

How to Install a Radio Set in Your Automobile; 65 Advance Programs; Why You Don't Hear Los Angeles Every Night; Super-Het Panel Layout

Radio Digest

EVERY WEEK **100** PROGRAMS **Installed** TEN CENTS

REG. U. S. PAT. OFF. & DOM. OF CANADA

Vol. IX

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SATURDAY, MAY 10, 1924

No. 5

IMPROVE SUMMER RADIO

GIVE BISHOP OFFICE BEFORE MICROPHONE

PHILADELPHIA.—For the first time in the history of Radio, a bishop was recently installed in office before the microphones of WIP, when the Right Reverend Thomas James Garland was made bishop of the Protestant Episcopal Diocese of Pennsylvania. The ceremony took place in the Holy Trinity Chapel, while thousands of ardent Radiophans listened to the unusual program which was being broadcast.



LOOK TO HOT SEASON FOR CLEARER AIR

Leaders Claim Improved Sets, Better Stations and Programs Will Make Boom

See Campaigning on Air

NEW YORK.—Plans and programs just completed by the larger broadcasting stations in the United States, as well as by the leading manufacturers of apparatus, will make the summer of 1924 the greatest Radio summer since broadcasting was begun.

This is the announcement made by E. B. Mallory, Chairman of the Radio section of the Associated Manufacturers of Electrical Supplies. Extraordinary circumstances have combined, he declared, to create an exceptionally interesting situation this summer, and a nationwide survey discloses the fact that at no time

(Continued on page 2)



Alyce Mills (left), well known motion picture artist, has given several talks over the Radio. Miss Mill's last talk was broadcast from WJZ, New York, on April 19. Marguerite Zender (above), popular musical comedy star, played the leading part in Sally, Irene and Mary, when the show was broadcast recently from WDAR, Philadelphia. Helen Whalen Yuncik (right) is one of the foremost women violinists of Detroit and is a frequent entertainer on the WCX, Detroit, programs.



Broadcast on Record Is Sent and Re-recorded

Novel Experiment Conducted by WGN, Chicago

CHICAGO.—Re-recording the broadcast of a phonographic record of a previous broadcast, was the recent achievement WGN, Tribune-Zenith station, listeners were unknowing parties to.

The opening program of WGN was recorded in the New York Laboratory of Frank Hoyt, inventor of a new method of phonograph recording. The records were sent to WGN here, where they were recently broadcast. Mr. Hoyt picked up the broadcast of the records and recorded it a second time, together with the announcement telling of what was being done. The second broadcast, from the records made by Hoyt, was sufficiently clear to be recorded a second time.

CHARLESTON, S. C.—Station WBBY, Charleston, S. C., has been heard 1,800 miles away several times, reports come in. The antenna input is only twenty watts.

Announcers Making Public Appearance in Vaudeville

DETROIT.—Announcers in time become famous people. Their voices are heard over vast stretches and the listeners are curious to see how they appear in the flesh.

E. F. Harrington, announcer for station WJZ and G. D. Foster, announcer for the Red Apple club, were requested to give an act at the Regent Theatre. But were

11 STATIONS, LINKED, BROADCAST COOLIDGE

PRESIDENT'S VOICE CARRIED TO PUBLIC SCHOOLS

Long Distance Phone Lines Connect Plants with Executive's Microphone in New York.

NEW YORK.—Speaking before members of the Associated Press in the banquet hall of the Waldorf-Astoria hotel here, the voice of President Coolidge was recently heard by millions of people throughout the United States, urging a new conference of world powers to bring about further disarmament.

The participation of the people in the event of his speaking was made possible through the broadcasting of the speech by eleven powerful broadcasting stations in this country, WEAJ, WCAP, WMAJ, WJAB, WNAJ, WFI, WCAJ, KSD, WDAJ, WBAJ and WWJ.

Each of the stations was linked to the microphone in the banquet hall by long distance telephone lines which brought the speech through without loss in volume, or clarity of tone.

People Crowd About Receivers

In clubs, schools, homes and offices, wherever a Radio set was located, a group of people were to be seen listening to the president as he discussed the soldier bonus, governmental economy, peace, and the reparations solution worked out by Gen. Charles G. Dawes and his associates.

Many of the schools had receiving sets equipped with loud speakers so that all the pupils could listen to the speech. These were installed by the pupils themselves. So intent were they that when the band played the "Star-Spangled Banner," just before President Coolidge spoke, everyone sprang to their feet and stood at attention until the conclusion of the anthem.

IMPROVE SUMMER RADIO

(Continued from page 1)

has the industry been geared to give a higher standard of service to the public.

Presidential Issues Will Be on Air

"In the first place," said Mr. Mallory, "the Democratic national convention in June in New York and the Republican national convention during the next month in Cleveland, will place the Radiophan right in the thick of the pre-election campaign. For the first time in the history of the United States virtually millions of people will attend the national conventions. They will be able to follow each issue as it is debated on the convention floor; they will hear the nomination speeches of 'favorite sons'; the thunder of applause for popular candidates—the music, the clamor and excitement of the impromptu parades which will spring up from time to time on the convention floors.

Summer Reception Greatly Improved

"Immediately after the conventions will come the Presidential election campaigns. There again Radio will play an epoch-making part, for it is clear that every candidate is preparing to broadcast through the air his appeal to the electorate.

"The fact that there are more Class B high power broadcasting stations in operation this year than last year, is assurance to the Radio audience that reception during the hottest summer months will be vastly better. The new allocation of wave lengths, particularly among the larger stations, it is generally agreed, will eliminate much of the interference that resulted from conflicting wave lengths.

Events of Summer Daytime Events

"Then, too, many of the stirring events that will be broadcast by Radio this summer are daytime events. This means clarity of reception. Not only the national conventions, but most of the great sporting classics and other outdoor events throughout the country will be held during the daytime. So much for this point.

