles Swan, Bailey, Md., 175

WCBN James P. Boland, Fort Benjamin Har

WCBQ The Radio Shop, Inc., Memphis, Tenn., 250

WCBQ Robert G. Phillips, Youngstown, Ohio, 246

WCBR Charles H. Alonter, Providence, R. I. (portable), 246

WCDT Clark University, Mass., 250

WCBU Arnold Wireless Supply Co., Arnold, Pa., 254

WCBV Tullahomna Radio Club, Tullahomna, Tenn., 252

WCK Steeby & Fuller Dry Goods Co., St. Louis, Mo., 360

WCM University of Texas, Austin, Texas, 360

WCX Detroit Free Press, Detroit, Mich., 517

WDAF Kansas City Star, Kansas City, Mo., 411

WDAG J. Lawrence Martin, Amarillo, Texas, 264

WDAH Trinity Methodist Church (South), El Paso, Texas, 268

WDAR The Courant, Hartford, Conn., 261

WDAO American Telephone & Telegraph Co. and

WDAP Board of Trade, Chicago, Ill., 360

WDAR Board of Trade, Philadelphia, Pa., 395

WDAS Samuel A. Water, 626 Main St., Wester

WDAY Electric Equipment Corporation, 220

WDBA Fred Ray, Columbus, Ohio, 236

WDBB A. H. White & Co., Inc., Taunton,

WDBC Kirk, Johnson & Co., Lancaster, Pa., 250

WDBO Church of the Covenant, Washingt

WDZ James L. Bush, Tuscaloosa, Ala., 278

WEAA Frank D. Fallman, Police Bldg., Flint, Mich., 250

WEAF American Telephone & Telegraph Co.,

WEAH Wichita Board of Trade, Wichita, Kan.

WEAI Cornell University and Extension, N.

WEAJ University of South Dakota, Vermi

WEAM Borough of North Plainfield, North

WEAN Shepard Co., Providence, R. I., 275

WEAO Ohio State University, Columbus, Ohio

WAEP Metropolitan Co., O'Gunnion Mobile, Ala., 360

WASHINGTON Evening News Publishing Co., Bala

WEAT Davidson Bros. Co., Sioux City, Iowa, 360

WEBW Iris Theatre, Dallas, Texas, 360

WEBR 1110 Olive St., St. Louis, Mo., 273

WEV Hurthill-Steel Electric Co., McKin

WEW Savannah, Ga., Lee, Louis, Mo., 261

WFDA Dallas News and Dallas Journal, Tex

WFAB Carl F. Rowe, 802 McBride Street, Syr

WFAP Electric Supply Co., 617 Houston St., Port Arthur, Texas, 236

WFJG Hillside Avenue, 23 Hanover St., Asheville, N. C., 360

WFAM Times Publishing Co., St. Cloud, Minn., 330

WFAN Whiterspoon Electric Service Co., Hutchinson, Minn., 360

WFAP Missouri Wesleyan College, Cameron, Mo., 360

WFCF New Columbus College, Sioux Falls, S. Dak., 258

WFVB University of Nebraska, Lincoln, Neb., 273

WF 138 Broadway & Clothier, Philadelphia, Pa., 395

WGC Lancaster Electric Supply and Con

WGAN Cecil E. Lloyd, 216 W. Romana St., Pensacola, Fla., 360

WGAV Glenwood J. 900, Texas Ave., Sheveport, La., 252

WGAW Ernest C. Albright, 1918 W. Chester St., Altona, Pa., 261

WGAZ South Bend Tribune, South Bend, Ind., 360

WGI American Radio and Research Corpora

WGL Thomas F. H. Bond, Philadelphia, Phila., 360

WGN Chicago Tribune, Chicago, Ill., 370

WGR Federal Telephone & Telegraph Co., Buffal

WGV Interstate Electric Co., 356 Barrone

WGY General Electric Co., Schenectady, N. Y., 380

WHA University of Wisconsin, Madison, Wis., 360

WHAA State University of Iowa, Iowa City, Iowa, 484
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- Made from grade A quality wire, stranded, and is one of the best reels on the market. Will hold wire of any size and strength. L3102 Electrolytic condenser, price ... $1.00

**Rice**
- Made from grade A quality wire, stranded, and is one of the best reels on the market. Will hold wire of any size and strength. L3105 Rice, price ... $1.00

**Dial Marker**
- The dial marker is a precision instrument, made from grade A quality wire, stranded, and is one of the best reels on the market. Will hold wire of any size and strength. L2100 Dial marker, price ... $1.00

**Wax Cables**
- Made from grade A quality wire, stranded, and is one of the best reels on the market. Will hold wire of any size and strength. L3100 Wax cable, price ... $1.00

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Call Owner Location Wave-lengths in Meters
WHAR Clark W. Thompson, Galveston, Texas
360
WHAD Michigan University, Ann Arbor, Mich.
360
WHAG University of Cincinnati, Cincinnati, Ohio
222
WHAI Hafer Supply Co., 112 W. Sixth St., Joplin, Mo.
283
WHAK Roberts Hardware Co., Clarksville, W. Va.
258
WHAM University of Rochester (Eastman School of Music), Rochester, N. Y.
283
WHAP Otto and Kuhn, 160 S. Water St., Decatur, Ill.
360
WHAR Paramount Radio & Electric Co., 1215 Atlantic Ave., Atlantic City, N. J.
311
WHAS Courier-Journal and Louisville Times, Louisville, Ky.
400
WHAV Wimpimngton Electrical Specialty Co., 403 Delaware Ave., Wilmingtom, Del.
278
WHAZ Res nale, Polytechnic Institute, Troy, N. Y.
300
WHB Sweety School Co., Sweety Bldg., Kansas City, Mo.
411
WHK Rook and Sons, 2903 E. 10th St., Cleveland, Ohio
283
WHJ Green School, 1500 Broad St., York, Pa.
360
226
WIAB Joslyn Automobile Co., 520 Church St., Rockford, Ill.
244
WIAL Cleveland Tribune, Cleveland, Texas
360
WID Howard R. Miller, 6118 N. Park Ave., Chicago, III.
354
244
WIAH Steer Bost, Springfield, Mo.
252
WII Fox River Valley, Waukegan, Ill.
325
WIAJ 425 Sherry St., Neenah, Wis.
224
WIAK Journal-Stockman Co., Oshkosh, Wis.
278
WIAO School of Engineering, Milwaukee, 815 Marshall St., Milwaukee, Wis.
251
WIQ Chronicle Publishing Co., 411 Washington St., Marion, Ind.
326
WIAS House Electric Co., 315 N. Third Ave., Burlington, Iowa
283
WIU American Trust & Savings Bank, Le Mars, Iowa
360
WIW Woodward & Leps, Washington, D. C.
273
244
WIL Central Radio Supply Co., 800 North St., Washington, D.C.
260
259
WJK Jackson Experimental Laboratory, 811 Austin St., Waco, Texas
360
WIAF Mingleton Press and Smith Electric Co., Muscle, Ind.
160
WIAJ Newark Daily News, Newark, N. J.
283
WIAM Clifford L. Green, Greenfield, Ind.
254
WIAM D. M. Reham, 132 Third Ave., Utica, N. Y.
264
WIAM Peoria Star, Peoria, Ill.
268
260
WIAR The Outlet Co., Providence, R. I.
260
250
WIKAT Kelley-Vawter Jewelry Co., 309 11th Ave., Mo.
260
WIKI Union Trust Co., Cleveland, Ohio
360
WID Denison University, Granville, Ohio.
229
WJX Desforst Radio Telephone & Telegraph Co., 1391 Sedgefield Ave., New York, N. Y.
360
WJY Radio Corporation of America, New York, N. Y.
225
WJZ Radio Corporation of America, New York, N. Y.
360
WKA D. F. Paar, Cedar Rapids, Iowa
206
WKA Charles Loft (Greater Park), East Providence, R. I.
260
WKA W. S. Radio Supply Co., 725 Tenth St., Wichita Falls, Texas
360
WKA United Service Battery Co., Montpelier, Idaho
266
WKA Andrew F. Smith, Cranston, R. I.
260
WKA Radio Corporation of Porto Rico, San Juan, P. R.
260
280
WKA Leona Radio Club, Leona, N. Y.
360
WKA Pennsy College, Langhorne, Pa.
260
WKA WKY Radio Shop, Oklahoma, Okla.
360
WKA Cutting & Washington Radio Corporation, 18 W. Franklin St., Minneapolis, Minn.
247
WKA Samuel Worthwood, 425 Brownell St., Syracuse, N. Y.
234
WKA Waco Electrical Supply Co., 181 Austin Ave., Waco, Texas
360
WKA Verena Electrical Co., Bellows Falls, Vt.
360
WKA WKY Radio Shop, Oklahoma, Okla.
360
WKA Cutting & Washington Radio Corporation, 18 W. Franklin St., Minneapolis, Minn.
417
WKA Arthur E. Schilling, 108 Elm St., Palatine, Ill.
360
WKA WKJ Radio Shop, 30 S. Pulaski St., Pennsauken, N. J.
260
WKA Police Department, City of New York, New York, N. Y.
360
WKA Putnam Electric Co. (Greencastle Community Broadcast Station), Greencastle, Ind.
231

Radio News for July, 1924
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NEW YORK OFFICE: 50 Church Street

Radio News for July, 1924

Call  Ower  Location

VLB  University of Minnesota, Minneapolis, Minn.  369
WLS  Sears, Roebuck & Co., Chicago, Ill.  345
WLW  Crosley Mfg. Co., Cincinnati, Ohio.  309
WMAB  Radio Supply Co., 707 N. Broadway, Oklahoma City, Okla.  360
WMAC  Clive B. Meredith, Fernwood St., Canton, N. Y.  261
WMAP  Round Hill Radio Corporation, Dartmouth, Mass.  360
WMAH  General Supply Co., 144 N. Thirteenth St., Lincoln, Neb.  254
WMAJ  Drovers Telegram Co., Kansas City, Mo.  275
WMAK  Norton Laboratory, 33 E. State St., Trenton, N. J.  360
WML  Trenton Hardware Co., 33 E. State St., Trenton, N. J.  256
WMAN  First Baptist Church, Columbus, Ohio  286
WMAT  Utility Battery Service, 263 Northampton St., Easton, Pa.  246
WMAQ  Chicago Daily News, Chicago, Ill.  448
WMAV  Alabama Polytechnic Institute, Huntsville, Ala.  250
WMAW  Waldron Electric Co., Waldron, N. D.  254
WMAY  Kingshighway Presbyterian Church, St. Louis, Mo.  289
WMAZ  Mercoy University, Macon, Ga.  268
WMCC  Commercial Appeal, Memphis, Tenn.  304
WMAE  Yellow Stores, Boston, Mass.  275
WMAD  University of Oklahoma, Norman, Okla.  361
WMAN  R. J. Rockwell, 5109 Capital Ave., Omaha, Neb.  266
WMAN  Syracuse Radio Telephone Co.  270
WMAN  F. E. Jefferson, Syracuse, N. Y.  286
WMAQ  Western Sun College, Springfield, Ohio  273
WMAS  Charlestone Radi o Electric Co., Charleston, S. C.  360
WMAR  C. C. Rhodes, Butler, Mo.  231
WNAS  Texas Radio Corporation, Austin, Tex.  360
WNAC  Page Organ Co., (H. E. Mann), 404 N. Main St., Lithonia, Ohio  264
WNAD  Friday Battery & Electric Corporation, Signourney, Iowa  360
WNAE  Medina College, Fremont, Ohio.  283
WNAF  Tyler Commercial College, Tyler, Texas  360
WMAO  Apollo Theatre, Belleville, Ill.  273
WMAH  Palmer's Radio Corporation, 26 King St., Charleston, S. C.  360
WMAL  Southern Equipment Co., San Antonio Texas.  385
WMAO  James E. Vaughn, Lawrencetown, Iowa  360
WMAO  Lyndam Mfg. Co., Mishawaka, Ind.  360
WMAO  Kalamazoo College, Kalamazoo, Mich.  283
WMAO  Henry P. Lundskov, 1066 Sheridan Road, Kenosha, Wis.  299
WMAO  Roy M. Hample, 215 Market St., Wilkes Barre, Del.  360
WMAO  Pennsylvania National Guard, 112th Infantry, Erie, Pa.  341
WMAO  Woodmen of the World, Omaha, Neb.  536
WMAO  Franklin J. Martin, 600 Ingham Ave., Trenton, N. J.  249
WMAO  Palmer School of Chiropractic, Davenport, Iowa  483
WMAO  Iowa State College, Ames, Iowa  360
WMAO  P. F. Bluff Co., Phe Bluff, Ark.  360
WMAO  John Wansamaker, Philadelphia, Pa.  509
WMAO  Western Electric Co., Kansas City, Mo.  299
WMAO  L. Bamberger & Co., Newark, N. J.  405
WMAO  Missouri State Marketing Bureau, Jefferson City, Mo.  441
WMAO  Pennsylvania College, State College, Pa.  283
WMAO  Donaldson Radio Co., 210 Tiger Bldg., Okemah, Okla.  268
WMAO  Des Moines Radio Corporation, 39 Center St., New Haven, Conn.  368
WMAO  North Dakota Agricultural College, Agricultural College, N. D.  360
WMAO  Avery & Lick Electric Co., 114 N. Third St., Columbus, N. D.  286
WMAO  Auerbach & Guttel, 707 Kansas Ave., Topeka, Kan.  360
WMAO  Theodore D. Phillips, 222 Lexington Ave., Worcester, Ky.  360
WMAO  General Sales & Engineering Company, Froebstburg, Md.  360
WMAO  Ward Battery & Radio Co., Elk River, Minn.  236
WMAO  St. Patricks Catholic, El. Park, Texas  231
WMAO  Caesar Radio Co., Mount Airy, Texas  360
WMAO  John R. Koch, Charleston, W. Va.  272
WMAO  1910 Avenue A, Wilkes Barre, Pa.  360
WMAO  E. B. Gish, 108 E. Eighth St., Amosville, Texas.  360
WMAO  Whitem Electric Co., 59 W. Main St., Waterbury, Conn.  242
WMAO  Moore Radio Station, Spring Field, W.  275
WMAO  Sandusky Register, Sandusky, Ohio.  360

Call in the Actres
Radio News for July, 1924

**The Radio Marvel of 1924**

**The Shamrock-Harkness two-tube reflex**

**Shamrock-Harkness Kit includes:**
1. Shamrock-Harkness Flexformer T-1
2. Shamrock-Harkness Transformer T-2
3. Shamrock Double Tube Socket
4. Shamrock Crystal Detector
5. Shamrock Single Circuit Filament Control
6. Shamrock Audio Frequency Transformers
7. Shamrock Binding Posts
8. Shamrock Dials
9. Wiring Panel
10. Drilled Rear Panel

**Price $35**

**Licensed Manufacturers**

The Shamrock-Harkness Reflex is stampeding the radio world. It’s a whiz for performance. By an astonishing feat of engineering craft, this two-tube set has the pulling power of a standard four tube receiver. Operates a loud speaker with wonderful clarity and volume. Does not whistle, squeal—or radiate. It’s remarkably selective and easy to operate—permitting you to log every station with the utmost accuracy. Many Shamrock fans report that they receive 1500 to 2000 miles consistently with this set.

Shamrock has spent months designing the various parts necessary to build the Harkness Reflex. All parts are included in the Shamrock kit. Buy only genuine parts—and avoid imitations. Only when you buy the genuine (guaranteed) Shamrock parts will you be sure of getting maximum results with this set.

**Before building your set send for this booklet**

The "Shamrock Radio Builder’s Guide Book" contains diagrams and complete instructions for building the Shamrock Reflex—and nine other receivers—at prices from $15 to $50. It makes set-building easy and accurate—shows you how to select the best set for your requirements and how to construct it at the least cost. Send 10 cents for this booklet today. It will save you money.

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Name ____________________________

Address ____________________________

Dealer’s Name ____________________________

Shamrock Reflexpricesetting

Complete instructions, enabling you to complete the set in a half-day.