"Another factor that will make for good reception this summer is the striking improvements noted by our technical committees in the new receiving apparatus now on the market. It is impossible of course, to measure mathematically the advances made by the Radio manufacturing industry in the course of one year. But this may be said: One of the results of the many notable improvements made in receiving sets is that daytime reception this summer will be better than night reception in previous years. This ensures that the splendid program of sports, music, speeches and entertainment planned for this summer from many broadcasting centers will be received with great satisfaction by the millions of Radio listeners in the United States."

New Broadcasting Station Opening in the Southwest

HOUSTON, TEX.—The Houston Dispatch is having made what will be one of the largest broadcasting stations in the south-west and which it is reported, will cost \$50,000.

WHO SENDS LOZENGES TO WLAG SOPRANOS?

MINNEAPOLIS.—Day after day they come, little red boxes full of throat lozenges and addressed: "Sopranos, Station WLAG." And there it is. Nobody knows from whence they come. Whether the sender is a friendly soul moved by compassion for the soprano singers or a critical listener who finds qualities in the voices of all sopranos that suggest the soothing effect of the lozenges.

Radio Gets Undeserved Knocks as Executioner

Electrocutions Often Unjustly Laid at Door of Ether Waves

WASHINGTON.—Radio, unfortunately and unjustly, frequently gets a "black eye" through improper headlines and sometimes badly written stories in the daily press. The headline—"Electrocuted by Radio," which recently appeared in a local paper, was not only misleading, but wrong according to the brief story itself.

In the first place, Radio itself cannot electrocute anyone, except in case of transmitting stations where high power supply is used. At the receiving end, Radio is not dangerous. It is even doubtful if the high frequency power put into transmitting antennas, at big commercial stations could kill, although it is admittedly dangerous to touch bare wire, the motor-generator, bus bars, or the transmitting circuits, as a shock or burn might result. Only at high-powered, low-frequency stations could serious results occur. Receiving sets are not dangerous, according to all well-informed experts, unless of course they are charged by out-

RADIO GETS CREDIT FOR SONG'S SUCCESS

NEW YORK.—"Swanee River Rose," the waltz ballad by Frank Davis and Sam Braverman, is proving to be a big seller, thanks much to broadcasting. The song is of a good happy type and had an appealing melody. "Swanee River Rose" was originally "plugged" by Radio by Frank Davis, with the result that a large demand for it was created in New York state and vicinity.

side electric power.

Referring again to the headline and the story of the unfortunate lad, who, it developed, let his antenna come into contact with an electric wire charged with 2300 volts, it is readily seen that he was not electrocuted by Radio but by an electric power line. He would have been the same had he been stringing wire clothes line, although his death would not have been charged to a clothes line. An autoist who stalls his machine on a railway track and is killed by an express train is not said to have been killed by an automobile.

Pastor Puts Loud Talker on Altar and Entertains

WASHINGTON, D. C.—A novice stunt was successfully tried out by the Rev. Walter F. Smith, Pastor of the Park View Christian church here, when he dismissed his parishioners from Sunday night service and placed a loud speaker on on his altar and entertained his congregation with a concert. After the regular service was over he invited the congregation to remain for a Radio concert. The congregation heard an organ recital from New York. It was WEAJ broadcasting through WCAP. Few of the congregation left before the concert was over.

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Looking Ahead

Installing a Radio Set in a Ford Car will be the second article by H. J. Marx on Auto-Radio installations. This series will take up installation of various sets in as many different types of cars.

French Short Wave Transmission and Reception, on waves less than two meters long, is one of the features of the next issue. This article was written by René Meany, of the Department of Marine of the French government, well known for his work in Radiophony on extremely short wave lengths.

A Traveler's Portable Receiving Set—Next week Edward Thomas Jones will tell about his new set using three dry cell tubes and especially designed for the travelling man.

Super-Heterodyne Assembly and Base Layout—Allan C. Forbes will devote the third part of his interesting series to more information on the construction of the super-heterodyne, a wonderful set.

Technical Terms and What They Mean is the ninth part of the instructive and descriptive article by Paul E. Edelman, who will tell just what the technical words really stand for.

Getting the Most Out of Your Neutrodyne, is the final article on the neutrodyne receiver by Peter J. M. Clute. He has many pointers of value to be taken up next issue.

Newsstands Don't Always Have One Left

Radio Digest

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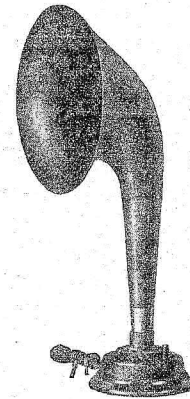
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ETHERWAVES CARRY LANGUAGE LESSONS

TESTS PRSAGE FOUNDING OF RADIO "U"

Listeners Hear Professor's Questions, Student's Answers and Teacher's Correction

CINCINNATI.—Crosley Station WLW has just completed an experiment which presages the foundation of a Radio university of languages. The unique enterprise is to have the assistance and cooperation of several members of the faculty of the Cincinnati university.

In conducting the experiments the instructor occupied a position at the microphone in the studio with pupils assembled in a class room in a remote part of the building, which was equipped for two-way communications by means of a telephone line connecting the class room and the studio. This arrangement not only permitted questioning by the instructor and answering by members of the class but all listeners were able to hear both sides of the lesson, a microphone having been placed in position along side the telephone in the class room.

Regular Class in Spanish May 12

For the first lesson the instructor gave the class five Spanish words with their English equivalents, requesting that these be written by the students, after which one of the students was asked to pronounce the words over the telephone. Such mistakes as were made were then corrected by the instructor, who then gave simple English sentences to be translated into Spanish, the same procedure as in the use of the words being followed.

The lesson lasted fifteen minutes. Soon after it had ended scores of telephone calls indicated an immediate interest, many requests being made that a regular course be followed. As a result a Radio class in Spanish will be inaugurated on Monday, May 12, continuing daily for two weeks from 12:45 to 1:00 p. m. central time.

Students Call Maek on Phone

Under the proposed plan as worked out by Fred Smith, whose idea it was, there will be two classes—one in the studio with the instructor and one assembled in the class room—in addition to such individual outsiders as may desire to pursue the studies of the course. The latter will by no means be slighted. When the point of quizzing has been reached in each lesson the instructor will broadcast a request that certain of the outside students, all of whom previously will have been registered, card-indexed etc., call him on the telephone immediately for personal questioning. While waiting for such calls the instructor will fill in the time either lecturing before the "Mike" or quizzing members of the visible class.

It is believed that the initial Spanish course will open vast educational possibilities for Radio and that it eventually will lead to the establishment of a complete university, limited only by such subjects as require special visual demonstrations. Even the latter may come soon, with the adoption of the Frances Jenkins Radio photo transmitter.

SYMPHONY ORCHESTRA AT CAPITOL THEATER

New Organization Will be Part of Weekly Concert

NEW YORK.—The Capitol Theater broadcasting orchestra which gave its first performance on the program broadcast by S. L. Rothafel last week, has brought such a response from Radiophans that it has been decided to make the new organization a regular part of the weekly concert.

The new orchestra, which consists of twenty men, was recruited from the solo players of the Capitol Grand Orchestra. It is the only organization of its kind on the air, comprising as it does, every type

COUPLE, 64 AND 62, MARRIED AT WOC

MOLINE, ILL.—Onesimus Stoker, 64 years old, of Davenport, Iowa, and Mrs. M. J. Mulone, aged 62, of Cleveland, were married in the studio of Station WOC here recently by the Rev. J. S. Neal of East Moline and the ceremony was broadcast. The couple heard Reverend Neal's Christmas sermon by Radio and insisted that he marry them and that the ceremony be broadcast.

SACRIFICES 'STATIC DOPE' IN COPS' RAID

MINNEAPOLIS.—Robert Stewart of this city testified that the pitcher he smashed when prohibition agents recently raided his room, contained nothing but "rank poison," and not alcohol, which he was using in some experiments on an invention to rid the ether of static. He did not want to give away the secret of his invention, he said, hence the smashed pitcher.

MOTHER TUNES IN MOTHERS' DAY



Just an old-fashioned mother, the best and truest friend anyone ever had, thinking of someone who is miles away, and imagining that she hears their voice. Mrs. Louis Gowdy, 88 years old, of Minneapolis, Minn., listens in the new way, hoping and praying on the day of days, "Mothers' Day." O. J. Hibbard Photo

of instrument used in the regulation symphony orchestra. There is a wealth of musical literature which this orchestra can draw upon for its programs, including salon music, French music, light operettas, semi-classic music as well as special arrangements of many types of composition.

Reo Automobile Company to Open Broadcast Stations

DETROIT.—The Reo Motor Car company at Lansing, Mich., it is announced, has arranged for the installation of a broadcasting station. Entertainments will be broadcast, and the station may also be used as a medium for advertising, it is reported.

Employ Trouble Shooter, Mayor Tells Listeners

Would Study Complaints to Locate Interference—Officials Aid

COLUMBUS, O.—Mayor J. J. Thomas' Radio committee, organized to work for better Radio conditions in Columbus, has made an appeal to listeners for funds to employ an electrician and establish a clearing house for complaints.

The purpose is to learn the general source of interference by a study of the complaints made by listeners and then send out an electrician to discover the

CLAIMS BROADCASTS HURTS VAUDEVILLE

KEITH CHIEF BARS HIS STARS FROM AIR

John J. Murdock, However, Fails to Explain Success of Other Circuits in Radio

NEW YORK.—Radio and vaudeville clashed again here recently with the result that the B. F. Keith circuit, controlling most of what is known as "big time" vaudeville, is including in its contracts a clause which prohibits its performers from broadcasting.

John J. Murdock, general manager of the Keith circuit and former president of the Vaudeville Managers Protective Association, claims, "Our investigation has shown that the interests of Radio and vaudeville are opposed in practically all cases. We found that advertising gained by broadcasting does not offset the loss of patronage."

Mr. Murdock did not explain why Marcus Loew continues to find broadcasting through WHN an excellent medium for advertising his acts at Loew's State theater here and keeping his house filled.

Capitol Theater Broadcasts Profitable Neither did Mr. Murdock refute the fact that the Capitol theater, a motion picture palace with variety acts interspersed with the picture, had found its broadcasting from WEAF every Sunday night a most profitable means of advertising.

Mr. Murdock is known to have given his support and position to aiding the American Society of Composers, Authors and Publishers in its divers methods of attempting to control the music situation. Confidential letters have been uncovered proving this connection.

APPROPRIATION BILL SKIMPS RADIO COPS

Secretary Hoover Succeeds in Effort to Have Amount Increased

WASHINGTON, D. C.—The House of Representatives has passed the appropriation bill for the Department of Commerce but no one on the floor undertook to get an additional appropriation for the administration of the Radio law.

As the bill passed it carried an appropriation of but \$158,788 for the administration of Radio. This is only \$2,000 more than the appropriation of last year and is approximately \$20,000 less than recommended by the bureau of the budget.

The Senate committee on Appropriations, however, has reported out the appropriation bill and allowed the Radio section \$180,278.

This is the amount originally recommended by the budget bureau. Secretary of Commerce Hoover appearing before the Senate committee asked that it be raised \$21,500 to \$180,278. The additional amount will be allowed by the Senate in passing the bill, it is believed.

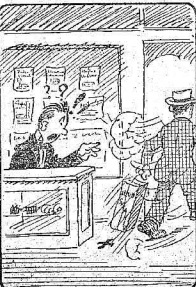
Broadcast Unites Sister and Brother at Deathbed

MINNEAPOLIS.—Brother and sister were united at the deathbed of the sister at Quilcene, Wash., through the assistance of Twin City Radio Central, WLAG, Minneapolis and St. Paul, when Peter Campbell was located after a long absence from La Crosse, Wis. WLAG received a notice to broadcast for Mr. Campbell. The broadcast was received by Mr. Campbell's daughter and delivered to him ten minutes after the broadcast was made.

exact point where the trouble is located. Officials of the municipal and Rail-Light company lighting plants have indicated they would co-operate by eliminating any grounds or other defects pointed out by the electrician. Approximately \$500 has been subscribed to the fund so far.