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<td>Celis Radio Co. (Alden, Texas)</td>
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<td>WQAW</td>
<td>Prince-Walter Co., 108 Merrimack St., Lowell, Mass.</td>
<td>266</td>
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<tr>
<td>WQAW</td>
<td>Catholic University, Washington, D. C.</td>
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<td>WQAX</td>
<td>Radio Equipment Co., Peoria, Ill.</td>
<td>360</td>
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<td>WQAT</td>
<td>Turner Electric Co., Houston, Texas</td>
<td>536</td>
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<td>WQA</td>
<td>The Radio Club, Laporte, Ind.</td>
<td>224</td>
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<tr>
<td>WQT</td>
<td>Stanley, N. B., 191 Alabama Ave., Providence, R. I.</td>
<td>231</td>
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<tr>
<td>WQAL</td>
<td>Northern States Power Co., St. Cloud, Teals Falls, Wis.</td>
<td>248</td>
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<tr>
<td>WQAB</td>
<td>Indianola, Gatesville, Iowa</td>
<td>244</td>
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<td>WQAN</td>
<td>Black Hawk Electrical Co., Waterloo, Iowa</td>
<td>236</td>
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<tr>
<td>WQAO</td>
<td>St. Louis Radio Service Co., 1735 Bartman Ave., St. Louis, Mo.</td>
<td>360</td>
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<tr>
<td>WQAV</td>
<td>Antioch College, Yellow Springs, Ohio</td>
<td>247</td>
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<tr>
<td>WQAX</td>
<td>Avenue Radio Shop, Reading, Pa.</td>
<td>247</td>
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<td>WQFA</td>
<td>Flexon's Gloucester City, N. J.</td>
<td>268</td>
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<tr>
<td>WQAS</td>
<td>Radio Sales Corporation, 1110 Spruce St., Scranton, Pa.</td>
<td>280</td>
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<tr>
<td>WEAR</td>
<td>Radio Shop of Newark, 39 Leigh Ave., Newark, N. J.</td>
<td>233</td>
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<td>WRC</td>
<td>Radio Corporation of America, Washington, D. C.</td>
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<td>WRK</td>
<td>Ferns Bros. Electrical Co., Hamilton, Ohio</td>
<td>260</td>
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<td>WRL</td>
<td>Union College, Schenectady, N. Y.</td>
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<td>WRS</td>
<td>University of Illinois, Urbana, III.</td>
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<td>WRT</td>
<td>City of Dallas, Police and Fire Department, Dallas, Texas</td>
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<td>WRA</td>
<td>Rice Radio Research Laboratory, Tyler, Texas</td>
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<td>WRSB</td>
<td>Southeast Missouri State Teachers College, Cape Girardeau, Mo.</td>
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<td>WSC</td>
<td>Clemson Agricultural College, Clemson College, S. C.</td>
<td>360</td>
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<td>WSD</td>
<td>J. A. Foster Co., 69 Dorrance St., Providence, R. I.</td>
<td>261</td>
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<td>WSA</td>
<td>Marshall V. Davis and George Preston, N. W. St., St. Petersburg, Fla.</td>
<td>244</td>
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<td>WSU</td>
<td>United States Playing Card Co., Cincinnati, Ohio</td>
<td>190</td>
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<td>WSAJ</td>
<td>Grove City College, Grove City, Pa.</td>
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<td>WSSU</td>
<td>Allentown Radio Club, Allentown, Pa.</td>
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<tr>
<td>WSAF</td>
<td>The Seventh Day Adventist Church, New York, N. Y.</td>
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<td>WSR</td>
<td>Daughy &amp; Welch Electrical Co., Fall River, Mass.</td>
<td>254</td>
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<tr>
<td>WSAO</td>
<td>Donohoo-Ware Hardware Co., Plainview, Texas</td>
<td>268</td>
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<tr>
<td>WSAR</td>
<td>John J. Lang, 27, Camagüey, Cuba</td>
<td>275</td>
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<tr>
<td>WSAO</td>
<td>Chicago Radio Laboratory, Chicago, Ill.</td>
<td>268</td>
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<tr>
<td>WSAR</td>
<td>Port Chester Chamber of Commerce, Port Chester, N. Y.</td>
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<td>WSB</td>
<td>Chase Electric Shop, Pomeroy, Ohio</td>
<td>271</td>
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<td>WSH</td>
<td>Atlanta Journal, Atlanta, Ga.</td>
<td>247</td>
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<td>WSG</td>
<td>A. &amp; B. Electric Co., Ellgin, Ill.</td>
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<td>WSH</td>
<td>Alabama Power Co., Birmingham, Ala.</td>
<td>279</td>
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<td>WTA</td>
<td>Fall River Daily Herald Publishing Co., Fall River, Mass.</td>
<td>248</td>
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<td>WTC</td>
<td>Penn Traffic Co., Washington, D. C.</td>
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<td>WTAO</td>
<td>Jews J. Gallo, 2222 La Salle St., New Orleans, La.</td>
<td>268</td>
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<td>WTK</td>
<td>Kern Music Co., 84 Wayne St., Providence, R. I.</td>
<td>259</td>
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<td>WTAH</td>
<td>Carmen Pefco, Belvedere, Ill.</td>
<td>266</td>
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<td>WTAU</td>
<td>The Radio Shop, Portland, Me.</td>
<td>236</td>
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<td>WTAU</td>
<td>Toledo Radio &amp; Electric Co., Toledo, Ohio</td>
<td>274</td>
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<td>WTAU</td>
<td>Willard Storage Battery Co., Cleveland, Ohio</td>
<td>274</td>
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<td>WTAU</td>
<td>Cambridge Radio &amp; Electric Co., Cambridge, Ill.</td>
<td>242</td>
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<tr>
<td>WTAU</td>
<td>J. H. Van Gorden &amp; Son, Oswego, Wisc.</td>
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<td>WTAU</td>
<td>Reliance Electric Co., Norfolk, Va.</td>
<td>262</td>
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<td>WTAU</td>
<td>Charles D. B. Richdale, R. F. D. No. 6, Box 75, Elgin, Ill. (near)</td>
<td>286</td>
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<tr>
<td>WTAU</td>
<td>Edison Electric Illuminating Co., 39 Boynton St., Boston, Mass.</td>
<td>294</td>
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<td>WTAU</td>
<td>Cambridge Electric Co., Cambridge, Ill.</td>
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<tr>
<td>WTAU</td>
<td>Jewel Gorden &amp; Son, Oswego, Wisc.</td>
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<td>WTAU</td>
<td>Agricultural and Mechanical College of Georgia Station, Stovall, Ga.</td>
<td>280</td>
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<td>WTAU</td>
<td>Williams Hardware Co., Stovall, Ill.</td>
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<td>WTAU</td>
<td>Korea Broadcasting Station, Oak Park, Ill.</td>
<td>233</td>
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<td>WTAU</td>
<td>Automotive Parts Co., 535 Main St., Madison, N. J.</td>
<td>283</td>
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<td>WTAU</td>
<td>Sargent Radio Co., 191 Atlanta Ave., Stovall, Ga.</td>
<td>248</td>
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<tr>
<td>WTAU</td>
<td>Co., 535 Main St., Madison, N. J.</td>
<td>283</td>
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<td>WTAU</td>
<td>Bridgeport, Conn., (neat)</td>
<td>286</td>
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<td>WTAU</td>
<td>Wright &amp; Wright, Inc., 2215 N. Main St., Des Moines, Iowa</td>
<td>248</td>
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<td>WTAU</td>
<td>Lawrence J. Crowley, Joliet, Ill.</td>
<td>277</td>
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<tr>
<td>WTAU</td>
<td>Frost Supply Co., 371 Maple Ave., St. Camden, N. J.</td>
<td>216</td>
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</table>
Before you buy another condenser, compare other condensers with RATHBUN Condensers, point by point. Single hole mounting, plates die-cast into milled tubes, absence of mica, metal fields, longer brass bearings, split phosphor bronze contact spring—these RATHBUN features guarantee you the BEST Condenser value!

Write for literature on the new Rathbun Vernier Variable Combination Condensers featured at the Chicago Radio Show.
**Call** | **Owner** | **Location** | **Wave-length in Meters**
--- | --- | --- | ---
CHCE | Western Canada Radio Supply, Ltd., 919 Fort St., Victoria, British Columbia | | 400
CHCL | Vancouver Merchants Exchange, Vancouver, British Columbia | | 400
CHYC | Northern Electric Co., 121 Shearer St., Montreal, Quebec | | 410
CJCA | Edmonton Journal, Journal Bldg., Edmonton, Alberta | | 450
CJGC | London Free Press Printing Co., 420 Richmond St., London, Ontario | | 420
CJCD | T. Eaton Co., James and Alberts Sts., Toronto, Ontario | | 410
CJE | Sontet Shaw Radio Co., 1894 Tower Bldg., Vancouver, British Columbia | | 420
CJCI | Maritime Radio Corp., 543 Albion St., St. John, New Brunswick | | 400
CJCN | Simon Agnew & Co., 19 Melinda St., Toronto, Ontario | | 410
CJFX | Percival Wesley Shackleton, Oshkosh, Alberta | | 400
CJSC | Evening Telegram, Toronto, Ontario | | 420
CK LC | La Presse Publishing Co., St. James St. and St. Lawrence Blvd., Montreal, Quebec | | 400
CKCD | Vancouver Daily Province, Vancouver, British Columbia | | 410
CKCE | Canadian Independent Telephone Co., Wallace Ave. and Ward St., Toronto, Ontario | | 450
CKS | Leader Publishing Co., Regina, Saskatchewan | | 420
CKOC | Westinghouse Radio Supply Co., 31 John St. N., Hamilton, Ontario | | 400
CKY | Manitoba Telephone System, Sherbrooke St., Winnipeg, Manitoba | | 450

**MEXICAN BROADCAST STATIONS**

**Call** | **Owner** | **Location** | **Wave-length in Meters**
--- | --- | --- | ---
CVB | “El Ruego Tono” Cigarette Manufacturing Co., Mexico City | | 400
CVL | “El Universal” (newspaper), Mexico City | | 400

We shall be grateful if the owners of broadcast stations will inform us of any changes in location, wave-length or power. This will enable us to keep our broadcast station list up-to-date.

---

**The Staccatone**

(Continued from page 21)

control, as the slightest change in the capacity of the apparatus, such as is caused by moving the hand near the set, will change the pitch of the beat-note considerably. As such a system would be impractical for this purpose a vacuum tube is used connected so as to generate low or audible frequency notes which sound the same as the beat-notes heard in radio.

Such a circuit would require larger values of capacity and inductance than are used in the ordinary radio circuit, and for this purpose a number of large honeycomb coils are used with fixed and variable condensers. A comparatively large capacities, so that the natural frequency of the oscillating circuit will be at a low audible note. By employing sufficient capacity and inductance in the circuit to give us the lowest note desired we can, with a number of switches corresponding to the keys on a piano, cut inductance or capacity, or both, in and out of the circuit and raise the pitch to any value we wish, each key or switch corresponding to a musical note.

---

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Philadelphia

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Literature describing Atwater Kent Receiving Sets and the Atwater Kent Loud Speaker sent on request.

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<tr>
<th>Name</th>
<th>Address</th>
<th>City</th>
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The tones are heard, of course, from a loud speaker connected in the plate circuit of the vacuum tube. The complete circuit is shown in the accompanying diagram. Those familiar with radio hook-ups will recognize this at once as the Hartley circuit. The inductance consists of six 1,500-turn honeycomb coils, all connected in series and clamped together.

With a six-volt-a-hour tube, such as the type UV-201, and a "B" battery voltage of 90 or more, the sound will be so loud as to be heard for several blocks away. Of course, a good loud talker must be used. But for inside use in a small room, a dry cell tube may be used with a 45-volt "B" battery. In fact most of the instruments that radio receiving sets may be employed in the Staccatoe.

New Radio Patents (Continued from page 59)

CONDENSER

(Patent No. 1,480,604. W. Dubbile, Assigned to Dubbile Condenser and Radio Corporation.) TERMINAL CONVERSION FOR CONDENSERS, in which the conducting plates have terminals extending from the sides of the stack which are gripped together by a smooth, round metallic hook.

ARC TRANSFORMER

(Patent No. 1,480,659. O. A. Brackett, Assigned to Westinghouse Electric and Mfg. Co.) SIGNAL ELECTRICAL AMPLIFIER SYSTEM, comprising an anode which is controlled to produce signals with radio frequency amplifier, and the detecting circuit for preventing disturbing currents from being transferred from the amplification circuit to the detector circuit.

TUBE CONSTRUCTION

(Patent No. 1,481,422. Gilles Hohf, E. Oster, Assigned to General Electric Company.) HIGH FREQUENCY RECEIVING SYSTEM, in which a link circuit is produced between a radio frequency amplifier and the detecting circuit for preventing disturbing currents from being transferred from the amplification circuit to the detecting circuit.

SELECTIVE RECEIVER

(Patent No. 1,480,952. H. T. Hymeyer, Assigned to July 30, 1924, issued Jan. 25, 1924. Assigned to General Electric Company, Incorporated.) SELECTIVE RECEIVER SYSTEM, in which a link circuit is produced between a radio frequency amplifier and the detecting circuit for preventing disturbing currents from being transferred from the amplification circuit to the detecting circuit.

INTERFERENCE ELIMINATOR

(Patent No. 1,481,453. Weinberger, Assigned to July 30, 1924, issued Jan. 25, 1924. Assigned to Radio Corporation of America.) RADIO RECEIVING SYSTEM, with a circuit arrangement between the antenna and the input of the receiving tube, comprising a coupling between the first and second tuned units, and a transformer between the second tuned unit and the detector of the receiving tube. The transformer is connected in series with the antenna circuit and the detector circuit of the receiving tube.

DISTRESS SIGNAL ALARM

(Patent No. 1,482,132. W. Y. Fanning, Assigned to March 3, 1924, issued Jan. 29, 1924. Assigned to Radio Corporation of America.) RADIO SYSTEM, for operating a signal alarm upon receipt of a certain definite call by radio. The device is particularly described in connection with a selective receiver on board ship, and is used for an alarm upon receipt of distress call.

LOOP RECEIVER

(Patent No. 1,483,385. H. K. Sandell, Assigned to November 2, 1924, issued Feb. 12, 1924. Assigned to Mills Novelty Company of Chicago.) RADIO RECEIVING SYSTEM comprising a loop antenna, the input of which is connected in the grid circuit of a detector tube and the other in the plate circuit forming a resonant circuit in parallel planes on the antenna frame and a condenser provided in one corner of the antenna.

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A RADIO SENSATION

Patent Applied For

A tuner that works without "B" bat-

d, Ingenious, Portable, Fool-proof and a hook-up that will revolutionize the art. It positively does not re-radiate and works with leads or aerials. Works loud speaker with one tube on local signals.

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RED SEAL COAL COMPANY

Coal Exchange Building, Chicago, Illinois
frame which forms a variable tuning connecting means between the loops.

ANTENNA MAST
(Patent No. 1,381,866, O. Van Brall, filed Sept. 3, 1921, issued Feb. 12, 1924. Assigned to Gesellschaft für Drahtlose Telegrafie mbH.)

ANTENNA ARRANGEMENT FOR RADIO TELEGRAPHY in which the antenna is supported by a conducting mast and an electrostatic force applied to the antenna mast substantially equal and opposite to the electrostatic force normally induced in the mast by radiation from the antenna.

LOOP AND ANTENNA RECEIVER

RADIO RECEIVING Apparatus, utilizing a combined closed loop antenna and an open antenna. The open antenna comprises a coil which is structurally separate from the turns of the loop antenna but which is wound with the turns of the loop. The loop and antenna circuits are coupled to the receiving circuit.

OSCILLATION GENERATOR
(Patent No. 1,484,899, R. Mayer, filed June 21, 1923, issued Feb. 19, 1924.)

METHOD AND ARRANGEMENT FOR PRODUCING NON-DAMPED OSCILLATIONS in which a mechanical interrupter connected to a charging circuit is provided in circuit with a separate circuit arranged to receive energy from the charging circuit and produce oscillations. The charging of the circuit proceeds until the electrostatic energy stored in said circuit is such that when oscillations begin the momentary value or strength of the oscillation current is substantially equal and opposite with respect to the value of the charging current and the circuit then oscillates under such conditions that the charging current will be substantially equal to the amplitude of the oscillation current still existing after one complete oscillation. The circuit can then be broken without sparking and after a brief period of interruption and reloading, more oscillations take place in a relatively longer period and this operation can be repeated as long as oscillations are needed.

CALL SIGNAL DEVICE
(Patent No. 1,484,405, A. Oswald, filed Jan. 12, 1920, issued Feb. 19, 1924. Assigned to Western Electric Company, Inc.)

SIGNALING SYSTEM, having means for controlling a distasteful responsive device such as a bell signal which will not respond to false signals or electrical disturbances. A slow acting indicator is provided for the receiver, which will only be actuated by the call signal. A source of opposing voltage is arranged at the receiver to cause the indicator to cease in response upon cessation of the signaling waves.

RECEIVER WITH RE-RADIATION PREVENTION CIRCUIT

RECEIVING SYSTEM, having a circuit arrangement for preventing radiation of the locally generated wave energy from the receiving antenna. The circuit arrangement includes a radio-frequency amplifier, a local oscillator and a detector in a circuit interconnected delivering the output of the amplifier and oscillator and the input of the detector which precludes radiation of energy from the local oscillator into the antenna.

C. W. RECEIVER
(No. 1,484,605, J. H. Hammond, Jr., filed Aug. 20, 1920, issued Feb. 19, 1924.)

RADIO DYNAMIC RECEIVING SYSTEM, employing heat reception in which tuning is accomplished by an arrangement whereby two series of periodical impulses having different frequencies are impressed upon the oscillating circuit. Periodic electrical heats are produced in the oscillating circuit and the frequency of the heats may be maintained constant by varying the frequency of one of the series of impulses.

ANTENNA TRANSFER SWITCH
(No. 1,485,080, E. T. Jones, filed Dec. 27, 1921, issued Feb. 19, 1924.)

SWITCH, particularly designed for transferring connection from the antenna ground system to the radio transmitter or the radio receiver. The switch has a shaft mounted on the extremity of an extended pivot shaft, each blade carried by the shaft adapted to enter contacts on either side of the pivot when the shaft switch is rotated.

ANTENNA SYSTEM FOR MULTIPLEX TRANSMISSION
(No. 1,483,111, J. Betzmann, filed Aug. 2, 1921, issued Feb. 26, 1924.)

RADIO TRANSMISSION SYSTEM, in which a plurality of high frequency generators are provided at the same station for simultaneous operation to obtain multiplex transmission. The antenna is divided into two separate sections adapted to radiate different wave-lengths. The generators

F. A. D. ANDREA, INC.
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IN KEEPING with its established policy of producing only the finest of radio apparatus, F. A. D. Andrea, Inc., announces a new Audio Frequency Transformer suitable for all circuits, and particularly adapted to the audio stages of Neutrodynes receivers.

A high average amplification over all audio frequencies is the outstanding accomplishment of this new FADA transformer. Encased in bakelite with nickeled binding posts, it looks twice its worth. Try FADA Audio Transformers in your receiver and know what uniform and distortionless amplification really means.

—and now, new variable condensers

The name FADA on a condenser means just one thing—condenser satisfaction. The new FADA condenser is made in two capacities—15-plate, capacity .0003 micro-farads, and 23-plate, .0005 micro-farads; and each the exact capacity at which it is rated. Radio frequency losses are reduced to a minimum by special rotor wiping contact brushes. A true "low-loss" condenser with an efficiency exceeding that of condensers selling at much higher prices.

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FreeBlueprints of Radio-Frequency Hook-ups

Ask your dealer for free blueprints of Duratran radio frequency hook-ups. If he has none, write to us for them and give us his name. They show how a Dubilier Duratran will convert your one-tube set into a sensitive radio-frequency receiver.