THE ANTENNA BROTHERS

Spir L. and Lew P. Part I—A Squawk from the Speaker



WGY AWARDS PRIZE IN DRAMA CONTEST

"MILLION CASKS OF PRONTO" WINS \$500

Agnes Miller Submits Winning Play—Date of Presentation to Be Announced Later

SCHENECTADY.—First prize in the Radio drama competition conducted by WGY, station of the General Electric company here, has been awarded to Miss Agnes Miller, 150 East 72nd Street, New York, for her comedy drama of business life, "A Million Casks of Pronto."

The object of the competition was to develop a type of play especially adapted to Radio presentation, a type of play that will tell its story through an appeal to the ear and imagination, just as the screen play is directed exclusively to the eye. Miss Miller's play was selected from nearly 300 manuscripts as the best original drama submitted. She will receive a cash prize of \$500.

Writers Write for Blind Man

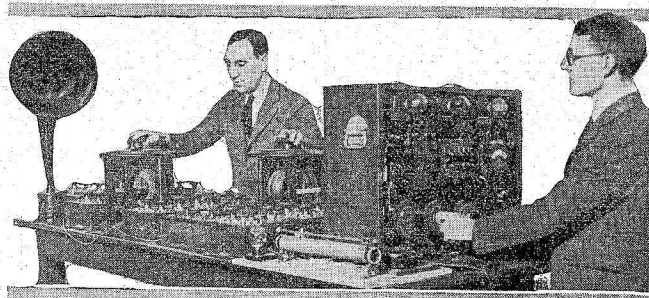
Miss Miller is a writer of juvenile fiction and has published three books in a series known as "The Linger-Notes." The books are "Golden Quest," "Valley Feud" and "Mystery House." She has also contributed many stories to young people's magazines.

The successful play will be presented by the WGY players at a date to be announced later. The WGY players have offered one production weekly since October 1922. The competition was for the purpose of stimulating writers' interest in what is destined to become a new branch of dramatic art.

Writers were advised to bear in mind that the Radio audience "gets" a play exactly as a blind man would in a theater and they were urged to take full advantage of "noise effects" as a means of creating atmosphere.

Broadcasts were utilized during National Forest Protection Week as a means of stimulating interest in the conservation of forests and the reduction of the forest fire hazard.

PRODUCES ARTIFICIAL SPEECH



A close imitation of many spoken sounds has been produced by means of electrical apparatus invented by Dr. Harvey Fletcher, of New York. Using a combination of vacuum tube oscillator, amplifier and tuned circuits, a loud speaker is made to say "a, e, i, o, u" in unmistakable fashion. Artificial speech is produced by a vacuum tube oscillator producing tones which are fed into an over-loaded vacuum tube. This produces harmonics of the fundamentals. Two tuned circuits are coupled to the output and enable two groups of harmonics to be emphasized. The resulting coupled tone is fed into a loud speaking receiver. Photo shows, left to right, Dr. John C. Steinberg and Dr. Fletcher.

WEOA Giving Garden Tips

COLUMBUS, O.—Various members of Ohio State University's agricultural faculty have begun a series of garden lectures daily from Station WEOA for

the benefit of farm gardeners as well as backyard gardeners in the cities and villages. An effort is being made to answer all the problems encountered by truck growers, with timely suggestions.

'HUSHPUCKINY' SAYS 'HOWDY' IN CHICAGO

"Solemn Judge" and His Riverboat Whistle of Memphis Visit Sears-Roebuck Plant

CHICAGO.—George D. Hay, the "Solemn Judge," directing announcer of Station WMC of the Commercial Appeal, Memphis, and the famous "Hushpuckiny" travelled the air last week from the Sears-Roebuck station here, WLS.

The young-old judge, with the Hushpuckiny tucked under his arm, arrived in Chicago by the way of the Mississippi river and the canal just in time for the whistle of the river boat to blow one long mellow note, followed by two shorts, to open the evening program of WLS.

"We are visiting Chicago for a week, the Hushpuckiny and me," Mr. Hay said, and then he broadcast the life history of Hushpuckiny, which is now almost a year old.

Hushpuckiny is a river boat whistle about one foot long and finished in red cherry. It is the co-partner of George Hay in announcing that WMC is on the air. One long toot and two shorts, then Hay does the rest. But the whistle always has the last word. Hushpuckiny means sunflower in the language of the Chickasaw Indians that once built their camp fires along the Chickasaw bluffs of the Mississippi river.

Ten cents is the cost of a college course in the new Station KDKA University of Pittsburgh broadcast curriculum.

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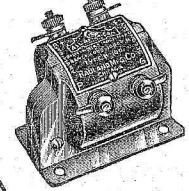
5-10-24

Did You Read It?

The Chicago Daily News Laboratory's Report of Tests on the New All-American Long Wave Radio Frequency Transformers?

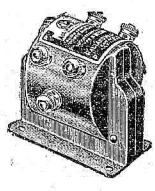
Three All-Americans were tested "with instruments and in practical service," reads the report headed "SUPER-HETERODYNE DATA," published April 5 in the Chicago Daily News. "They were virtually uniform: 6,500 to 12,500 meters, 6,450 to 12,500 meters, 6,500 to 12,500 meters. The curve of these transformers is almost flat from the point where the amplification rises above 1 milli volt on the scale at 6,500 until it drops back at 12,500. There is a gradual decrease in amplification but the curve is still high at 15,000." Again All-Americans lead!

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Absolutely the most efficient and most satisfactory. Develop round, rich, deep, pure tones in amazing volume. Input and output types. Only \$6 each.