Don’t throw your one-tube regenerative set away because you can’t get the distant stations. Simply add a stage of Duratran radio-frequency amplification. And you will save the ten or fifteen dollars you would spend in building a new radio-frequency set.

The Duratran will enable you to bring in the distant stations because it amplifies on all broadcasting wave-lengths twenty times. All the stations come in with equal clarity because of this unrivaled uniform amplification.

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PATENTS

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are connected to these sections of the antenna and a connection of substantially infinite impedance provided in each of the sections to the wave lengths of the other sections for limiting induction effects there between.

CONNECTION BETWEEN OSCILLATOR AND LOAD CIRCUITS


SYSTEM OF DISTRIBUTION, in which an oscillation generator delivers current at a constant frequency, regardless of the nature of the load by reason of the fact that the load is prevented from reacting on the generator. An asymmetrically conducting repeater is placed between the output circuit of the oscillator and the load circuit permitting the transferring of alternating current to the load circuit, but preventing reaction from the load circuit upon the generator.

AUTOMATIC PRINTER RADIO SYSTEM

(No. 1,485,212. J. B. Brady, filed Dec. 28, 1921, issued Feb. 26, 1924. Assigned to the Westinghouse Electric & Manufacturing Company of Chicago.)

RADIO TRANSMITTING SYSTEM, wherein signals are automatically transmitted and received directly in pairs. The system contemplates the broadcasting of news by radio from a central transmitting station to newspaper offices where the news may be received on a machine which automatically prints the signals, eliminating the necessity of skilled operators at either end of the system.

BROADCAST STATION


RADIO BROADCASTING EQUIPMENT, for controlling the radio transmitter. The patent describes circuit arrangements between a studio and a radio transmission room whereby a person in either room may broadcast. Signal indicators are provided in each room to automatically indicate that the circuits are in suitable condition for broadcasting from that particular room.

LIST OF RADIO TRADE MARKS PUBLISHED BY PATENT OFFICE PRIOR TO REGISTRATION (The numbers given are serial numbers of pending applications)

149,274 "VACTUPHONE" for telephone for aiding hearing. Globe Phone Company, Reading, Mass. Claims use since April 12, 1921. Published December 25, 1923.


157,776 "UC" for electrical condensers. Radio Corporation of America, New York City. Claims use since about August, 1921. Published January 14, 1923.

166,971 "O-R" for complete radio sets and parts thereof. Robinson Specialty Co., Keyport, New Jersey. Claims use since on or about January 15, 1924. Published January 19, 1924.

170,674 "TSTER-NITE" for condensers. Sibley Radio Manufacturing Corp., New York, N. Y. Claims use since August 14, 1922. Published January 1, 1924.


187,856 "TELOS" for radio receiving sets. Doniger-Jones, Incorporated, New York, N. Y. Claims use since February 3, 1923. Published January 3, 1924.

164,007 "RACO" in ornamental design for antenna. E. Ross Antenna Company, Providence, R. I. Claims use since April 1, 1924. Published January 8, 1924.


181,105 "LISTENING IN—THE WORLD OVER" in ornamental design for radio headsets. Morris, Salt Lake City. Claims use since February 18, 1923. Published January 23, 1924.


186,609 "PERFECTONE" in ornamental design for radio transmitting apparatus. Perfectone Radio Corporation, New York, N. Y. Claims use since October 15, 1923. Published February 12, 1924.

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Extraordinarily superior to all other. Ideal for radio, complete electrical characteristics by N. Y. Mall and Tiffany.

Sure-Fire Line of Crystals

Extraordinary price for superior crystals. Send for Free Samples.

Camco Pure Tone Unit

for any Loud Speaker Horn or Phonograph, talks like a winner and folks boost the baby. If you have the opportunity to hear it in side-by-side comparison, you will select the Camco.

Price $8.00.

Camco Heads

Cannon Ball, $2.50. Or, $3.00. Write your dealer or write.

Simplify Your Set! Increase Your Range—Improve Your Control—Hook Up a

LEMCO EQUIPMENT

TRIPLE DUTY TUNER

Ingest on Lemco Products, if your dealer hasn’t them we will forward upon receipt of purchase price.

No. 100. Broadcast Tuner (last dial dual) $7.00
With Bakelite dial (as illustrated) $8.70
No. 340. Crystal Set (as illustrated) $7.50
No. 275. Reflector Crystal Set for loud speakers...
No. 275. Reflector Units (with 15 place condensers)...
LEE ELECTRIC & MFG. CO., Dealers and Jobbers
230 Eighth St. + San Francisco, Cal. Live Proprietors

SURE-FIRE Fixtures

READY TO HANG

(spark from manufacturers)

Complete in free including gaskets. (Just off the Press)

Iluminated, decorative circulars sent on request.

Sure-Fire Fixture Supply Co.
STATION 9, ERIE, PA.
Radio News for July, 1924


189,227 "SUTRON" in ornamental design for amplifiers and tubes. Fred W. Brown, Bethel, Ohio. Claims use since Nov. 22, 1923. Published February 19, 1924.

189,884 "DICTO GRAND" for loud speakers. Heterograph Products Corporation, New York. Claims use since March 6, 1922. Published February 19, 1924.

180,466 "AMATEUR" for radio apparatus. Apparatus Company, Cambridge, Massachusetts. Claims use since August 1, 1919. Published February 26, 1924.

180,480 "LITTLE GIANT" for radio apparatus. Metropolitan Radio Corporation, Newark, New Jersey. Claims use since August 21, 1922. Published February 26, 1924.

Timely Suggestions

(Continued from page 37)

fundamentals of radio with a better understanding. The adoption of newer circuits is always encouraging new and radiating receivers. We had best "grin and bear it," for it is a foregone conclusion that this disturbance will die a natural death.

THE AMATEUR

We now have the amateur transmitter up for consideration. As a source of interference, the amateur with his transmitting equipment has been positively proven to be the smallest offender. This fact is established by countless investigations. It is true that in various cases, the small boy with his spark coil, or even his vacuum tube transmitter, may cause some interference, but it can almost be said that the amateur as a source of interference can be passsed.

There is, however, a general misunderstanding among the broadcast listening public relative to the amateur transmitter. He is licensed by law and by law to transmit wave lengths between 150 and 220 meters, the particular band for any particular station being determined from the apparatus used and the possibility of the case avoiding interference with broadcast reception. He is distinctly forbidden to transmit between the hours of 8 p.m. and 6 a.m. on Sundays, or during the broadcasting of local church services on Sunday mornings. Although he may be strictly observing these and other provisions of his license, his transmitter is capable of causing interference of a most obnoxious sort with the broadcast receivers within a few hundred feet of him, even though he may be operating entirely within his rights. This is due to what is known as "self induction" and is as yet, non-preventable. The broadcast listener located within the shadow of an amateur transmitting station must, therefore, share the air until such development of the art cares for the situation. As a general rule, if the amateur is approached in the proper spirit, he will willingly relinquish some of his lawful operating time in an effort to co-operate with the nearby broadcast listener.

FOREIGN INTERFERENCE

We have covered the chief sources of interference from other radio services. Let us now consider foreign disturbances. The broadcast listener living near a hospital or a doctor's office where X-ray machine may be in operation, experiences an annoying source of interference, as yet not provided for in the Radio Communication Laws. However, disturbances of this nature, including the violet-ray, are entirely preventable.

(Continued on page 108)

Will You Give Me a Chance to Pay You $100 a Week?

I want to make an offer whereby you can earn from $100 to $1,000 a month, cash. You can be your own boss. You can work just as many hours a day as you please. You can start when you want to and quit when you want to. You don't need experience and you get paid in cash every day when you earn it.

These Are Facts

Does that sound too good to be true? If it does, then let me tell you what R. A. Prentiss of Winterashire, Massachusetts has accomplished. Prentiss was working in a factory. His hours were long, his pay was small. He accepted my offer. I gave him the chance I am now offering you. At this new work he has made as much as $945 in a single month. If that isn't enough, then let me tell you about J. C. McCordell of Pennsylvania. He didn't know anything about selling. In his first month's spare time he made $208 profit. Since then he has made as high as $58.20 profit in two days.

T. D. Wick is another man I want to tell you about. He was working in an office at a pay of $4.60 a day. But with this wonderful idea he has made as much as $13.60 net profit from two hours' work.

Yes, and right this very minute you are being offered the same proposition that has made these men so successful. Do you want it? Do you want to earn $40.00 a day?

A Clean High-Grade Dignified Business

Have you ever heard of Comer Coats? They are advertised in the leading magazines. Think of a single coat that can be worn all year round. A good-looking, stylish coat that's good for summer or winter—that keeps out wind, rain or snow, a coat that everybody has and needs, made of fine materials for men, women and children, and sells for less than the price of an ordinary coat.

Now, Comer Coats are not sold in stores. All our orders come through our own representatives. Within the next few months we will pay you as much or more than three hundred thousand dollars for sending us orders. And now I am offering you the chance to work as our representative in your territory and get your share of that three hundred thousand dollars. All you do is to take orders. We do the rest. We deliver. We collect and you get your money the same day you take the order. You can see how simple it is. We furnish you with a complete outfit and tell you how to get the business in your territory. We help you to get started. If you only send us your name and address in the coupon below, which you can get in an hour or so in the evening, you will make $100 a week.

Maybe You Are Worth $1,000 a Month

Well, here's your chance to find out, for this is the same proposition that enabled Fred Roberts of Ohio to make $56.00 profit in a single day's work—the same proposition that gave William Bernsheim $15.00 profit in a single long day's work.

James A. Wilson to make $654 in his spare time.

I need 500 men and women, and I need them right away. If you mail the coupon at the bottom of this ad I will show you the easiest, quickest, simplest plan for making money that you ever heard of. If you are interested in increasing your income from $100 to $1,000 a month and can devote all your time or only an hour or so a day to my proposition, write your name down below, cut out the coupon and mail it to me at once. You take no risk, and this may be the one outstanding opportunity of your life to earn more money than you ever thought possible.

Find Out Now!

Remember, it doesn't cost you a penny. You don't agree to anything, and you will have a chance without waiting—without delay and without investment—to go out and make big money in a single day. Do it. Don't wait. Mail the coupon now.

Dept. BS-82
Dayton, Ohio

Mail This Special Coupon Now!

THE COMER MFG. CO.
Dept. BS-82, Dayton, Ohio
Please send me, without expense or obligation, your special proposition, and tell me how you can get a Buick Touring Car free.

Name ____________________________
Address __________________________
(Write plainly) _____________________

GIVEN

I N addition to your base earning we offer you a Buick Touring Car without cost to you, and you can use it to help you develop your distribution business. Mail the coupon now.
Radio March:
Another Prize Winner of RADIO NEWS Broadcast contest. Here, music lovers, is a wonderful number! Is there anything so appealing as the stirring strains of a military march?

Listen In:
Featured in RADIO NEWS Broadcast contest, has caught the fancy of all America! Its rare swing hypnotizes—and its tuneful melody makes it simply irresistible.

Radio Jazz:
Irresistible fox trot. One of the prize winners of RADIO NEWS Broadcast contest! Young feet dance—old feet tap time, to the fascinating melody of this real masterpiece of jazz.

RADIO HITS!
In a recent nation-wide Musical Radio Contest three compositions were selected from the hundreds of manuscripts submitted as prize winners. These numbers have now been published in the conventional form so that Radio Music Lovers and also Music Lovers everywhere can enjoy these distinctly new hits in Popular Music.

These prize Radio Hits will be a sensation in your dance folio. They offer you the opportunity of buying three fine melodies at the same time each better than the other. It were as if you had picked the choice numbers out of hundreds of songs at your dealer.

These Radio Song and Dance hits will be exclusively Radio—To and for the Radio Public. They will be Broadcast from your local Broadcasting station. Listen in for them. Your local Radio Dealer will have copies for you. Look them over the next time you visit him or write us direct for your copies.

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The Conrad Company, Inc.
233 Fulton Street, New York City

35c
THE COPY
AT ALL RELIABLE DEALERS

Conrad
RADIO'S FOREMOST PUBLISHERS
They're All Local Stations

Lucius Pendleton, Mystic, Conn., gets Walla Walla, Wash. J. W. Sutcliffe, Bristol, R. I., gets Los Angeles. F. A. Thompson, De Kalb, Mo., gets London, Eng. They ALL come in like local stations with a

"SHEPCO" "ALL WAVE"

Non Radiating DX Coupler

Exclusive bank wound tapped primary and tapped secondary.

Build an "All Wave" Coupler into your set and bring in distant stations with volume and selectivity you never thought possible. Doubles and triples the efficiency of your tubes. Honeycomb coil performance in one compact unit. Eliminates inductance losses.

1500 Miles Minimum Guaranteed

Guaranteed wave lengths: "All Wave" Jr.; 150 to 3,000 meters in single circuit, 150 to 700 meters in non-radiating triple circuit. "All Wave" Sr., 150 to 3,000 meters. Not handicapped by short aerials.

Build your set the "SHEPCO" way and we guarantee results.

At all Dealers in Standard Radio Parts or Sent Prepaid on Receipt of Price

ABSOLUTE MONEY BACK GUARANTEE

SHEPARD-POTTER CO., Inc.

Plattsburgh, N. Y.

Irving Herman, 131 Woodlawn Ave., Albany, N. Y., after testing "SHEPCO" "All Purpose" Set, says: "Better than my two tube set. Distant stations come in as good as Schenec-
tady, only 16 miles away."

"SHEPCO" "All Purpose"

Receiving Set

Patented "SHEPCO" features make this complete one tube set a wonderfully selective distance getter. Equal to one step of audio frequency for volume.

Contains only best units, including "SHEPCO" "All Wave" Jr. Coupler, mounted on genuine Bakelite panel in finely finished mahogany cabinet.

Interchangeable Circuits

Exclusive arrangement of terminals permits quick change of hook-ups without tools. Countless combinations possible.

Ideal for novice or expert experimenters.

The parts bought separately would cost more than this assembled set. Without accessories.

Two Stage Audio Amplifier, for use with "All Purpose" or any other set.

$21

CELESTO-PANELS

HARD RUBBER is the most effective insula-
tion for radio use—and CELESTO Panels are made of the finest grade of genuine hard rubber. When you build your radio set on CELESTO Panels you are therefore building on the bedrock of certainty.

Guard against losses by making CELESTO Panels your choice! CELESTO Panels are for sale by the better dealers everywhere. CELESTO Panels are packed in individual wrappers for your protection.

Some CELESTO Distributors

Bay State Panel Co.

738 Broadway, New York

Peirce Panel & Radio Co.

38 Park Place, New York

Viking Radio Co.

16 Hudson St., New York

Hall Cycle & Supply Co.

19 Portland St., Boston

New England Electric

99 Bedford St., Boston

Noble Radio District Co.

9 S. Clinton St., Chicago

Scott Bros., Ltd.

132 St. Catherine St., Montreal

Peerless Electric Co.

247 Bleury St., Montreal

Northern Electrical Co.

121 Sherer St., Montreal

Vimy Supply Co.

567 College St., Toronto

Radio Engineers of Canada

20 Granville St., Halifax

Albert A. Bergman Co.

12 N. Ninth St., Philadelphia

Lansingburgh & Densten

300 Bl. & Radio St., Baltimore

Fulton Electric Co.

65 Pryor St., Atlantic

Sumter Radio Mfg Co.

Telephone St., Sumter, S. C.

Perry-Mason Electric Co.

Columbia, S. C.

Some Territories Are Still Open!

TRIANGLE RUBBER & SUPPLY CO. 68-74 South St. Boston, Mass.
able, and ordinarily the physician or the hospital authorities can be prevailed upon to take the necessary steps to eliminate it. Often certain parts of an X-ray machine are grounded. This results in the formation of an oscillating circuit when the machine is in operation. The ground should, therefore, be removed. Should the interference persist, the entire apparatus must be enclosed in a wire-screen cage, and the cage itself grounded. This is not an expensive procedure, but if the physician feels that the expense should not be his burden, small contributions from the suffering broadcast listeners would be accepted in good spirit.

Static, our new may as well pass over. No reliable method for practical home use has as yet been evolved for its elimination, and we can only await progress.

Let us consider next the inductive disturbances caused by leaky power lines. These manifest themselves in intermittent clicks, growls and buzzes, not unlike static, or sometimes in a low steady hum. The cause is generally a cracked insulator on a high power line, a wet treep branch touching a high potential wire, rain leaks across insulators or transformer cases. These all mean loss of money to the power company, and where such leaks are brought to their attention they will be only too glad to correct them. Often such leaks can be located by comparing the intensity of the disturbance at several receivers in the neighborhood. Look along your alley some dark, rainy night, particularly near pole transformers, and you may often see a little violet spark cavorting merrily across the wet insulation. In cold, snappy weather the leakage very often can be heard in the form of a crackling noise, audible for several feet from its source. The power company is the obvious remedy for these troubles.

MINOR CAUSES

Minor causes of undesirable noise in the receiver are found in passing trolley cars, determined by gradually increasing intensity as the car approaches, reaching maximum when it is at the point nearest the antenna system and gradually decreasing as the car passes on.

Some great causes of noise in the receiver itself are run-down B and C batteries, loose connections, particularly in the plate circuit of the tubes, and corroded contact points on the base of vacuum tubes. The remedies in each case are obvious.

Small motors in the neighborhood may also cause an annoying hum; those on shoe repair machinery, meat-grinders and coffee-grinders, being common offenders. Fortunately, most of these are silent after the close of business at five or six o'clock.

A peculiarly persistent source of interference recently came to the writer's attention. It was finally found to be caused by mercury arc rectifiers in the garage of a large dairy company employing electric trucks. The operation of the charging rectifiers during the night in charging the truck batteries produced a particularly disagreeable hum.

We started out to do our best and means for improving our apparatus, and have wound up with a discussion of various sources of interference and their elimination. Perhaps it is as well, for running down interference is a sure method of improving reception. The summer season, when radio receivers are at rest, may be less in the card, is a good time to put into practice all the little kinks and wrinkles picked up in the past winter.