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A type for

every circuit

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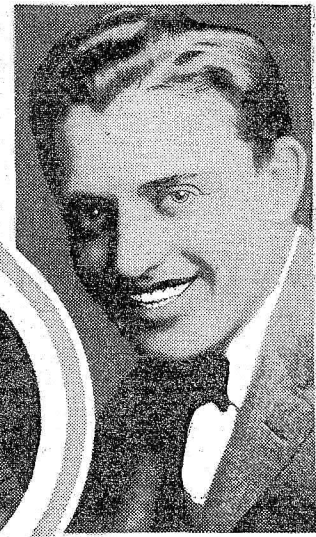
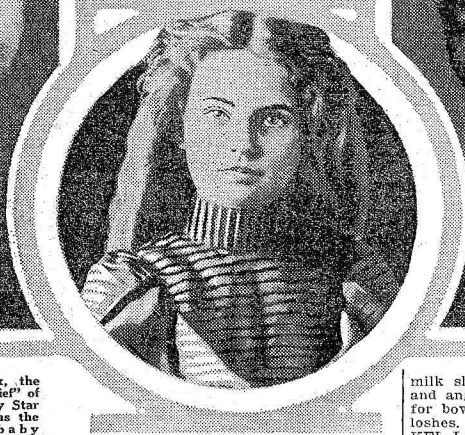
LARGEST SELLING TRANSFORMERS IN THE WORLD

BEFORE THEY THOUGHT OF "MIKES"

This youngster with the expression of satisfaction, is now announcer for one of the large eastern stations. He is noted for his splendid vocabulary, round, measured accents and his perfect enunciation. Before taking up Radio he was a very successful salesman.



Managing director, announcer and program director are the titles attached to this young lady's name. She is one of the few lady announcers and it should be easy to guess her name. Read her life history next week. Paul Reese (right) is one of the youngest announcers in the country. Read the article below for some sidelights on his life.



Leo Fitzpatrick, the "Merry Old Chief" of the Kansas City Star Nighthawks, was the three-year-old baby whose picture was shown last week.

Paul Reese, KFI

milk shakes with or without, black hair and angel cake; not to mention a hatred for bow ties, tea, roll top desks and goshes. Now he is announcing for station KFI, Los Angeles.

OFFER REWARD FOR PICKING UP BOWDOIN

SET AND \$100 UP FOR WORD FROM NORTH POLE

First and Second Amateurs Who Pick Up Signals Will Win Chicago Prizes

CHICAGO.—One hundred dollars in gold will be paid to the first amateur who succeeds in picking up the Donald B. MacMillan station, WNP, on the Schooner Bowdoin, now frozen in within eleven degrees of the North Pole. The offer is made by U. J. Hermann, managing director of the Radio Manufacturers' Show association, which conducts Radio shows in New York and Chicago.

To the next amateur who reports a confirmed reception of the MacMillan expedition's transmission, E. F. McDonald, Jr., president of the Zenith Radio corporation, will award a Zenith receiving set—an exact duplicate of the one in use on the Bowdoin.

Schooner in Almost Continuous Daylight
The offers of Mr. Hermann and Mr. McDonald are made to stimulate watchfulness on the part of amateurs capable of receiving the code messages of WNP. Nothing has been heard from the MacMillan party for several weeks and while this causes no great uneasiness—due to the fact that Captain MacMillan is now experiencing twenty-three hours and fifty-six minutes of daylight—the donors of the two prizes hope that some freak of reception may bring word from the ice-bound schooner.

Amateurs who pick up the messages sent from WNP are requested to at once telegraph U. J. Hermann, National Radio Manufacturers' Show association, 127 N. Dearborn St., or E. F. McDonald, Zenith Radio corporation, 332 S. Michigan Ave., both of this city.

Municipal Station Unable to Obtain Call "CONY"

WASHINGTON, D. C.—Radio officials of the Department of Commerce state that the new municipal station in New York city will not be able to have the call letters CONY because C is the beginning call letter used by England according to international agreement. New York made a request for the call letters CONY, supposed to stand for "City of New York." This request was denied.

There are only three call letters allotted to the United States, N, W and K. The letter N is only allotted to the navy which means that the New York call letter will have to begin with either W or K.

Leo Fitzpatrick, WDAF

THE kid who appeared on this page last week—you remember, the one that we said resembled Napoleon—is here shown, changed by the processes of the elements. We now behold him with rapture and admiration; for this is none other than Leo Fitzpatrick, himself.

He entered the world by way of Wichita, Kan., on January 24, 1894, almost 327 years and eight months to the day after the Battle of Hastings had been fought. Old enough to be wise enough.

Educated in Kansas, he quit college with no aim but to drag down the money, but soon found he had a soul, and got into the newspaper game. Fair enough.

From that time on, experience was his teacher, and Mr. Fitzpatrick ground out stories for the dailies all over the country, eventually landing with the Kansas City Star.

The reporter asked him to give a short description of himself, he did. Very short.

Height: medium; weight: extra beef; complexion: light and dark, mixed; color of hair: black today, gray tomorrow; eyes: blue as the skies; habits: Saturday night baths, forgetful, "glad you called"; vices: all of them; gifts from Radiophans: everything from live hawks to neckties and Paris garters; married or single: wedding ring bought a week ago; aversions: Mme. U. No lie, payday, song pluggers; experience: considerable; motto: "An Enemy of Sleep Am I"; talents: singing and speaking, etc., etc.

GIVES STATION TO SALT LAKE CITY

Complete Equipment Ready for Operation, Presented by Nathaniel Baldwin

SALT LAKE CITY.—One of the most powerful broadcasting stations in America is to be placed at the disposal of Salt Lake City by Nathaniel Baldwin, president and founder of Nathaniel Baldwin, Inc., inventor of the famous Baldwin receivers.

Equipment valued at \$25,000, capable of communicating with Chicago, Mexico, the Hawaiian Islands, Vancouver and other points as far distant will be provided. Installation will be on the roof of the Hotel Utah, Salt Lake City's premier hotel.