Let us make our sets permanent. Dress them up. Put a neat cabinet around them: do a workmanlike job of the wiring and installation and get the whole set to see that there are no loose connections, or dirty contacts. Such time will be well repaid in the greater enjoyment derived from the receivers in the coming winter season.

(Continued from page 105)
How to Make and Use A Wave Meter
(Continued from page 47)

way, 5XV never goes above 200 meters as a transmitting wave.

The modus having been taken care of, next comes the construction of the meter. Obtain a good variable condenser, preferably one having a metal case with the rotary plates grounded to it. Also, it would be more than a good idea to have a vernier as the fine adjustment is often wanted. Fig. 1 shows how to connect the coil and condenser, and is not an apple-pie in its simplicity. Fig. 2 suggests a possible method of mounting the coil on the condenser with rigid metal strips. The coil itself is of 19 turns of No. 28 D.C. or a small shell and should be wound on a bakelite or other rigid type of form 3½ inches in diameter, and should be shellacked, varnished or Jowalized into place to avoid losing the calibration once it is obtained. Nothing about a wave-meter should be variable but the rotary plates of the condenser, and they only in their foreordained manner. It is so easy to make a good job of this that there is no excuse in doing otherwise. But, above all, do it!

OTHER COILS

Now you are wondering what you are going to do to increase the wave-length range of the thing, that you might check the higher waves as well. The process will amaze you in its simplicity—if you don’t already know it.

Assuming for convenience, that your wave-meter has been calibrated for a wave range of 100 to 300 meters with whatever coil you happen to be using, the procedure to get higher wave-layers will be exactly like this. Tune your receiver or transmitter, it doesn’t matter which, to 200 meters, which, as you notice, is just double the minimum of your wave-meter as it stands. This 200 meters will become the minimum of your new wave-meter calibration, which is to be exactly double that of the original coil; or, in the case of these illustrative figures, from 200 to 600 meters. (Please get it straight that these figures are just chosen at random to represent the scale your meter might have. It is necessary, though, to work out the system given here to have a wave and its double (150, 300; 125, 250; etc.) Now, having set your receiver or transmitter as exactly on that wave as possible, you should prepare the coil for the double range. The coil formerly mentioned was specified as having 19 turns, so this coil must cover just double the range of wavelengths and will have 40 turns of No. 28 D.C.C. wire, or possibly smaller, on a form of similar dimensions. This should be wound carefully and tightly and gives a thin coat of shellac. Make temporary connections of the wire terminals, for this coil is not yet finished. Attach the coil to your wave-meter and find out where on the scale of the condenser, the 200-meter tuning point of the receiver, or transmitter, which you had set as per the foregoing, shows up. If it shows up exactly on the same reading that indicated the 100-meter point on the smaller coil, everything is O.K. If it falls below the scale of your receiver and the coil originally meant 100 meters, then things are also O.K., as that is what the coil is expected to do. Then, all that remains to do is to remove one turn at a time until the 200 points shows up exactly where 100 stood before, and the wave meter will be calibrated for just double scale reading.

Further calibration will not be necessary for practical purposes, although it must be realized that this is not a laboratory precision method. The small coil, well suit, originally read 150 meters at 50 on the condenser scale; the large coil will then, at 150, read 300 meters, and so on, covering the range of the meter, if care has been taken. This method, of course, can be used to

Soldering Hints
for Summer Radio Fans

1. Don’t blame “static” entirely for poor summer results. Most similar sounds result from loose connections. During the summer overhaul your set. Inspect all contacts and make sure they are properly soldered—with Kester. One poor connection will jinx the whole set and kill all your and your friends’ enjoyment.

2. Those building portable vacation sets; use Kester while you’re making it. And take a supply along; for even a successful journey is a hardship on a set. With Kester you have a solder ready and easy to use. It “requires only heat.” Campfire will heat iron fine.

3. By all means heed these hints, for the value of good connections cannot be over-estimated. In most cases proper use of these hints will show surprising improvement in your D. X. reception.

Use KESTER Rosin-Core SOLDER for Radio Work

Kester Solder is ideal for Radio work. It’s safe, simple and economical. It “requires only heat” because inside the hollow wire form of solder are tiny droplets of liquid, scientifically prepared flux. This flows to the joint bit by bit as the solder is used—saving the user’s time and the material generally wasted by the old method.

For delicate Radio and electrical work Kester Rosin-Core Wire Solder is recommended. Standard diameter is about 1/32", and comes on 1, 5 and 10 lb. spools, 1 lb. coils in cartons, and 10 lb. spools in 5 lb. boxes.

For general soldering use Kester Acid-Core Wire Solder. Standard diameter is about 1/16". Packed on 1, 5 and 10 lb. spools and 1 lb. coils in cartons. Kester 5 lb. case is obtainable in standard size at most Radio, Electrical, Hardware and Auto Supply Shops.

Ask your dealer.

Manufactured by the
CHICAGO SOLDER COMPANY
4245 Wrightwood Avenue, Chicago

Direct Factory Representatives

DAVIES-ELY CO., 149 Church St., New York City; 34 Portland St., Boston, Mass.
THE FAUCETTE-HUSTON CO., Chattanooga, Tenn.
LOUIS J. ZIESEL CO., 268 Market St., San Francisco, California
KLAUS
Complete Stock of
Broadcast Receivers

Ready for shipment, KLAUS carries a complete stock of the latest and best broadcast receivers. All apparatus distributed by KLAUS is manufactured by the best manufacturers and bears the KLAUS GUARANTEE. Get our prices on amateur receiving and transmitting equipment.

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for Dealers—Do You Get It?

Expert advice regarding radio problems, latest information about new equipment, and hints on radio merchandising which helps dealers make more money, is in every issue of the KLAUS RADIO BULLETIN. If you are not on our mailing list of dealers receiving the bulletin, send us your name and also receive our trade discount lists.

KLAUS RADIO & ELECTRIC CO.
Authorized Distributors

EUREKA, ILL.

Send for New MODERN Bulletin of Hook Ups

This new bulletin, issued by the manufacturers of Monax “Push-Pull,” “Reflex,” and Standard Audio Transformers, is distinctly different.

The Modern Electric Mfg. Co.
Toledo, Ohio

New York’s Finest Radio Shop

Announces That Their LATEST CATALOGUE
(which includes a commemorative set)
is Ready for Distribution!

To every one of our dealers in the United States and Canada, we respectfully submit our first surmise of Radio Supplies.

Harold Herbert, Inc.
160 West 46th Street
New York City

Radio News for July, 1924

KLAUS

Snambergarlson

Amplification of sound waves.

Ask

Throaty tones eliminated Sound waves

Snaumburgarlson

Standards.

VAN -LE

A Single

van -le Reproducer

An entirely new and radical departure in the amplification of sound waves.

Throaty tones eliminated. Sound waves carry equally to any portion of the room.

Ask your dealer or write us.

RADIO CABINETS

"Ebco Specials" and Standard. Solid made.

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RADIO CABINETS

"Ebco Specials" and Standard. Solid made.
Federal No. 102 Special Set Is CONVERTIBLE

“Convertible” is the only word that even nearly describes the Federal No. 102 Special Receiver. It is a complete “portable” set, with dry batteries, head phones, etc., ready for immediate camp or road use—PLUS the capacity for quick and easy changing to wet battery for city and country “home” use. True to Federal standards, the No. 102 Special incorporates exceptional tone beauty, selectivity and distance range. Federal flexibility pervades throughout—the No. 102 Special will operate perfectly on any tube interchangeably.

Ask any Federal Dealer for a demonstration of the Federal No. 102 Special Set.

FEDERAL TELEPHONE AND TELEGRAPH CO.

Buffalo, N. Y.
Boston, New York, Philadelphia, Chicago, Pittsburgh,
San Francisco, Bridgeburg, Canada, London, England

Radio News for July, 1924

111

Federal

Standard RADIO Products

Complete Parts for 3 and 5 Tube

NEUTRODYNE

WITH FRED-E-SMITH or FADA LICENSED PARTS

Parts for 5-Tube Set as follows:

2x13x2-16 drilled and engraved panel with baseboard.
2 Audio Frequency Tubes.
Erla Lectro.
6 475 Ohm Condensers.
3 Filament Glass Jars.
Flexible Mica Disc.
Howard Vibrator Rheostat.
Aluminum Back.
Strip of Bakelite.
6 Binding Posts.
1 Grid Leak and Mica Condenser.
2 Phone Jacks.
2 Fitch Dials.
2 Breguet Breakers.
Mounting Feet.
20 Ft. Bus Bar Wire.

Western Electric

VT-2 Tubes

$7.45

Screws, Nuts and Miscellaneous for Set.
Construction Book and Schematic Print.

Complete Parts for 1 and 3 Tube

COCKADAY

Parts for 3-Tube Set as follows:

7x21x3-16 Drilled Panel and Baseboard 5.25
1 Fitted Dial 1.00
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2 Howard 25-Ohm Rheostats 1.50
2 Firth Dials 1.35
1 Switch Lever .75
7 Points, 2 Stops and 8 Binding Posts .50
1 Binding Post Strip .05
2 Parent 2-Circuit Jacks 1.00
2 Parent 1-Circuit Jacks .35
2标语 Beads .45
1 Grid Leak and Mica Cond. .65
20 Ft. Bus Bar Wire and Miscellaneous Screws, Nuts, etc. 2.25
Schematic Blueprint .50

1-Tube Set $11.95
3-Tube Set $27.95

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SAVAGE MEANS

Savannah, Service, Satisfaction.

When you buy radio apparatus from the Chicago Salvage Stock Store, the world’s greatest radio store, you can be certain of these three things:

1. You have saved money through the hundreds of radio bargains made possible by our enormous buying power.
2. You have been served intelligently by men who are qualified radio experts.
3. You have bought quality apparatus because we handle nothing but brand-new. merchan dise GUARANTEED to give complete satisfaction.

Complete Parts for a real 8 tube

8x9x4 1/2 Panel Engraved and Drilled.
43-Plate Webster Conden-
sor.
8 Kellogg Sockets.
1 400-Ohm Frost Poten-
tiometer.

Complete instructions for assembling and blueprints for wiring are included with each set. We give this service only on panels included with complete sets.

SUPERHETERODYNE

2 1-Mf. Condensers.
1 Tuned R. F. Transfor-
meter.
1 Oscillation Coupler.
2 Jewell No. 54 Meters.
1 Ammeter.
135 2.00
d C. Voltmeter.
10 D. C. Ammeter.
1 C Battery.

2 6-Ohm Rheostats.
5 .00028 Condensers.
1 102 Condensers.
1 .006 Condensers.
3 1-Meg. Leaks.
2 4-Inch Dials.
35 ft. Bus Bar Wire.
1 Single Jack.
6x39 Base Board.
7 Binding Posts.
3 Radio Receiver 1716

Transmitters.
2 Radio Receiver Audio-
Transmitters.

Our Price $92.50

Specialty drilled panels are included with each of the sets illustrated and described here. We give this true service only on panels included with complete sets.
The Greatest Book on RADIO ever written

only

$1

514 pages Pocket Size

40,000 ALREADY SOLD

Compiled by HARRY F. DART, E.E.
Formerly with Western Electric Co., and
U. S. Army Instructor of Radio

Technicaly edited by F. H. DOANE

New edition just off the press! The greatest book on radio ever written. Price only $1. Filled with sound, practical, tested information for every radio fan, from beginner to hard-boiled owl. Written, compiled and edited by radio experts of national reputation.

Every page tells you something useful. And there are 514 pages! More than 150 illustrations and diagrams!

You may dip into this I. C. S. Radio Handbook at random, or hunt up special information you want, or read it right through. Different types of receiving and sending hook-ups are explained; interesting experiments; definitions; codes and symbols; technical data and thousands of suggestions for getting more pleasure out of radio. Will save you from wasting money on things that won't work. 40,000 already sold.

Travel As A Radio Operator

Scores of radio operators are now needed for the summer shipping trade. We prepare you in a short time for one of these positions. Radio Mechanics also needed. Inquire about these opportunities for amateurs.

Resident and Correspondence Courses.

Y. M. C. A. RADIO INSTITUTE

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RADIO MFG. CO., Dept. 66

24-30 S. Clinton St.

Chicago, III.

Complete Parts For The

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"Nameless" R F Circuit

are now available in "Kit" Form

Kit No. 1—includes Vernier Condensers and Rheostats, 3-Circuit and Audio Transformers, Jacks, drilled and engraved panel, sub-base, etc. (everything for 5-tube set except Tubes, Cabinet and Phones)—all parts of every highest grade manufactured.

Price $63.50

Kit No. 2—essential B-T parts for 4-tube set.

Price $25.50

Diagrams furnished with above show complete diagrams and instructions for building on the now famous "Step-by-Step" plan—circulars on request.

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Canal and Harrison Sts.

Chicago, Ill.

A Pleasant Surprise Awaits the User of the A. C. H. SHARP TUNING DIALS

Why the ACH is different

3 in. DIAL

Price 3 7/8". $2.50

4 in. DIAL

Price 4 7/8". $5.00

MONEY BACK IF NOT SATISFIED

Extra Advantage of the A C H DIAL

1. Can be attached to any receiver from any maker.

2. Tuning pointer never goes out of range.

3. Movement so fine that the eye cannot detect but the ear can.

4. Automatically loads instrument so no jar can disturb tuning.

5. Dial rounded reducing the body capacity to a minimum.

6. Special dial 2 eliminations where ordinarily one.

MAIL ORDERS SENT PREPAID IN U. S. A.

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GHEGAN RADIO RELAY

These permit tubes of various impedances to be used. With Bourns' telephone harbor (A) (above) with interchangeable bases for nine sizes, any tube can be changed. With Williams' transformer (B) up to 300 words per minute have been obtained. Normal operating current is 1 1/2 to 2 Milli-Amperes. (See catalog No. 10 C.)

Ghegan Radio Relay

S1.00

American Broadcasting at 5000 Miles
(Continued from page 55)

Pa., was received. The program lasted, in all, some four and one-half hours. This is believed to be the first successful reception of a United States broadcast station in Chile or the Argentine.

The first identified and proved reception up to the present time is, however, to the Radio News station, KDKA, Pittsburgh, Pa., was received.

Other stations identified but not confirmed are WGY and KJH. All announcements from these two stations were quite intelligible. Others which are doubtful owing to difficulty in understanding the announcers are KPO, WNAQ, WAZ and WBAP. There are at least a dozen other stations from which music was heard more or less well but whose announcements were absolutely unintelligible.

This, of course, brings me to a most hearty support of the Radio News editorial of January 24, in which it was suggested that stations use an automatic transmitter to send their call letters slowly in code.

This is a magnificent idea, yet there is one further point about it that the editor did not mention, i.e. the advantage for the listeners who do not speak English. It is difficult enough to distinguish letters like “B,” “D,” “E,” “G,” “P,” “V,” and “Z” even for an English speaking person. What chance does the unfortunate listener unacquainted with the English language have to determine a call such as WHAZ when it is spoken as “doubleoy aitch aitch zee” and he knows them as “doubley achi ah theta”? whereas the code is international.

It is interesting to note that the Argentine should have set the example to the world in this respect. There is already one station in Buenos Aires, operated by Senor Benito Bonita, where the call letters TCR are sent automatically during the interval between two renditions of a news story. This is accomplished by a tube oscillating at audio frequency which is connected into the microphone circuit.

This is the second time that Buenos Aires has led the radio world, having also been the first city to broadcast a complete season of opera from the theatre.

Only indefinitely over quite a length of time and experience operating it. So I eliminate most of the time and save all that experience for a more useful purpose by gaining my knowledge from the curves which only required, with some others, a couple of hours of easy and pleasant work.

SCHEDULE OF STATION WWV
(Wave-lengths in meters in parentheses)

Eastern Standard Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Station</th>
<th>Wave-length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00-11:08 P.M.</td>
<td>WWV</td>
<td>550 (345)</td>
</tr>
<tr>
<td>11:12-11:20 P.M.</td>
<td>WWV</td>
<td>660 (340)</td>
</tr>
<tr>
<td>11:24-11:32 P.M.</td>
<td>WWV</td>
<td>750 (350)</td>
</tr>
<tr>
<td>11:36-11:44 P.M.</td>
<td>WWV</td>
<td>813 (380)</td>
</tr>
<tr>
<td>11:48-11:56 P.M.</td>
<td>WWV</td>
<td>940 (370)</td>
</tr>
<tr>
<td>12:00-12:08 P.M.</td>
<td>WWV</td>
<td>1050 (380)</td>
</tr>
<tr>
<td>12:12-12:20 A.M.</td>
<td>WWV</td>
<td>1150 (380)</td>
</tr>
<tr>
<td>12:24-12:32 A.M.</td>
<td>WWV</td>
<td>1250 (380)</td>
</tr>
</tbody>
</table>

OTHER STANDARD WAVE STATIONS

<table>
<thead>
<tr>
<th>Station</th>
<th>Wave-length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWJ</td>
<td>517</td>
</tr>
<tr>
<td>WCAP</td>
<td>509</td>
</tr>
<tr>
<td>WRF</td>
<td>449</td>
</tr>
<tr>
<td>WSB</td>
<td>390</td>
</tr>
<tr>
<td>KDKA</td>
<td>326</td>
</tr>
</tbody>
</table>

Radio News

USE "RAGECO" TOOLS TO BUILD BETTER RADIO SETS

AR201. Combination Plier, Wire Cutter, Wire former and Wrench. Drop forged, slender but exceptionally strong. 6 inches long. Price $ .75

AR202. A R 7000, Bench Vise. This vise can be clamped to any table. Can be used for filing, sawing, drilling, soldering etc. Very strong jaws. 1 ½ inch face. Black japanned and finished. Price $ .60

AR600. Scriber and Marker. Made of finest steel with hardened and tempered points, 8 in. long. Handle of tempered steel. Price $ .15

AR400. Hol low Handle Tool Set. Genuine Coco Bota handle, containing the following tools; five inches long, made of tempered steel: 1.00

Chisel, Reamer, Small Screw Driver, File, Bridawl, Saw, Large Screw Driver, Scratching AWL.

AR100. Drop forged Wrench. Consists of 1 inch long. Price $ .40


AR203. Set of Three Screw-Drivers. Specially selected for the radio constructor. Stainless blades with flat sides of wood, nickel plated ferrules. Lengths 4 ½, 5 ½ and 7 ½ inches. Price $ .75

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Complete Radio Soldering Outfit

This outfit is absolutely complete. Nothing more to buy—only necessary tubes needed—no upkeep of any kind. The simplest radio outfit made—you build it yourself. So simple that anyone can construct it. Complete instruction booklet with every outfit.

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DUCK'S

5 Tube Super Tuned Radio Receiver $120.00

Extreme simplicity of operation, wonderful selectivity, workmanship and highest quality instruments characterize this receiver. Backed by 16 years of continuous radio experience. Sold on money back guarantee. 4 Tube "Bear-Cat" Tuned Radio Receiver $95.00. Same workmanship and quality of instruments as in our 5 tube set.

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The William B. Duck Co., Dept 3 711-12 Adams St., Toledo, Ohio
Tuned Radio Frequency
in Most Compact Form

That summer portable set you’re planning—is it a reflex? Surely, it has some form of tuned r.f. for use on small antenna or loop. Well, here’s a tunable transformer that requires scarcely one-fourth the usual space.

The superiori of the BALLANTINE variable over fixed trans-
formers is shown by the curve. Consider this uniformly high amplifi-
cation throughout the broadcast range—in comparison with compact form. Then build with BALLANTINES.

Keep your set “on its toes” all summer with the BALLANTINE VARIOTRANSFORMER.

Boonton Rubber Mfg. Co.
Pioneers in Bakelite Molding
624 Fanny Road, Boonton, N. J.

Radio News for July, 1924

Distortionless Broadcast Reception
(Continued from page 59)

With our receiving set we can, with small additions, usually correct this at a loss of some volume which is not of great importance, because its necessity is imaginary more than real.

Try putting condensers across the resistances R-5 or R-6—anything you have for an experiment.

A. 0.01 mfd. condenser will not have such action.

B. 0.1 mfd. condenser will considerably cut down the high tone.

C. 1 mfd. condenser will muffle very greatly—giving orchestra a very distant sound.

Now try some inductance coils; and here is an inductance coil which will be generally useful. A standard transformer iron core is used, as shown in Fig. 4. Four sections, each of 600 turns of say, No. 38 D.S.C. wire are wound and connected in series, arrangement being made for taps.

The total inductance is about 100 Henries. Half the number of turns will be .5. Quarter the number of turns will be .25.

So that if you wind this with four sections and take off taps, you have a useful choke coil.

Excuse this spasm of local pride from an English resident.

Returning to the receiving set employed in these essays, the primary and secondary of the radio frequency transformer are closely coupled, being wound into two, half of each on the rotor and half of each on the stator of a variometer. Movement of the rotor, therefore, alters the inductance of the primary and the secondary, thus accurately tuning the transformer. Furthermore, when one tunes the antenna circuit (by the ordinary variable condenser) and the transformer (by the rotor) to the same, or approximately the same, wave-length there is considerable regeneration created by inter-element tube capacity. From this it can be gathered that there are but two tuning elements, the con-
denser and the rotor of the variometer.

It is easy to tell when they are in tune by the fact that when the tube oscillates a carrier wave can readily be picked up. By proper adjustment zero beat point is reached and the speech frequency is passed minus the carrier wave. This set is just as easy to operate as the ordinary regenerative set with the same number of controls.

RICHARD B. OWEN
PATENT LAWYER
2 Owen Building, Washington, D. C,
2274 A Washworth Bldg., N. Y., City

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for
STANDARD JACKS
Complete in Cards and 20 Four Head Sets
THE BARRELEW ELECTRIC MFG. CO.
MIDDLETOWN, OHIO, C. A. NO. 663 PRICE 150

RADIO NEWS
If you put .6 henry across R-5 or R-6, the lower tones will be greatly reduced and speech becomes high pitched and super-in-telligible (of course, weaker, due to the loss of amplification).

2.5 henries will be much less effective, but the four taps will enable you to vary the ratio of high and low notes considerably. Perhaps a simpler way to make this easily variable is to stick a .6 henry and vary a series resistance in series with it. This is illustrated in Fig. 5.

The advantage of doing this operation on a tube plate resistance is that you can calculate exactly what you are doing.

In general, a condenser, shunted across the resistance does what is shown in Fig. 7 to our broadcast signals. It will be seen that the degree of amplification decreases on the higher notes.

Fig. 8 shows the effect of a shunt inductance, or the alternative arrangement of Fig. 6. The higher the note, the greater the amplification. In other words, the condenser weakens the higher notes, while the inductance accentuates them. The addition of resistance in series with the inductance holds down its action.

If we did the two operations together, then we would produce a curve, which would only exaggerate our head-plate curve, but if we put a condenser in series with the inductance and make the minimum impedance frequency the same point as the maximum response of the phone, we can see that a partial correction of our telephone curve is possible.

A good combination for most head-phones is shown in Fig. 9; and this combination is connected across one of the resistances in the resistance amplifier (e.g., R, in Fig. 2).

You will quickly find approximately the best position for the condenser, which should be adjusted first with R at zero, as there is a peculiar place where speech changes over from muffle to normal through an intermediate.

\[ \text{Ideal Conditions} \]

\[ \text{Ideal Conditions} \]

Figs. 6 and 7 herewith show the effects of a shunt condenser and a shunted inductance in the phone circuit.

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Radio News for July, 1924

No Matter What Your Vocation

Whether Professional Man
Business Man or Daily Worker

A Thorough Training In

CHEMISTRY

Will Help You To Get Ahead

I have a theory today is to know Chemistry! Every line of business, every branch of our伟大的工业 world requires a rudimentary knowledge of Chemistry in some form. You may not realize it, but your own proficiency in whatever work you are doing would be increased by a knowledge of Chemistry. In many lines such knowledge is absolutely essential. It is always a guarantee of promotion and more money.

The keen competition that exists in every commercial activity today requires that a man know all there is to know about his vocation. If you have something to sell no matter what, Chemistry enters into its makeup. The salesmen who know the chemical composition of their product can talk about it more intelligently than the one who lacks this information, and his sales are proportionately larger. In the holding trades Chemistry is of prime importance. The tailor, electrician or tailor who knows something about Chemistry can do better work and command more money than the one who does not. Through Chemistry a shop-keeper learns how to attract the most trade, and even in clerical positions one can capitalize his chemical skill.

Chemistry should be as much a part of your mental equipment as the ability to calculate or to write correct English. The world is a paying thousands for ideas for actual labor. The high paid man can show how to turn out a little better product at a lower cost. This is what Chemistry will give you the ideas that will save money for your shop or yourself in the very beginning of your business. It is not remarkable about this; it is going on every day. If you have not heard of it before, it is because the general public has been slow to recognize the tremendous value of chemical training. People have been content to leave Chemistry in the hands of a few trained chemists who could not possibly develop the subject to anywhere near its greatest extent.

We are one of the few great American chemical institutes. Our headquarters at the West has been in existence since 1878 and is now the largest and most complete laboratory in the United States. We are one of the oldest and most respected in the United States. Our students are taking the subject now for what it is in their line of business.

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MODEL III

A handsome set for auto trips, camps, summer cottages or any room in any home at any time of year.

A FIRST class regenerative receiving set that can be picked up and taken along anywhere. Completely self-contained—batteries and all. Operates on any aerial—or even with a wire fence for an antenna. Stations are always found at the same dial setting—wherever you are and regardless of the kind of aerial used.

Licensed under Armstrong Patent No. 1,113,149

Write for special circular.

THE COLIN B. KENNEDY CO.
Saint Louis, Missouri

The Royalty of Radio

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Prices Smashed! Quality Not Sacrificed

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We ask for no deposit. Simply send name and address and style wanted. Battery will be shipped the day we receive your order.

We guarantee the battery value. If in doubt as to our examination on arrival. Our guarantee accompanies each battery. We allow 50¢ discount for cash with order. You cannot lose! Act quickly. Send your order today—NOW.

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Chicago, Ill.

PIONEER RADIO CORPORATION
101 Pioneer Avenue, Galesburg, Ill.
Variameters — — Variacouplers

position which is the correct one. Without resistance, this may overdo the effect and give you speech which is full of "S" sounds, and low tones, but no middle ones. It all depends on your head-phones—how much resistance you must have to put in, to get it quite right. Voice and piano are the best to listen to, particularly if you know the man’s voice. After you have done all you can with the combination, you may still be a bit dissatisfied; then across R4, if you are already using a combination across R4, try the condenser "tone lowerer" or the inductance "tone raiser." You have available:

1. A tone-lowerer.
2. A tone-raiser.
3. A middle-weaker (the Fig. 9 combination without the resistance R).
4. And if you so desire, you can arrange two middle-weaker circuits.

And now one more point. You probably know what blasting means—I will define it as when, either in the transmitter or the receiver, the tubes are carried beyond their straight line limits, i.e., the representative point travels around the head in the characteristic turn. Harmonics are produced by these blasts.

Now on these receivers which I have shown, with "head-phone strength" of signals at the end, you are not likely to blast, so the blasts will be transmitted ones, because those produced by frequencies around 1,000 are much more noticeable on these corrected circuits than on any ordinary circuit. The reason is obvious—the 1,000 oke is exaggerated in ordinary reception and any false harmonic passes unnoticed, but with the correct circuit the higher harmonic is given out in its right proportion. However, there is a counterbalancing advantage. Blasting by bass note is exaggerated by the ordinary head-phones, but minimized by the corrected circuit.

Those who do these experiments thoroughly will be very well satisfied, however critical they may be; voice, pianos and orchestras will be very much better than ever heard before.

Just one last word to those who have little time and patience. I will give a circuit, showing a crude way of doing the previous tests, though not so satisfying, but quite effective, if your receiver is fairly distortionless to start with.

The condenser C3 and the iron core inductance (choke) Z may, if desired, be connected across the head-phones terminals of the set. The condenser C4 (0.05 mfd. or 0.08 mfd.) depends on the phones, the choke Z (4 henries) and the resistances all enable different combinations of tone lowerers, tone-raisers, etc., to be obtained for all sorts of interesting experiments may be carried out by making different combinations of inductances, condensers, etc.

A Reflex Receiver With Neutrodyne Control

(Continued from page 49)

plate and grid elements of the vacuum tube. Actually, more critical observation will show in many cases, that the real cause of self-oscillation is to be sought in casual magnetic and electrostatic couplings aside from the extremely small tube coupling. It is not generally realized that a tuned plate coil will, at times, produce violent oscillations when brought within a foot of the grid circuit in one position and will stop those oscillations immediately when the coupling is reversed. The casual couplings in a small compact receiver, such as the one to be described, is almost always sufficient to be noted about self-oscillation, even when using tubes having a low inter-element capacity. It will be no
stages, panel details as to the style and trying unusually a "B" condenser across the wiring. It is a condenser across the ling and leak by the radio frequency choke it involves. This latter method shows a great immunity from howling and the effects of neighboring alternating current mains and so on. This also permits the use of a small condenser in the grid circuit to by-pass the radio frequency currents and stop the audio frequency impulses, giving most excellent signal strength with most any make of audio frequency transformer having the proper step-up ratio and adequate primary winding.

The aerial tuning is of an extremely selective type. Almost incredible selectivity results, together with a curious indifference as to aerial characteristics, so that both for wave-length and regeneration control, the effect of suddenly throwing on and off a good-sized outdoor aerial is hardly noticeable insofar as the wave-length adjustment is concerned. This makes possible the desirable feature of condenser scales graduated directly in wave-length (for stations), in place of meaningless or arbitrary degrees. In the outfit described here, both the grid and plate condenser scales are marked directly in stations. If searching is necessary, it is to be carried out with the single tube alone, the reflex action being eliminated temporarily by throwing over the switch shown so that the grid is connected by way of the customary grid-leak to the positive "A" battery instead of through the audio frequency transformer and the radio frequency choke. The margin between steady oscillation and howling is too small in a reflex receiver for comfortable searching when connected in the reflex condition.

Of other details, the placing of the phone condenser across the "B" battery as well is merely a matter of convenience in actual wiring. It is well to have a 1-1/2" blocking condenser across the "B" battery, as this proves of considerable advantage when the "B" battery is run down.

**CONSTRUCTIONAL DETAILS**

As each constructor has his own ideas as to the style and size of the cabinet, in which he finally mounts his set, only the panel details are given here, together with a bare frame for use in the experimental stages, to hold the inductances and transformer in their respective positions. The panel has been kept as small as possible (eight inches square) with the result that the components appear to be somewhat crowded. Provided the matter of magnetic coupling, previously discussed, is borne in mind, trying out other distributions of the parts,...

---

**Radio News for July, 1924**

**Bristol Single Control Radio Receiver**

Complicated combinations are eliminated when tuning in with Bristol Single Control Radio Receiver--every station is on the one dial. It gives the joys of radio with technicalities left out.

The well known Grimes Inverse Duplex System (non radiating) is utilized in this Receiving Set. Because of the reflex, only four tubes are required to give power equivalent to six. The price, without accessories, $190.00.

You forget the radio equipment when listening thru the Audiophone Loud Speaker. The tone is full, clear and pleasing. It gives a true reproduction of the original. Made in three models--Senior $30.00, Junior $22.50, and Baby $12.50.

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Cico Automatic Plugs—allow you to connect and disconnect cord tips automatically and instantly by pressure of your fingers. Mostingenious single plug in use. Bakelite body. Fits all jacks. Takes all tips, 60c.

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THE OMNIGRAPH Automatic Transmitter will teach you both the Wireless and Morse Codes—right in your own home—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or to Sounder, it will send you unlimited messages, at any speed from 5 to 30 words a minute.

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If you own a Radio Phone set and don’t know the code—you are missing most of the fun

Radio News for July, 1924

and that grid connections are kept as short as possible, the whole may be rearranged at will for greater convenience.

The two tuning variable condensers have a capacity of .0005 or .0006 mfd. each. The neutrodyne condenser must have a very low minimum capacity and should have a vernier adjustment. A small three-plate vernier will suit the purpose and a variable condenser will solve the usual difficulty in constructing the receiver is offered by the second small fixed condenser in the neutrodyne circuit. The minimum capacity of ordinary condenser is considerably too high for use in this position, and the capacity must be effectively diminished, at the same time retaining the desirable feature. This is easily accomplished by introducing in series with the variable condenser a small fixed condenser. The value of this depends on the extent of capacitance of present-day condensers, the particular tube used and so on; therefore, it cannot be stated dogmatically. In the author’s receiver it had to be made of the order of .0005 mfd. and consisted of three pieces of tinfoil overlapping each other for about 1/4 square inch and separated by rather thick bits of microfard. The whole was mounted in a commercial condenser shell; this is entirely a matter to be decided by careful experiment and adjustment.

The goal at which to aim after completing the remainder of the receiver and finishing all wiring is to have vibration oscillations manifest with the neutrodyne variable condenser at zero and cessation of oscillation before the complete capacity of the condenser is used, or the whole wave-length band. This may not be possible with a critically tuned plate circuit in the single tube circuit alone, but should be achievable by the set working in the reflex condition. Too large a neutralizing condenser will bring in a fresh set of lows. Of course, all this adjustment is made without aerial connections. The neutralizing condensers of extremely low minimum capacity are on the market as a result of the growing popularity of the Neutrodyne, and a type is suitable for use in the present set. In this case, a small single adjustable condenser was used, the total capacity required being only a few micro-microfarads.

The primary or aerial coil consists of 10 turns of double No. 20 D.C.C. wire (i.e., two wires laid side by side and connected in parallel) wound on an insulating tube of 1/4 inches in diameter. This is to avoid using a few feet of a much larger gauge wire, which is difficult to work with. This forms the semi-aerial primary coil. It is then continued, auto transformer fashion for 60 turns more, single layer, and in the same direction, making, in all, 70 effective turns across the tuning condenser. The plate coil consists of 50 turns No. 22 D.C.C. wire, two-layer bank wound, on a tube of the same type as that used in the previous coil. A second coil, identical to the plate coil, is placed closely, both not connected electrically with the first. This serves as the Neutrodyne coil. These are connected as shown so that the inner end of each— the middle of the coil—is near "ground" electrically. As the two coils are wound in the same direction they will oppose each other's effect on the grid as desired.

The radio frequency choke may be any coil of fairly low distribution capacity, such as a No. 200 or 300 honeycomb or duo-lateral coil. The tube actually employed was the low capacity Myers type. It has an extraordinarily generous filament emission for its filament current. The tube is very convenient for its setting into its special clips on the front of the panel. As the tube is extremely robust it was not thought worth while to place it behind the panel. The circuit works successfully with any hard vacuum tube.

For the crystal detector, careful experiments showed that the extra sensitivity of galena or other types does not justify their use in this circuit where stability must be the first consideration, so the simple and reli-
Bill backed out of the office still trying to get a flicker of interest in Mr. Pulsifer's eye.

That very afternoon, as Mr. Pulsifer was passing through the accounting room, he glanced up and saw Bill, who was staring at something in his hand, with a look that suggested deep concentration. He paused to look at Bill's face, and then turned away without saying anything. Bill, who was obviously deep in thought, continued looking at the object in his hand, until finally he turned to his companion and said, "I think I've got it..."

Lucy's Radio Present

(Continued from page 32)

able carbonundum was used. It does not require any applied potential when used in this position. With a firm contact made with a springy piece of turned iron (ordinary roofing tin) the fragment of carbonundum being set in a cup with Wood's metal in the usual way, absolutely no attention or further adjustment is needed. Of course, any attempt to use a crystal detector is suitable for use in this position, but the carbonundum is preferable.