The plant will be ready for operation by October 1, and the Chamber of Commerce-Commercial club of Salt Lake City will have charge of all programs for two years, after which other arrangements will be made for supervising the broadcasting.

The transmitter is one of the latest type of 500-watt sets now manufactured. In addition to equipping the station, Mr. Baldwin will furnish two operators and will provide the electric current for the operation of the station.

WHEN he was young he spoke German, but being out of that class now, he sings in French. You're right, Paul Reese is the young man's name. Upon leaving school (no he wasn't asked to leave), he "covered" operas for a Chicago paper. How he covered them we don't know, but he did.

About that time he decided his life career was invalidating, and spent about three years on a California ranch, chasing cows and chickens.

Becoming bored with this, he went into vaudeville—the two-acting and sang his own songs, "pattered" others, and even tried to dance some. A very versatile young man you must admit.

Musical comedy seemed the next legitimate step so he promptly opened a song shop in Los Angeles. Success did not smile at him this time, it laughed out loud.

Having accumulated quite a collection of dollars of the realm, he departed for the big city—New York, and rode on busses, subways and other tourist-accommodating vehicles. This was the turning point in his life.

Shortly after returning home he acquired a taste for football, bachelorhood,

SUPER-HET PATENT CLAIMED BY U. S.

Hold Armstrong Was in Government Service at Time of Invention

WASHINGTON.—It was announced here that the government in asking for bids on 500 super-heterodyne sets, for its own use, has declared through a high official in the Signal Corps, that it is the owner of the super-heterodyne patents.

As Major Edwin H. Armstrong was in the employ of the United States government at the time the unit was invented and the patents were granted, the government therefore believes it is owner of the patents.

In submitting his bid, a manufacturer may do so with the proviso that the government defend him in any prospective litigation incidental to the sale, or he may bid and reserve the right expressly to attend to the defense himself of any threatened or instigated litigations.

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A. B. C. Lessons for Radio Begin
Two, Three, and Four Tube Reflex Circuits.
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In addition to these features, the current issues give you all the live news in Radio. The popular Q and A. Department. How to Operate Your Set. Advance Broadcasting Stations Programs, and a correct list of all Broadcasting Stations.

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One year's subscription, and choice of one volume. Send Vol. Enclose...\$5.00
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Bound Volumes 3, 4, 5 and 8 now available. This offer good only in U. S., and Possessions, and Canada. This offer not good through dealers or subscription agencies, but must be sent us direct with the full subscription price. Remittance must be by check, money order or draft.

BLOODLESS SCALPEL USES RADIO ENERGY

BURNS ITSELF THROUGH
HUMAN TISSUES

Peculiar Needle-like Instrument Seen
as New Possible Cure for
Cancer

CHICAGO.—Following more than a year after first announcement was made in Radio Digest, recent press dispatches tell of a new bloodless Radio surgeon's scalpel—a possible cure for cancer—having been perfected at the Alexian Brothers' hospital here and of its use by Dr. L. E. Schmidt in operations.

The knife, practically without change, was used by Dr. Howard Pratt of the American Hospital here over one year ago. The Radio application involved was explained at that time.

How the new "knife" is a distinct improvement over the keen-edged scalpel and what wonders it is able to work with cancer cases is a romance in itself.

No Pressure Exerted on Tissue

The "Radio knife," which is not really a knife but looks more like a knitting needle, "burns" itself through the human tissues as quickly and without pressure, as though one were cutting through butter.

It is the microscopic searing around the edges of the incision which practically makes the operation bloodless. This searing is sought in certain operations for cancer, in the hope that it will seal in cancer cells which otherwise might run through the blood and lymph streams.

Very Small Loss of Blood

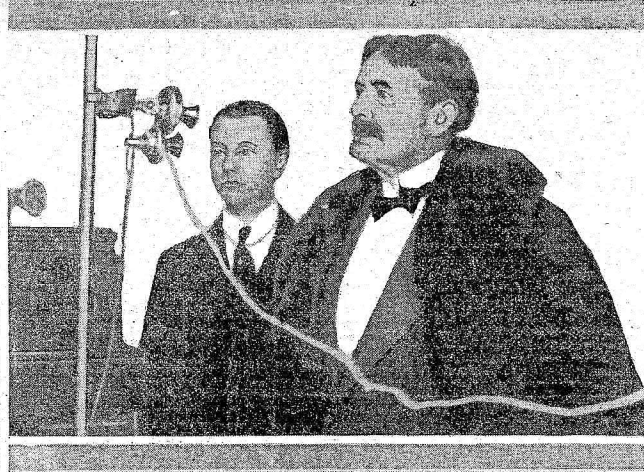
Two major operations were performed here on men with cancer of the bladder, but the blood lost might have been caught in a few tablespoons.

Beside the operating table stood a cabinet closely resembling the ordinary Radio transmitting set. In his hand the surgeon held the knife, set in a hard rubber handle, a cord leading from it to the cabinet. Another cord is attached to a sheet of tinfoil on which the patient lies. The heat developed through this knife has not yet been accurately measured, although it is great enough to fuse brass.

Strangely enough, the knife remains comparatively cool to the touch.

Never tinker with the set and expect satisfactory service.

AMBASSADOR SPEAKS TO STATES



Upon invitation of a young American Radio experimenter in Paris, American Ambassador Myron T. Herrick consented to try to bridge the Atlantic. Speaking into the microphone, he made a few reassuring remarks about the serious condition of the French franc, after which Mr. Gouraud, the experimenter, spoke. The only drawback was that Gouraud forgot to ask anyone on this side to listen in. Photo shows Mr. Herrick speaking, with Mr. Gouraud in the background.

Wide World Photo

Fascination of Airwaves Plays Part in Her Cure

NASHVILLE, MICH.—Radio is playing a large part apparently in the recovery of Mrs. Frank S. Ward, who lives on a farm near here. For about three years she has been seriously ill from spinal trouble and nervousness, and was confined to bed most of the time.