In the experimental instrument shown, the panel is simply mounted in front of a frame eight inches square and nearly six inches deep, a narrow shelf on which the tuning devices are supported. The audio frequency transformer, radio frequency choke and grid bias coil find accommodation below this shelf. The base board is of 3/8-inch soft wood 7 3/4 inches by nearly 6 inches. The two sides are of 3 1/2-inch hard wood, each of approximately the same size. The shelf is 3 1/2 inches wide and there are two strips of wood across the top to support the panel and to keep the arrangement secure. The tiny adjustable neutralizing condenser, in series with the vernier, is placed in an accessible position just inside the top.

Any sort of an aerial may be used, probably a loop also, though that has not as yet been tried. Of course, the higher the aerial the better, but the operation of this receiver is entirely independent of the type of aerial, within limits.

ACTUAL PERFORMANCE

The receiver illustrated gave, with the equipment described, and with a good outdoor aerial, the loudest signals that the writer has ever succeeded in getting with a single tube on any instrument. The pleasant voice of one of the speakers at station ZLO London was clearly audible all over the house with the help of a good loud speaker. By placing the speaker at the open window and turning the aerial so that the signals were audible at the far end of a large garden. On a favorable night a great many stations came in at comfortable strength on the phones in turn, and with remarkable selectivity.

In the Summertime—You Need the Best Receiver You Can Build

Build a Super Heterodyne Receiver that will bring in whatever you want in the Summertime, when adverse atmospheric conditions demand the best instrument you can get. (And remember, when next Winter's big radio programs come in, you will have the best possible receiver to get them.)

**Branson Kit No. R-99** contains 1 Oscillator Coupler, complete with mounting brackets, bank wound inductance and adjustable coupling coil with locking device; 1 Intermediate Frequency Transformers, very sharply tuned and completely shielded; 1 Special Transfer Coupler for first, or last stage of Intermediate Frequency; and 1 Specially Designed Antenna Coupler so that either loop or antenna can be used. This apparatus has been specially designed for Super Heterodyne, Ultradyne and similar circuits. It has been rigorously tested and proved better than any heretofore obtainable.

“Super Heterodyne Construction”

Our Book (one dollar) explains operation of Super Heterodyne receivers, gives circuit diagram and full size panel layout. It contains complete directions for building a Super Heterodyne Receiver that will be extremely selective, free from interference and, in fact, better than any other radio receiving method. The amateur, with this book, can easily build a superior receiving instrument.

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**INVENTORS PROTECT YOUR IDEAS**

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention and we will give our opinion as to its patentable nature.

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Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenters Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.
way, How can we ever get married, if we don't save?"

Bill usually caved in at once, before Lucy's shining black eyes, and her prancing lips, but this time he was firm. "Lucy, it may mean our fortune! I can't make enough to marry on. in that one-tube bank, if I work there a hundred years. I've got to make a chance, if I want to get anywhere. Aren't you willing to gamble with me?"

"It sounds so foolish, dear, to spend all your money for a radio set, when we might be paying something down on a little home of our own."

Bill kissed away Lucy's frown, and tried to laugh away her fears. "You just wait, dear. I'll show you. You'll see that there's life in this old town yet."

He finished the set on a Saturday night. The following morning, dressed in his oldest clothes, he started with it, up into the Furnace Hills.

In the square, Bill passed Mr. Pulsifer, who stared at the neat mahogany box, and asked what it was.

"My new radio, Bill replied. "Want to see it?"

"Heavens, no!" Mr. Pulsifer exclaimed. "What are you doing with it?"

"Just some experimenting, sir. This is the scheme I tried to interest you with. Here's the idea," and Bill opened the cover of his mysterious box, disclosing an array of tubes and wire.

"No! Take it away, Shadwell!" Mr. Pulsifer exclaimed, pushing down the open cover.

"That radio will be the ruin of you, now mark my words."

"Or the making of us all," Bill laughed.

"If I ever catch you even thinking of radio in my bank—" Mr. Pulsifer snapped, but Bill had turned, and was on his way.

Bill's actions on the hills were variously reported. Some said they saw him walking about the hilltops, holding over his head a square of wire, like a umbrella with any cloth cover; others saw him crouching near an outcrop of rock, with his head-phones at his ears, apparently listening to a concert. One fellow followed him, and asked him point blank what he was about; but Bill only offered him the phones, and asked if he wanted to hear Pittsburgh. Everyone agreed that something was the matter with Bill, and that radio was making him simply daft.

That evening, Bill took the flivver and drove over the long, rough road around one end of the Furnace Hills, to Lucy's home. Mr. Hopkins opened the door, nodding coldly to him, and saying, suspiciously the mahogany radio box that Bill carried. Mr. Hopkins was a practical man; a farmer, who prided himself on his head-bound common sense. What could Bill's flightiness was particularly obnoxious to him, and his first question was about the stories that had come to him, of Bill's strange doings that morning, on Furnace Hills.

Bill explained that he was making some experiments with radio.

Mr. Hopkins flushed with anger, and burst out, "To think of buying an expensive radio set when you ought to be saving for your wedding! It's preposterous! I can't let Lucy marry an improvident, flighty fellow like you!"

Bill protested, "But Mr. Hopkins, this radio may make our fortunes! Let me tell you about it—"

"Foolishness! I don't want to hear about a toy for children. If you want to make money, you ought to spend your time on the bank's business and forget all this nonsense."

Bill finally got Lucy into the back parlor, where he set up the radio, and adjusted the head phones over her ears. "Now I'll tune in Pittsburgh," he told her, turning the two black dials to figures that were recorded in a little book. "How's that?"

Lucy shook her head. "I don't hear anything but a buzz."

Bill turned the dials, slightly. "That better?"
mmary and secondary circuits were altered. A trial showed the signals could be brought in by leaving the secondary at its normal setting and increasing the capacity added to the primary to something considerably beyond the ordinary amount required. But when this was done the set was very unstable, oscillating on the slightest provocation.

The cause was not discovered for some minutes, but a little thought showed that something must have happened to either aerial or ground. A walk outside showed that the ground lead was no longer attached to the terminal of its insulated tube. A recent acquired puppy had found it a splendid thing to play with and his teeth marks on the insulation of the wire showed that he had pulled and pulled until it came adrift.

A note was made for future reference: If the set is unstable and if more capacity is required in the aerial tuning condenser, examine the ground lead.

TRANSFORMER TROUBLE

Here is another rather strange case. I received from a correspondent some time ago a long letter— it contained six pages—in which he told me that a perfectly untraceable fault had occurred in his 5-tube set (R. F. transformer coupled, a detector and two audio). Here is his account of the mishap:

On the Thursday evening the set had been working perfectly. When switched on the next evening it refused to function. The greatest feats of tuning could extract something more from it than occasional faint signals from a high-powered spark station, no great distance away. Eventually the set was taken to pieces, most of the connections being resoldered since a friend had suggested that the trouble might be due to the oxidation of the solder. The fault was at length traced to a burnt-out primary winding in the first audio frequency transformer. This trouble again could have been diagnosed without much loss of time had a milliammeter been available. The reduced output reading would have shown that since all was well with the batteries something must be amiss with one of the plate circuits. Had the instrument been applied to each in turn it would have registered nothing or very nearly so when the audio frequency tube was reached.

In this case one could first suspect the transformer and would test it for continuity with the help of the milliammeter thus coming to the solution of the problem.

A USEFUL SYSTEM

I have always found it most useful with multi-tube sets to provide an easy means of cutting out either the radio frequency or audio frequency tubes or both at will. In this way one can make extremely rapid tests without the necessity of using any instruments. One of the simplest systems of doing this is as follows—Place a group of four terminals upon the panel in the neighborhood of the first R.F. tubes. To two of them are connected (A, C, Fig. 1) the leads from the secondary coil of the tuner. The other two (B, D) are connected to the slider of the potentiometer and to the grid of the first tube. Normally these terminals are connected as shown in the Fig. (A-C, B-D) by swing hooks cut from sheet brass. A similar arrangement is made between the last R.F. tube and the detector, one pair of terminals (E, F) taking the leads from the transformer's primary while the others (G, H) are connected to those from the grid of the detector and "A" battery negative. These are again normally connected (E-G and F-H) by brass hooks. A third group of four terminals comes between the detector and the first audio frequency tube. Of these
K and L are connected respectively to "B" battery and plate while M and N receive the leads from the transformer's primary. When the full set is in use they are connected as shown, K-M, L-N. Should a breakdown occur it is best to see first of all whether the detector is functioning properly. To do this disconnect A from C, B from D, E from G, F from H, K from M, and L from N, to do which is a matter of a moment. Now place the telephone across K-L, connecting A-G, and B-H by means of wire leads. The set thus becomes temporarily a single-tube one. Should everything be satisfactory when it is worked thus AC, BD, EG and FH are re-connected so as to test the K.F. side. This having been done one can rejoin KM and LN so as to see whether the fault if not so far discovered is in the audio amplifier. If preferred double pole single throw switches may, of course, be used instead of the four terminals, but I much prefer the latter since switches are apt to add to the capacity of the circuits and one cannot feel perfectly sure that their contacts are beyond reproach. The use of double pole double-throw switches to effect the changes in one simple movement is not recommended, since to employ them means using long leads, which is not good.

Radio to the Rescue

(Continued from page 15)

The higher the frequency used, the more efficient the radiation and the less loss in signal strength when carrying across gaps due to metallic breaks in the conductors. On the other hand, the attenuation of the high frequencies when traveling along metallic conductors or directly through the earth is very much greater than for the longer wavelengths. The optimum frequency to be used in each particular case depends upon the electrical constants of the underground metallic conductors, distances to be covered and type of communication desired.

TEST PROCEDURE

In practically all the numerous tests the general procedure has been to take a receiving set of varying degrees of sensitivity underground, and listen to broadcast music or speech from high-power broadcast stations. It is pointed out, however, that these tests should be interpreted with due reference to the conditions underlying them, such as general position of each test made in regard to surface and sheet waters, geological, mineralogical, and topographical conditions, and the presence of metallic conductors.

Sterling No. 45 Voltmeter

An All Around Good Pocket Meter

This meter does everything but "talk" and in its own language tells you all about the amperage of "A" battery cells and the voltage of "B" Batteries both dry and storage.

Price $1.25

It is reliable, accurate and has the "right resistance" so as to protect your batteries from atmospheric drain under tests.

THE STERLING MFG. COMPANY
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POWER from Electric Light Socket

A PERMANENT POWER PLANT FOR YOUR RADIO OPERATES YOUR SET FROM YOUR LAMP SOCKET OR FROM YOUR LIGHTING PLANT

NO MORE BUYING OF BATTERIES

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Gas. Freshman Co., Inc.
Gas Condenser for your Aerial

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"Clearspeakers" need no protection, neither will they spoil. A "Clearspeaker" is the complete efficient and economical aerial conveyor which eliminates all unsightly wiring, lightning arresters, etc., and precludes the possibility of dangerous grounding of power line. It also stops "canary bird" re-radiation from nearby oscillating sets interfering.

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THE STERLING MFG. COMPANY
2350 Prospect Ave.
CLEVELAND, OHIO
Reception is usually from broadcast stations of a power very much greater than can possibly be considered practical for underground sending sets. Yet even one way communication, from the high powered stations on the surface to a receiving set in the mine, is of value if entombed miners are equipped with a dependable receiving set. They should be informed of the progress of the rescue parties and in some cases directed to different parts of the mine where rescue parties may reach them.

Transmission from within the mine to the outside is regarded as of greatest importance, and up to the present tests being made by the Bureau of Mines, no effective method of accomplishing this result had been found. If a reliable means of voice transmission can be placed at the disposal of entombed men, they can inform rescue parties of their exact location, the number of men entombed, their names and designation number, the number of men living, and the condition of air supply.

It would be admirable if adequate provision could be made for placing mine communication rescue sets underground and have such sets ready for use in cases of emergency. However, the capital invested in idle equipment while waiting for something to happen, offers a serious obstacle. A direct operating use for the apparatus must be found in the everyday operation of a mine. Because of the fact that radio can operate effectively and efficiently when the radiated energy can be guided by metallic conductors the use of a simple low-power portable line-radio set is possible.

It has been found that practically any conductor which is insulated sufficiently for the economic transmission of power or lighting current, will act efficiently as a carrier for the high frequencies. The conductor must be in a double capacity—the high frequency current being superimposed upon the low frequency or direct current power without any interference to the power supply. The only slight interference to television circuits is noted by superimposing the high frequency carrier on the telephone line. Short breaks in the carriers such as opening of switches are not directly noticeable in operation, and severe disasters which might cause one or more breaks will not completely destroy the conductors.

I Want To Know
(Continued from page 63)

MAGNAVOX AS MICROPHONE
(1927) Mr. Henry Smith, N. Plainfield, N. J., asks:
Q 1. Would a properly insulated lightning protection system be of benefit in case the aerial was struck by lightning?
A 1. The value of the lightning protection system is in keeping the air surrounding the aerial, from becoming too highly charged.
Q 2. Could a Magnavox M.J. loud speaker be used as the microphone for a transmitting set?
A 2. It would probably work quite well in such an arrangement. It would be advisable to remove horn, and arrange a small mouth piece instead.

CORRECT TUBE BATTERY
(1928) Mr. Lloyd W. Crosse, Seward, N. Y., asks:
Q 1. Do loud speakers having large horns require more input energy than do those having small horns?
A 1. No.
Q 2. Are Leacham wet batteries suitable for WD-11 tubes?
A 2. These batteries are quite efficient. They may be used in place of the usual dry cell or storage battery.
Q 3. Which would be more economical, a single dry cell or a 2-volt storage battery unit, for lighting a WD-11 tube?
A 3. If facilities for charging a storage battery are available, it will probably be better to use that type of battery. Otherwise it would be more economical to use a single dry cell.

TUBE ADAPTERS
(1929) Mr. A. J. Thieler, Detroit, Mich., asks:

Quiet Simplicity

If you are looking for a set that howls and screams on the least provocation and that gets distant stations only occasionally, you will not be interested in the new UNIDYNE.

If, on the other hand, you are looking for the utmost in clear entertainment, you will want this new set. It is not a trick circuit and does not require an expert radio engineer to get results. It operates at all times with quiet operation. There are but two controls. Yet the new UNIDYNE is so selective that distant stations can be brought in by the novice while local stations are broadcasting. The new UNIDYNE is light and portable and makes an ideal summer set. Get a demonstration of this new four tube set from your dealer today. If he has not stocked the UNIDYNE we will see that you are taken care of if you will write us and mention your dealer's name.

United Mfg. & Dist. Co.
9705 Cottage Grove Ave., Chicago, Illinois

$95.00

UNIDYNE

CATALOG

SUPER HETERODYNE - NEUTRODYNE!

NEW Complete Dual Set Kits Including Qualitator Coupler, American Coupler, 2-Tube, R.F. Final, and Special Transfer Coupler, Combination Radiator, Polyphase Transformer, 25-60 and 60-125, All Adjustable, 2000 to 10,000, All Antennae, $25.00, Special Polyphase, 30-110, Qualitator Coupler, $7.00. Gen. R.F. Final, Polyphase Unit, 5 tube, $6.00; 6 tube, $6.06; Kit, $5.00.

TUBES REPAIRED

WD-11, WD-12, UV-201A, UV-199

$2.50 and others for

Quick service. All tubes repaired by us guaranteed to work as good as new. Send your dead tubes. All you pay is $2.50 plus postage to postman.

THOMAS BROWN CO.
511-519 ORANGE ST., NEWARK, N. J.
O. 1. What are the objections to using adapters with the various tubes? A. 1. If the tubes are being used as radio frequency amplifiers, they will not function as well when adapters are used as when the correct sockets are used. This is due to the fact that the capacity between the elements of the tubes is increased. This causes a reduction in the amount of amplification. In addition to this fault, four more contacts are added to the set at every tube, often causing tube failure.

LOUD SPEAKER EXTENSION CORD

(986) Mr. Clifford Frohberg, Ridgeway, Pa., writes:

Q. 1. Would a wave-trap serve to tune out strong interfering stations?
A. 1. A properly designed two coil wave trap would probably greatly reduce, if not eliminate, the signals from interfering stations.

Q. 2. Can a 20-foot extension cord be used on a loud speaker, permitting the location of the volume? Using an extension cord will reduce the volume slightly, but results will be entirely satisfactory.

THE EAGLE

Balanced Neutrodyne "King Of The Air"

Write for Literature

Dealers, Jobbers, Write

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20 Boyden Place, Newark, N. J.

Double Your Distance

The Variolites—the prettiest variable grid attenuators that will get you the extra grid resistance for your tubes. All re- sistance values from 1 to 10 megohms. May be used with any fixed resistor. Price 75c. Neutled $1.00 at all jobbers.

ELECTRAD, INC.

428 Broadway, Dept. H, New York
Radio News for July, 1924

at various voltages, when used to supply current to transmitting sets.

A. 1. We are showing these circuits. By using a standard filter, consisting of two choke coils and the condensers, practically pure D.C. will be had. The choke coils may be of one-half henry inductance. The condensers will have to be about 25 millices. An electronic circuit will fill the requirements. When connected in parallel, "S" tubes require condensers "K" of about 1,000 ohms.

Q. 2. What is the life of the "B" tube?
A. Approximately 5,000 hours.

There is still another class of broadcast station that experiences no difficulty in securing artists—those operated by educational institutions. One in the Middle West says: "We have a Department of Music, which enrolls over 900 pupils. So you see, we, perhaps, have less difficulty than the average station in securing talent. All talent performing at this station is local."

A Pennsylvania college writes: "So far, we have not had any trouble in securing artists. We have college talent among the college. The fellows get a kick when they receive cards from a distance. I only hope that it will wear off."

Although the preponderance of evidence points to the error of the oft-repeated statement that broadcast artists are dissatisfied and threatening to quit, there is also evidence that the public is not supporting and encouraging them as they deserve. It appears sometimes in statements like this one from a New England department store station: "We firmly believe that the radio audience does not, in general, appreciate the fact that they are receiving what might be termed 'free entertainment.' We believe they should send more applause cards to the station and not wait for them to come in and watch this entertaining. The average person, the writer believes, leaves it to the other listeners to send in the applause. Many radio fans believe if they write to a station once, that it is sufficient. From the station's point of view, it is desirable to have as many applause cards as possible on any one concert, as the artists who perform for that concert see only the cards that come in for that particular concert. Of course, they are more willing to come again if there is a good response. At times we have found it hard to secure competent artists, and one of them believes they should receive pay, and it has been our policy to depend on the advertising accruing to the artist from his appearance to remunerate him for his work. The average artist in the studio seems to like the idea of broadcasting as a novelty. If they receive a number of applause cards they are willing to come again."

A station in western New York reports: "While our station receives a goodly number of letters and cards in response to its broadcasting, we are still very anxious to receive more, as all such letters and cards are eventually turned over to the artists mentioned in them. This, as you know, forms their applause and is greatly appreciated by them."

ARTISTS DISGUSTED

Real trouble develops in the southern city, from which this letter came. "It is difficult to secure competent artists for more than one or two performances. They are usually disgusted after one appearance upon not receiving cards and letters to assure them that they get over. There are apparently two schools of artists. One class desiring to broadcast, as they believe the publicity gained is helpful, and a second class who believe that it is injurious."

From the same city in Canada in which one station reports enthusiastically that there is no trouble in securing the best of talent, there comes a letter that should make the broadcasters—the listeners—in do a little

BROADCASTERS, BROAD-CATCHERS AND BROAD-CASHERS

(Continued from page 126)

What one Editor said of the Freshman Crystal

"The new Freshman 'double adjustable' crystal detector 'played hot,' even when the set was deliberately shaken, stood up to 130 volts on the plate circuit without noise or distorting, wrote the editor of New York Evening World's Radio Magazine in an article of March 19th, 1924. And in a review it is continued: 'This detector meets every requirement of the reflex circuit. It is enclosed and provided with two adjustable knobs, one varying the position of the crystals and the other regulating the brush current adjustment. 'The crystal is a pure natural one and is embedded in an insulated housing, thus eliminating short circuits and consequent loud noises resulting from the cat whisker touching the metal housing. 'The Freshman detector can be panel mounted with only a small knob showing. All around it is the best crystal detector, unit found for reflex work.'

No more searching for the sensitive spot—merely turn the knob as you would a dial!

FRESHMAN

Double-Adjustable Crystal Detector

For base or panel use, complete with reflex crystal
Freshman Super Crystal With Non-Metallic Housing 50c

1. Turns the crystal without disturbing the contact pressure!
2. Non-metallic housing prevents short-circuiting noises during adjustment!
3. Mounts neatly on the panel with only small knob showing!
4. Crystal cannot be jarred from sensitive spot!
5. Adjustable at panel, also at base, with tension adjustment additional!
6. Super-Crystal withstands high voltages!
7. Loop-end contact permits complete coverage of crystal with gliding movement!
8. Rigid construction!

FRESHMAN Radio Condenser Products

106 Seventh Avenue, New York City

GREAT ACCESSORIES

For Radio Lovers Who Want the Best

Chas. Freshman Co. Inc.

GREAT EFFICIENCY

The Adams Perfected Radio Jack

Pure silver contacts; topmost bronze springs—electrostatic insulated. Ins construction is scientifically correct—its new features make it a decided improvement over the ordinary jack. You'll say no, too.

Write for full information
D. E. B. L. R. G. Get our attractive combination offer
THE ADAMS RADIO MFG. CO., 1042 West Van Buren Street Chicago, Ill.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.

Experiment Publishing Co., 33 Park Place, N. Y.
job of introspection. The writer is the broadcast manager of an industrial concern that gives a high-class entertainment program once a week and, on Sundays, broadcasts services from the various churches of the city. He says: "We experience no trouble in obtaining letters from listeners in the United States, although we believe the appliance card is hardly satisfactory to the artists. The card itself is printed with one object only, that of obtaining a verification from the broadcast station that so and so did get such and such a station on a certain date. Naturally the artists like to see mention made of themselves and their numbers, and while we pay some artists, many come voluntarily and we like to show that their efforts are appreciated. Listeners in Canada, for instance, are not good correspondents, although, as announced, I personally make every effort to get them to write. We receive thousands of letters, 80 per cent coming from the States and we believe that 50 per cent of these are applause cards, which cards are more or less selfish in their makeup. They give no real appreciation, but ask for a reply which, of course, is a verification of their reception. The radio listener must always remember that artists are human and broadcast stations are to be considered artists too, and while appreciation from listeners costs much less than the broadcast, it means a great deal when it comes along in the mail bag."

DO BROADCAST LISTENERS REALLY LISTEN?

The director of broadcasting in a far western college expresses himself as follows: "I am glad" he said "to learn that you are writing an article which will wake up the broadcast listeners. The average listener will applaud until his hands are sore at a vaudeville show, but will never write a letter to the broadcast station. We have, so far, been able to get our lecturers and musicians to donate their services, but some of them frequently say that they believe they are wasting their time. Tell the listeners when they write to mention names of artists and lecturers and to indicate that they have really listened to the performance." (Ouch!) "Many of our people believe that entirely too large a percentage of the listeners are simply playing radio golf and getting no benefit from the programs."

In the Southwest, a director finds: "There is a slightly increasing inclination of artists after their classes have started, to become radio enthusiasts, and phone a few times, to become more cheerful if asked to continue to render their services. We induce them, of course, to circulate through the publicity which we are able to get for them in the newspapers with which we are co-operating. Except for the publicity which newspapers give them, they do not see much nourishment in broadcasting."

A New Jersey station, quoted above as saying that artists were satisfied to appear for the publicity value they saw in broadcasting adds: "It would not be hard to secure talent of a satisfactory calibre, if it were not so hard to secure written communications from the listeners-in. It has been the writer's experience that the public is quite liberal in sending cards to distant stations but absolutely forget the nearby stations, relying upon meeting them personally, or telephoning in during the course of a business conversation."

The situation in a section of the South where neither broadcast stations nor artists are too numerous is commented on by the following Arkansas letter:

"We are very much in favor of your suggested article points out to the broadcast listeners their folly in not applauding the performers."

"In our experience, this is very trying. Our average range is 500 miles, having been reported in 41 states, Canada, Mexico, and Cuba, but alas and alack, the artists who perform once, say nevermore."
"We wish to suggest in the beginning that reporting broadcast listeners cut out sending in a printed card. We wish to thank you for your excellent program of ... Sig," and so on, that card doesn't mean much to a broadcast station. Let each person reporting give his opinion regarding the clearness, strength, and the numbers appreciated most. "BCL's, if they are so termed, simply take good broadcasting as a matter of course. It was there when they bought their sets, it will probably stay there—so they think.

Broadcast stations are invariably operated at a great expense. If it becomes necessary for them to pay for their talent in addition, man of the best ones will close. The artist doesn't enjoy broadcasting to an unresponsive audience. Reports of personal interest will help in the securing of programs from artists again.

"It only costs a cent or two to drop the station a letter, or better still a telegram. It is only through these expressions from the list that the stations can tell what they are doing.

"Primarily, stations are maintained for the good they can do. However, we are to know what is wanted most unless the listeners write freely and often. Give us your suggestions and constructive criticism of your own. Tell the artists that you appreciate their efforts, tell the broadcast station that is under a staggering operating cost that all is not wasted, but is received. Put the personal touch to it."

CHICAGOANS GET RESULTS

Chicago has probably established the world's championship for piling in replies. It has not, however, relied so much upon the attitude of the broadcast audience as upon their rapidity. Early in the game the Chicago broadcasters learned the little trick of holding the attention of the public by prize schemes. Every listener in knows before now that if he tunes in a Chicago station he is likely to hear of some prize offer and that if he does, he may be able to shoot in a reply by wire and secure some little gift such as a 7-tube receiver or a $3,000 automobile. It is no reflection on Chicago's programs, which are excelled by none in the United States, to say that much radio applause secured by such methods is about as sincere as soil for a politician's flattery of a widow who has a legacy to invest. When, however, it is discovered—as it was by the Chicago broadcasters—that so many representatives of the invisible audience have been taught appreciation of grand opera that 3,120 of them correctly identified the voice of a prima donna who sang incognito, announced as "Madame X," it is safe to assume that genuine appreciation is richly deserved and actual present.

De Forest Given Control of Regenerative Patents

(Continued from page 41)

A little over a year after the original conception, Dr. DeForest came to New York in an attempt to sell the telephone amplifier idea, and met Dr. John Stone, Consulting Engineer for the American Telephone and Telegraph Co. He showed Dr. Stone a sketch of the oscillator at the time. Subsequently this was to play a very important part in the patent litigation.

Another point stressed very strongly by Mr. Armstrong's attorney was that Dr. DeForest did not have a particularly clear idea of the use of the circuit. This notion possibly grew because no direct application of it was made until after the beginning of the legal squabble herein detailed. In the final court which handed down the decision, the fact that Dr. DeForest explained, in detail, his circuit to Dr. Stone upon the occasion of their visit in 1913, was taken to mean

Here's what they cost you delivered

Super-Dutho
3500 m. hours
24 v $9
45 v $17
90 v $32

B Type Dutho
2500 m. hours
24 v $5
45 v $9
90 v $17

Duthoid

Chemical Rectifier
$1.80
charges up to 90 volts at one time
keep your battery in perfect condition for clear reception

DURKEE-THOMAS PRODUCTS COMPANY
1228 FOLSOM STREET
SAN FRANCISCO

DEALERS: Dutho "B" Batteries sell on sight. Write for our dealer proposition

Stop Spoiling Your Rugs and Floors

Use TUFGLAS

Battery Trays

Made of Acid Proofing Glass of great mechanical strength. Sent post paid, direct to any part of United States. Add 50c extra if sent of Missouri.

RUSSELL B. CRESSMAN
200 FIFTH AVENUE, NEW YORK
Two New Additions!

How to Locate Troubles In Your Radio Set
By Thomas W. Benson

The simplified method of going after the trouble in your Radio Set. A handy book that takes every detail from the Aerial to the Ground and explains what might go wrong and how troubles can be remedied at home.

It is one of the best Radio Books for instant reference that is published today being written so that all the general troubles of the Radio Set can be quickly understood by the reader.

You can obtain a copy today at your local dealer or if he cannot supply you, write direct and we will send you a copy. Price 25c prepaid.

How to Build Practical Radio Receiving Sets
By W. G. Many

The Publishers of the Experimenter's Library, realizing an increasing demand, have published a complete book on some of the most effective standard circuits in use today.

The author has compiled in this book only those hookups that have been tested by time in the Radio Field, hookups that have and will always give complete satisfaction to the man who builds them correctly.

The book is made up in a standard, handy pocket size and is profusely illustrated with sketches and wiring diagrams that can be followed easily and quickly.

You can obtain your copy at any reliable radio dealer or write to us direct. Price 25c prepaid.

AT ALL RELIABLE RADIO DEALERS

OTHER BOOKS IN THIS LIBRARY

Tips for the Radio Amateur Constructor
Radio Questions Answered
Radio Frequency Amplification
How to Tune Your Radio Set

One Hundred Radio Hook-ups
All About Radio Parts
History and Operation of Vacuum Tubes
The Neutrodyne

The E. I. Company :: Conrad Co. Inc., Selling Agents
233 Fulton Street, New York City
Established!

The MOZART Baby GRAND

No piece of radio apparatus was ever more firmly or more quickly established. From every point of the compass, entirely unsolicited appreciations, testifying to the merit of our product, continue to pour in.

From telegram (April 8th), and letters later:

"Reproducers and units received. Dealers and public enthused. You can expect big results from California. The real thing was greater than our anticipation."

("Also) One party stated his wife was so pleased with your Reproducer that if he could not get another one, he would not take $50.00 for it. It is a pleasure to sell merchandise that brings comments like these.

(Signed) W. L. WUDE CO., 16 California St., San Francisco, Calif.

PRICES . . . F. O. B. Factory

Reproducer complete with (gold plated) unit and polarity-indicating cord $12.00

Unit only with polarity-indicating cord, gold plated .................. 5.00

Unit only with polarity-indicating cord, nickel plated .................. 4.00

Shipping weight of reproducer, 7 lbs. (approx.).

Dimensions—Diameter of bell, 12". Length and height over all, 12 1/2".

TERMS: C. W. O. or C. O. D. when accompanied by small deposit. Orders shipped direct from the factory or through your Dealer.

THE MOZART GRAND CO.
Manufacturers of Fine Instruments
NEWARK, N. J.
U. S. A.

Learn Electricity in only 3 months in the Great Shops of Coyne

Make $3,000 to $10,000 a Year!

Coyne is a recognized school. We get your pupils into the Chicago Electrical World. Don't let others advertise. Coyne has been in existence 27 years and is the oldest and largest Electric School in the world!

Coyne Educational School
1290-1294 W. Harrison St.
Dept. 59-48 Chicago, Ill.

Free Catalog

Free!

Jones "COLOR CAP" Connectors

Follow the Colors—You Can't Get Wrong

Radio fans, this is just what you have long been looking for. An insulated plug connector protecting batteries as well as tubes.

Remove your old binding posts and put in color caps—7 colors 25c each.

Manufactured by HOWARD B. JONES
612 S. CANAL STREET
CHICAGO, ILL.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.

Experiment Publishing Co., 13 Park Place, N. Y. C.
**ADVERTISING TESTIMONY!**

**EXHIBIT B**

**NATIONAL RADIO INSTITUTE**

1445 Pennsylvania Avenue, N.W., Washington, D.C.

**Exhibit B**

*March 29, 1924.*

Mr. Huston D. Gripen, Asst. Advertising Mgr.

Radio News,

55 Park Place,

New York City.

Dear Mr. Gripen:

I am sure you will be glad to know that in checking actual results received from our advertisements, we find Radio News is doing a larger business than any other radio publication.

There you have the real reason why we have not missed a single issue of your magazine for quite a number of years.

You can probably account for the extraordinary growth of your publication better than I can, but if I were asked my reason, I would say that it is due to the policy of the publishers to supply exactly the news that the B. C. L. and the Radio Amateur wants.

Gordially yours,

ELD P.

Director.

---

**Another Example of What Radio News Means to Advertisers**

[This is Exhibit B of a complete series to appear each month in Radio News — Watch for Exhibit C]

---

**THOMPSON NEUTRODYNE and SPEAKER**

$150

Retaining 14 years' experience by an organization devoted to wireless and radio apparatus.

R. L. THOMPSON MANUFACTURING CO.,

150 Nassau St., New York

Factory: Jersey City, N.J.

---

**Hudson-Ross**

Largest exclusive Radio Jobbers in middle West.

Write for discounts.

123 W. Madison St. Chicago

---

**DuoSpiral Hetro Loop**

Special construction for Super Hetro Receivers. If your dealer hasn't it, write us.

RADIO UNITS, INC.

1301 First Ave., Maywood, Ill.

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Radio News for July, 1924

The changes in the note made by these changes in the constants of the circuit were transcribed to the laboratory records. The placement of the coils, and the two coils which are open, shown in the sketch, are simply the result of the fact that telephone apparatus was used in the experiment. Coils 4 and 5 were both standard telephone transformers. The Stone sketch shows that Dr. DeForest thoroughly understood just what was making the circuit oscillate.

The results of this decision are impossible to state at this writing. In view of the fact, however, that there are 17 companies manufacturing regenerative receivers under the erstwhile Armstrong patents and that there are some large firms engaged on a large scale in the manufacture of radio transmitters using vacuum tubes, it is almost obvious that on-lookers will be furnished with a grand show at someone's expense in the near future.

Mr. Samuel E. Darby, Jr., a member of the firm of Darby and Darby, Dr. DeForest's attorneys, states that it will probably be some time before the whole matter can be straightened out on account of the ramifications extending through half a dozen industries and twice as many companies. He says, however, that the question of patent ownership on the oscillating action and the regeneration feed-back circuit is settled once and for all, and that further litigation on the subject is almost impossible. Mr. Darby has carried the legal battle from its inception to the present victory for Dr. DeForest.

**The Importance of the Trivial**

(Continued from page 29)

ally, not by end-thrust. It is amazing to know small a depth really rapid oscillations sink into a wire. They sink further into copper than into iron, for an iron wire has to be magnetized by the interior currents, and this causes so much delay that high frequency currents keep wholly to a microscopic skin on the wire. In fact, and they count the resistance of this thin skin is very high, so that if ever a choke is required to kill oscillations by high resistance, an iron wire is suitable.

For receiving purposes we want the oscillations alive, and not killed. Hence a specially efficient aerial can be made of a great number of insulated stranded wires, even as thin as No. 40.

These remarks apply especially to the lead-in wires. The aerial itself acts partly as a capacity, and for capacity these considerations do not apply; they only apply to resistance for high frequency currents. Similarly, all high frequency transformers and the different leads employed should, if perfection is aimed at, be made of fine stranded wire.

**The Beginners' Radio Set**

(Continued from page 30)

 tersink the holes for the heads of the machine screws or else drill half way through the panel with a 3/16-inch drill. After punching a hole in each one of the toothlugs place them on the base, pass the two machine screws through the holes provided and through the lugs. Place a washer on top of each lug and tighten a nut over each washer. A second nut is then placed on each machine screw for the purpose of making connections.

**THE CRYSTAL DETECTOR**

In order to render audible the waves which are received by your aerial, it is necessary to have some sort of a rectifying device. As
Be a Master of the Air

Pleasant Home Study

During the next few months you can, by devoting a few hours each week in a pleasant home study, qualify yourself to get into the biggest paying field of all time. My practical, understandable course of instruction will enable you to be a Master of the Air. Every problem in radio becomes an open book to you. Be a Master of the Air and you will be a master of your future.

$3,000 to $10,000 a Year as Radio Expert

15,000 ships, hundreds and hundreds of Radio stations, with new ones springing up every day, are all keenly competing for the services of the radio-trained man. So everyone is the call for the radio expert that the man who knows his business in this field is in a position to command the size of his salary. On land or sea, in Government or private service, there are boundless time paying opportunities for the man who understands radio problems and how to solve them.