Her son presented her with a Radio set for Christmas. At first she could scarcely listen in, because of her weakness, but gradually the fascination drew her to it until today she is able to sit up and tune in for long periods. It has taken her mind almost completely from her illness and in addition has brought her many new callers, for her's is the only receiving set in the neighborhood.

KDKA Girl Scouts are planning many summer activities. The Westinghouse station's troop has been enrolling over fifty new members every week.

Station KFNF, Field Seed company, Shenandoah, Ia., has a pig, "Penelope," as a mascot.

SEE TAX AS BLOCK IN PATH OF RADIO

DEALERS BAND TO GUARD
"INFANT INDUSTRY"

Levy Would Oppose Tendency Toward
Improvements and Price
Cuts, Claim

NEW YORK.—Following the receipt of protests from all parts of the United States against the proposed ten per cent. tax on Radio sets, parts and accessories, William H. Davis, Chairman of the Emergency Radio Tax Committee, formed to fight the imposition of the tax, issued the following statement:

"The only argument advanced for the tax is that the money must be raised somehow. Against this, criticism is expressed everywhere against imposing this tax on an industry just struggling to its feet with an enormous amount of development and standardization confronting it.

Chicago Trade Organizes

"Such a tax as proposed would, it is contended, have an adverse effect on the tendency to improve products and reduce prices. The public resentment, meantime, is certainly out of all proportion to the amount of income that can be expected to result from the tax."

Radio men in Chicago are forming an organization which will make it one of the strongest in the industry. More than twenty concerns manufacturing Radio apparatus are included in its membership.

The association's immediate object is to defeat the proposed Radio tax on the grounds that Radio is an infant industry, and its fundamental purpose is educational.

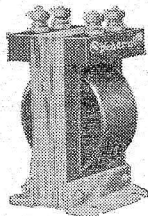
Radio played a part in Mexican politics recently when General Plutarco Calles broadcast his first campaign speech from Mexico City.

You don't know how thrilling
Radio Reception can be, Until
you've used—



Federal

Standard RADIO Products



The now famous No. 65
Audio Frequency
Transformer is but one
of over 130 radio parts
designed, manufactured
and guaranteed by Federal.

\$7.00



The Sign of Reliable
Radio Dealers

THE only difference between the program at the broadcasting station and as you receive it in your own home, is the origin of its source, if you use Federal Radio Equipment. The reproduction is truly amazing in fidelity and naturalness of tone.

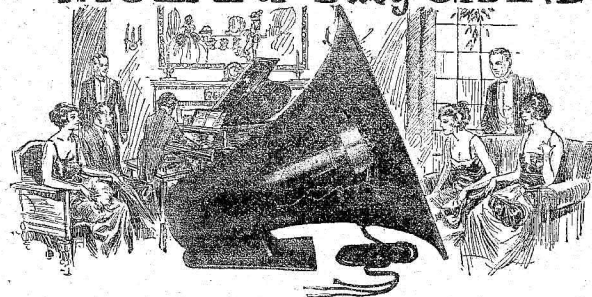
This guaranteed mechanical perfection is the result of the same tremendous experimental and engineering resources that make every Federal Radio Set and every one of Federal's 130 different radio units, the last word in radio equipment.

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Factory: Buffalo, N. Y.

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Pittsburgh Bridgeburg, Canada London, England

Establishing The MOZART Baby GRAND



IT WAS only to be expected that our name would help toward establishing our new reproducer in the enviable position it is so rapidly gaining.

Whatever the reason, probably no similar product ever met with more instantaneous success. May we quote from another entirely unsolicited appreciation, which accompanied one of our most recent repeat orders.

"All who have heard it have told me to keep it in the background, as I still have to get rid of. For clearness, it is the best I have heard and I feel I cannot stock too many.
Ship C. O. D., Etc."

(Signed) C. Kreslog, Wabash, Indiana.

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 in. Length and height overall, 12½ in.

Orders sent direct should be accompanied with a local dealer's name when possible.

Radio Division

THE MOZART GRAND CO.

Manufacturers of Fine Instruments

NEWARK, N. J.

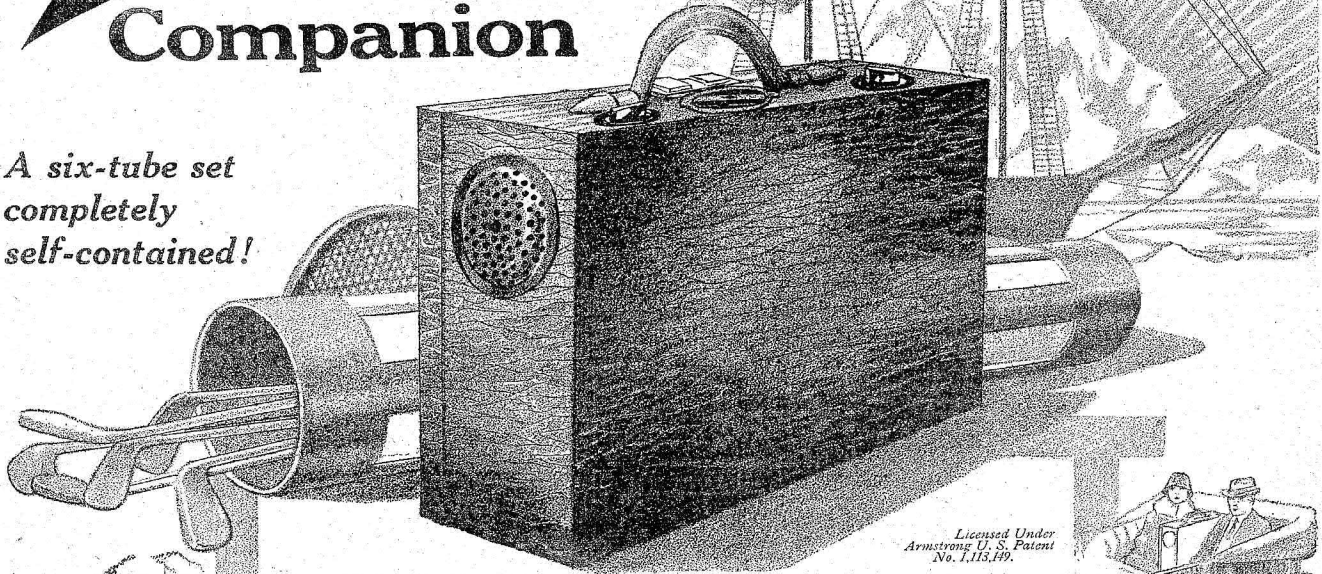
U. S. A.