Radio

where Knowledge is Power and Money is Cash

I show you how to construct, install, operate, repair and sell radio equipment. Instead of being a spectator in this big game with big stakes, you become an active player. I qualify you to handle every branch of radio. There is nothing theoretical or practical that is not presented to you in complete, concise form. You are standing face to face with the greatest money-making chance ever offered to you. Will you turn your back on it or will you decide now, once and for all, that you will get your share of the millions being spent in amateur radio training? Right in your own neighborhood you can make easy profits. Neighbors and friends will gladly give orders for sets and pay for advice on radio problems.

FREE 1000 Mile Radio Outfit

This set, when completed, has a range of over a thousand miles. I give it free with my course. I give you practical training by having you work on this set. The knowledge you gain is not mere book knowledge, but is usable, practical experience. When you have finished my course, you can charge a price which will more than pay the cost of the course.

Quick Practical Training

Everything in my course is clearly and simply stated so that you can easily understand every point I bring up. No previous experience or education is required. I give you fundamental and practical training in every angle of radio. There is no time to lose. Now is the best time to pass the other fellow by. Mail coupon today and get full information on my course, also details of the thousand mile set that I give free.

A. G. MOHAUPT, Radio Engineer

RADIO ASSOCIATION OF AMERICA

4513 Ravenswood Ave., Dept. 157, Chicago, Ill.

Mail Coupon

A. G. MOHAUPT, B. S. E. E.
Head of the Radio Association
Government Receiving Sets and Transmitters.

Send me Book Free "Radio Facts" and information on how I can get a FREE 1000 mile Radio Set.

Address

City

State

Radio News for July, 1924

with the condenser, the theory of the operation of this device will be explained later. It will only be necessary for you to know the construction of it at the present time in order to get your set working. The assembly of the detector is shown in Figs. 6A, 6B and 6C. First a base is necessary of the same size as the condenser base and drilled in the same manner. For this instrument it will also be necessary to secure a piece of fine wire. About No. 28 or No. 30 bare copper wire will be very satisfactory and it need only be about 3 inches long. Also, from an old tin can, cut a piece of the shape shown in Fig. 6D. This is to hold the crystal at the binding post. The sides of this crystal holder are to be bent up so as to form a three-cornered cup. It is then mounted in the machine screw, a washer and two nuts, as shown in Fig. 6B and on the opposite end of the base, a piece of wood and two nuts are placed. One end of the cat whisker or fine bare wire is clamped between the bottom nut and the washer. This completes the assembly of the crystal detector with the exception of the crystal. The latter may be purchased at any radio supply store and practically any one of the good types will give results. Galena is among the best. Always buy a tested crystal guaranteed by the company who puts it out, as you will then be assured of results.

The next step is to assemble the entire set on a baseboard. Have the board large enough so that you can lay it on and place in it the various parts of the apparatus. In order to make the connections on the board, you will need a good screwdriver for experimental work. We will purchase an ordinary drawing board such as it is used by draftsmen. This is provided with cleats on the rear of it so that it cannot warp and its several advantages are obvious. These drawing boards can be obtained in various sizes to suit the purpose at hand. By means of these cleats and the screwdriver, you can get the connections on the board and the board can be assembled on a panel and placed in the cabinet, changes at once become quite simple and the board can be easily shifted around and around and around. This is provided with cleats on the rear of it so that it cannot warp and its several advantages are obvious. These drawing boards can be obtained in various sizes to suit the purpose at hand. By means of these cleats and the screwdriver, you can get the connections on the board and the board can be easily shifted around and around and around. When the set has been assembled on a panel and placed in the cabinet, changes at once become quite simple and the board can be easily shifted around and around and around.

Wiring the Set

When you purchase your parts, get a half pound of bell wire or an annunciator wire. This is No. 20. It is covered with several layers of cotton insulating impregnated with wax. It gives excellent results for use in experimental hook-ups, as it is quite flexible and at the same time well insulated. The writer always uses this kind of wire for experimental purposes. After mounting your instruments on the board, as illustrated in Fig. 7, run the connections as shown. Connect the aeral to one binding post of the tuning coil and the ground to the other. Also connect these posts to the condenser and detector respectively, connecting the condenser and detector together as illustrated in Fig. 8. Connect the terminals of the phones or receivers across the condenser, as shown, and your hook-up will be completed. The schematic lay-out of the circuit is shown in Fig. 9.

In regard to the phones, we would advise that you buy a good pair in the first place, as they will give results for years and it will not be necessary to replace them. If possible, obtain a pair of the type utilizing coaxial diaphragms and operating on the
Silvertron Tubes
$3.75 Prepaid

Type 20A operates as either Detector or Amplifier.
Type Detector 1 1/2 volt. $10.00
Type Amplifier 1 1/2 volt. $10.00

Amplex Imp. License No, 1,113,149

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TERLEE

"INS-UR-TUBES" Prevent Accidental Tube Burnouts

Here is a device that gives you complete protection against accidental tube burnouts. No device attached to the set as switch or binding post can improve against short circuit within the set or improve against "A" and "B" battery terminals. No mistake about this. An "Ins-ur-tube" connected to the respective positive "B" battery terminal in use fully protects your tubes against all these. No storage age battery tubes and peanut tubes. Price $1.00 each. Avoid substitutes.

Improved VARIO COUPLERS

Special winding and improved insulating cut down that customary lost energy. "Terlee's" will give you range and selectivity even under the most trying summer atmospheric conditions. They're built for panel or table installation. Type "S" for crystal and audion circuits, $6.00. Type "R" for regenerative and non-regenerative circuits using radio frequency amplification, $7.50.

For best results, demand Terlee Products. If your dealer can't supply you, send your order direct to us.


"Makers of Radio's Best for Better Radio Results"

Radio News for July, 1924
covered with this type of set, but you cannot expect to do this every day. Sometimes you may hear stations up to a distance of 100 miles with this type of set, but this would be under very good conditions. Ordinarily you will not be able to receive over much more than 25 to 35 miles. However, the reproduction will be wonderfully clear and the signals fairly loud. Much of the volume will depend upon your crystal and it is advisable to have two or three of them at hand so that the best one can be obtained. It at any time your signals from a certain station seem to be weaker, rub the point of the cat whisker with a piece of fine sandpaper so as to clean it off. Also, never handle your crystal with bare hands, but use a pair of gloves or small tweezers. In case your crystal becomes dusty or dirty, wash it with alcohol and allow it to dry before using again. This will often restore signal strength.

CALIBRATING THE SET

In order to do things in a business-like manner, it is desirable to calibrate your receiving set so that at any time you desire you can tune in any certain station within your range, provided that it is transmitting. To do this it is necessary to make a chart of the stations which have been received. For this reason the figures on the front of the panel, as illustrated in Fig. 4B, are necessary. You should also mark the switches with the terms units and tens as shown. While in reality, the taps take every nine turns are not “tens” taps, still this is the common term used and serves the purpose.

A chart is to be made up as shown in Fig. 9. Space is provided for the call letters of the station received, as well as for the wave-length and the two switch settings. The method of making up this chart is as follows: When you get your set operating and a station tuned in, manipulate the switches until the volume is the greatest that you can obtain. Then in its proper column record the number to which the indicator on the tens switch is pointing and do the same with the units switch. At the same time record the wave-length of the station received. As each new station is heard, list it on the chart. If you call sheets have quite a lengthy list and it will help you considerably in tuning for new stations. For instance, suppose you have a list such as that shown in Fig. 9; also suppose that there is a station within your receiving range operating on 470 meters, or thereabouts. By referring to the chart you need for receiving from these stations operating on 455 and 492 meters, you can get an approximate setting for your switches on which you may expect to be able to receive from the new station. With a chart like this, it should be comparatively easy to tune in a station, such as is shown in Fig. 9, that is broadcasting at a point where your antenna is approximately 600 miles away. By using the chart in this manner, you will soon be able to tune in any desired station at any desired wave-length with a high degree of accuracy.

In next month's article, we will deal with increasing the efficiency of this set, showing how to make it more selective. In the meantime, make this set in the described manner and learn to tune the coil and adjust the detector. Then you will be ready to study the action of the set and change the construction of it somewhat.

<table>
<thead>
<tr>
<th>STATION CHART</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Letters</td>
</tr>
<tr>
<td>WEA5 ........... 8</td>
</tr>
<tr>
<td>WOR ............. 7</td>
</tr>
<tr>
<td>WZ .............. 6</td>
</tr>
<tr>
<td>WHN ............. 4</td>
</tr>
<tr>
<td>KDKR .......... 3</td>
</tr>
</tbody>
</table>

The above chart is an example only. You should mark down all the stations you can receive in the same manner. It will save you a lot of trouble.

Radio Wherever You Go
Vacation—Golf—Shooting—Touring

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53 Park Place
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Publishers of RADIO NEWS, SCIENCE and INVENTION,
PRACTICAL ELECTRICS and MOTOR CAMPER & TOURIST
common signaling wave-length, however, weds them all into one unit. After a signal has been received, by turning the receiving apparatus, which has a range wide enough to include any station that may be doing business, this is done by others. A decided advantage. The system, in its operating features, is the radio replica of the train dispatcher's circuit where any station can be tuned into others, and where any station can talk to any other as well as to the dispatcher.

Some idea of the apparatus requisite for this scheme of signaling may be had from the photographs shown. A uniform panel arrangement has been developed with the idea that the various units might be used interchangeably in meeting the requirements of different types of installations.

Thus, the particular apparatus shown is seen to take up very little more room than the ordinary radio receiving set. Of course, as the number of stations on any system is increased and if the system is intercommunicative so that each station may signal and speak with any other station of the system, then the amount of apparatus required will become greater and greater.

**Calls Heard**

(Continued from page 46)

FAHNESTOCK ELECTRIC

FAHNESTOCK PRODUCTS Co., Inc., Dept. 7-A, North Chicago, Ill.

ELGIN SUPER-REINERTZ

The set which copied

20 LONDON, ENGLAND

ONETUBE

Tuska Receivers give unending thrills, from far and near.

ELGIN RADIO SUPPLY CO.

137
314 Fifth Street

Elgin, Ill.

RING UP YOUR FRIEND BY RADIO

(Continued from page 43)

(9KF), 9BJQ, 9CBR, 9CKW, (9CDL), 9CVM, 9CLC, 9CFL, 9CTW, 9CUM, 9CVD, 9CWF, 9CWG, 9CWB, 9CWH, 9CWZ, (9CCP), (9CCD), Others too numerous to mention.

(3BWJ), (2CNH), (2CPA), (1CIT), (1CPI), TARP, 9DYY. (SALK), 1AAO. 1BTA, 1CDM, 2OL, 2NV, 7HG, the amount increased and if the system arrangement the photographs rung without disturbing others, and where stations are more or less concerned in what is being done by others, this is a decided advantage. The system, in its operating features, is the radio replica of the train dispatcher's circuit where any station can be tuned into others, and where any station can talk to any other as well as to the dispatcher.

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**Tests and listed as standard by Underwriters' Laboratories**

The Fansteel Balkite battery charger has no vibrators, bulbs or moving parts and is entirely noiseless.

The Fansteel Balkite Battery Charger for Radio "A" Batteries [6 volt] is an entirely new type of rectifier, based on the use of Fansteel Balkite, a new and rare metal developed for this purpose. It is entirely noiseless. It cannot deteriorate through use or disuse. It has nothing to replace, adjust, or get out of order. It cannot discharge or short circuit the battery, and requires no attention other than an occasional filling with distilled water. It will not overcharge, and cannot fail to operate when connected to the battery and line current. It is unaffected by temperature or fluctuations in line current. It is simple, efficient, and indestructible except through abuse. The charger may be used while the radio set is in operation. Without added attachments it may also be used to charge "B" storage batteries.

The Fansteel Balkite Battery Charger will charge the ordinary 6 volt radio "A" or automobile storage battery at 3 amperes, from 110-120 4C, 50 cycle current. It comes complete and ready for use. Get it from your dealer, or use the coupon below.

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**FANSTEEL BALKITE**

is a new metal developed for this charger. It acts as a valve, allowing current to flow into the battery but not out of it. Is the most efficient charger valve made, is practically indestructible, and does away with daily, delicate vibrators and bulb heads.

The Gould Storage Battery Company is also marketing, under the Fansteel Balkite Patents, a complete battery and recharging unit known as the Gould Unipower, into which this charger, under the name, "The Fansteel Balkite Rectifier," has been incorporated.

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for July, 1924

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6ACM, 6BHR, 6CM, 6BRZ, 6VQV, 6AGS,
6OL, 6BYV, 2CXL, 8BDA, 8OH, 9CM, 9BOP.
Would appreciate QSLs from any of the
above mentioned stations.

7AT, BASIN, WYOMING
C.W.—185Z, (187CW), 2FF, 1JRZ, 189BQ, (both
OSA), 4JF, (VY OSA often), 61AM, 5AGA,
5AU, 5AJL, 5AMN, 5ACU, (5RP), 15B, 5HA,
5OD, 5QO, 5QJ, 6AVL, (6ADT), 6AFA, 6AOW,
6BBW, 6LM, 6BRI, 6MW, 6CMU, 6JKW,
6VM, 6BRZ, 6IYK, 6BRL, 6ZB, 7ABY, 7ADS,
7AE, (7AFF), 7AQO, 7AIHS, 7AJL, TALK, 7AKZ, 7AXD, 7XRC, 7FQ,
7FS, 7GJ, 7GY, (7GW), 7JU, 7KV, (7LJ),
7QO, 7QO, 7RL, 7WJ, 7WJ, 7QY, 7TQ,
7WZ, 8AT, 8BBY, 8BCL, 8BHF, 8CLO, 8E1,
8CMY, 8CW, 8DAR, 8DHF, 8H1D, 8H1O,
8HS, 8VM, 8VY, 8VL, 9AIW, 9AIW, 9BOP.

Canadian: 3RG, 4CO, 4EO, 4IV.
1CW, 11T, 1CN, 5QJ, (5EL), 8GA, 9AIM,
9AGP, 9HW, 9H2Z, 9H2Z, 9I9Z, 9I9Z,
9I9Z, 9JF3J, 9JF3J, 9JF3J, 9JF3J, 9JF3J.
Dailie CW: 5AGN, (7CO), 9AGL, 9AMP,
9BHI, 9BYV, 9H1T, 9VX, 9VX, 9VX,
9VX, 9VX, 9VX, 9VX, 9VX, 9VX.
Fone: 1AKE, 5OFH, 6FM, 7CO, 7IOG, 9AZG,
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A new automatic and self-regulating de-
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to 57 miles on a gallon of gasoline. It re-
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PRACTICAL ELECTRICS is edited by H. Gernsback, Editor of RADIO NEWS, SCIENCE AND INVENTION, and MOTOR CAMPER & TOURIST. It contains over 60 pages every issue and maintains prize contests that amount to over Five Hundred Dollars. Some of these contests are listed below.

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EASIER TO USE—BEST RESULTS
For Making Eyes, Loops, Bends and Offsets on Radio Bus Wire
For Making Eyes.—Insert the Bus Bar between pin and lug and turn until coming to a stop—just as quick as it takes to tell it. For Making Angles, Bends and Offsets.—Place the Bus Wire between pin and lug, and with bender turn as far as it is necessary for the particular angle or bend desired.
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BENCH SAW
People will pay you liberally for B门诊cades cabinets to cover 14x14.
Radio and tube holders can build their own cabinets.

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9CSH—(Reassigned) Harry Mauch, Hubbard, 10 watts C.W., I.C.W. and Fone. All crds answered.
2AGM—Charles C. Finger, Jr., 335 Union St., Hudson, N. Y. All crds answered.
5LS—J. C. Johnson, 522 Welch St., Denton, Texas. All crds answered.
5AXO—Sam Zimmerman, Box 483, Port Lavaca, Texas. All crds answered.
2FO—J. V. Settle, 32 Dodd St., East Orange, N. J., 20 watts C.W., I.C.W. and Fone.
4TX—Donald Brown, 914 Aberdeen St., Savannah, Ga. 10 watts C.W. Reports on signs appreciated. Will QSL. 
3CJ—(Portable set) Raymond J. Carr, 617 Union Ave., Petersburg, Va. Pse KSL.
3BMN—Raymond J. Carr, 617 Union Ave., Petersburg, Va. 50 watts C. W. Pse QSL. All crds answered.
3SP—Arthur B. Cochran, 317 Main St., Crisfield, Md.
18X—R. B. Hodskins, 24 Converse St., Longmeadow, Mass. All QSL's answered.

Radio News’s Fifth Birthday
(Continued from page 23)

Editor, Radio News:
I am glad that in my opinion Radio News merits a great deal of praise for the valuable service it has rendered to the radio art. It always utilizes every opportunity to assist in the progress and the development of the art in all its phases. I am sure the amateurs and engineers appreciate fully the value of your journal in bringing quickly to their attention, in an understandable form, every new development in radio.

LOUIS COHEN
Office of Chief Signal Officer, U. S. War Department.

Editor, Radio News:
Radio News is indeed to be congratulated on its fifth birthday. The circulation of over 350,000 is most astonishing. Such popularity is without doubt an expression of approval on the part of radio folk from all parts of the globe.

The importance of Radio News, as a medium through which thousands are informed, is not to be neglected. The power of such a publication is undoubted. By including in each issue constructive and educational articles, Radio News is contributing in a large measure to the uplift of the vast throng of radio enthusiasts. By continuing to present radio subjects so that they can be understood by the non-technical man, the success of Radio News is certain to remain.

W. PALMER POWERS
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Radio News for July, 1924

143

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Provides a stepless range of grid leak control from 1/4 to 10 megohms. Furnished with or without grid condenser rated at 0.00025 Mfd.

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Made in three ranges—10,000 to 100,000 ohms; 25,000 to 250,000 ohms; 50,000 to 500,000 ohms. Ideal for use as fixed or adjustable resistors.

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THE PERFECT POTENTIOMETER
Made in 200-ohm and 400-ohm ratings for all circuits. Gives a smooth, stepless range of potential control, so essential for super-heterodyne circuits.

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PERFECT BATTERY SWITCH
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