ZENITH

TRADE MARK

Radio Companion

A six-tube set
completely
self-contained!



Licensed Under
Armstrong U. S. Patent
No. 1,115,149.

Zenith — MacMillan's Choice Encased in a Light Traveling Bag!

Here's a six-tube radio set that's entirely self-contained—tubes, "A" batteries, "B" batteries, loud speaker and loop antenna complete, and it's a *Zenith!*

Packed into a small, beautifully finished traveling case—much smaller than the average suitcase—this new Zenith is the most compact set ever made giving clarity, quality, volume and distance.

Do you see those two little buttons close to the handle? Those are the controls. In order to operate the new Zenith Radio Companion you simply turn the controls to bring in the station you want—then for maximum volume you swing the case so that the loop is facing that particular station. You will be astonished at the clearness with which the music and the voices come through—and in what volume!

Think what it would mean to you to be able to take one of these new Zeniths with you on your travels and outings. A real radio set—the exclusive choice of Donald B. MacMillan for his Arctic expedition—yet so compact that it takes up no more space than a light traveling bag!

Think of the fun you could have with this set—the dance music you could listen to on moonlit nights—the orchestras that would play for you as you and your pals gathered round the camp fire—the com-

panionship it could give you on your motor parties—at the bathing beach. Picture the enjoyment it could bring your guests at the house-party or the weekend gathering.

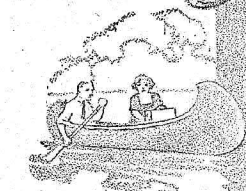
Again, think how such a set would while away a lonesome evening in that dreary out-of-town hotel—what a godsend it would be to that invalid mother—to that dear relative or friend who must spend weeks and months in the hospital!

But if you have already been initiated into the wonders of the Zenith, you don't need be told the extraordinary use you could get from this new model or the fun it could give you.

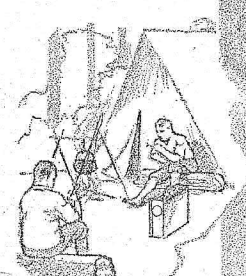
Just the knowledge that you could pick up this beautifully finished case—even as you would pick up your hand bag—and take it with you across city, country, lakes, mountains, and *still* turn those two controls and be able to listen at a moment's notice to the world you have left behind—that thought alone should be enough to suggest the infinite delights provided by this new Zenith Radio Companion.

You will want to know more of this remarkable set—so light and compact, so easy to operate, so wonderfully convenient. You will want to see it for yourself, at the very earliest moment. No ear-phones, you understand. No outside antenna. Yet clarity, volume, quality, distance! A real Zenith, packed into a traveling case!

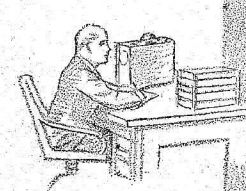
Your name and address on the coupon, and the coupon placed in the mail, will bring you full particulars.



Listening with the keenest pleasure, to music and voices in the cities they have left behind!



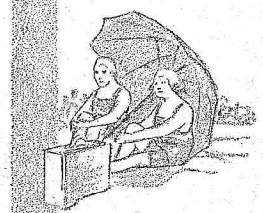
Lively orchestras entertain these boys, miles and miles from civilization.



Receiving the latest market reports, the latest news developments, with the aid of the Zenith Radio Companion.



The height of luxury—motoring to music!



When three is company at the bathing beach.



A constant source of entertainment and delight to the invalid.

Zenith Radio Corporation
McCormick Building
Chicago, Illinois

ZENITH RADIO CORPORATION,
Dept. 1-N 328 S. Michigan Ave., Chicago, Ill.

Gentlemen:

Please send me illustrated literature on Zenith Radio, including full particulars of the new Zenith Radio Companion.

Name.....

Address.....



COURT GIVES RIGHT TO USE MUSIC FREE

CINCINNATI RULING IS BROADCAST VICTORY

Holds Rendition of Song by Air Wave Is Not Public Performance for Profit

CINCINNATI, O.—A victory for broadcasting stations using musical numbers on which a copyright has been granted was won in the United States District court here when Judge Smith Hickenlooper dismissed a petition filed to halt the broadcasting of such numbers without paying the holder of the copyright.

The suit was filed by Jerome H. Remick & Co., New York music publishers, against the Crosley Radio Corporation of this city, manufacturer of receiving sets.

Judge Hickenlooper said he does not think the rendition of a song in the seclusion of a broadcasting studio is a public performance within the intendment of Congress in enacting the present copyright law.

Broadcast Intelligence and Music Judge Hickenlooper said:

"These Radio stations are operated for the transmission through space of intelligence and music. Such a station is undoubtedly maintained to stimulate interest on the part of the public, to advertise receiving sets and instruments of defendants' manufacture, and to permit the persons having receiving sets to receive a reproduction of the sounds broadcast.

"It must also be kept in mind that broadcasting stations are maintained throughout the United States by those who have no direct connection with the manufacture or sale of Radio equipment, solely for the advertising value of such broadcasting stations. A notable example of this is the station maintained by the United States Playing Card company here; other examples are those stations maintained by newspapers at various points.

Not Public Performance for Profit

"In order to constitute a public performance in the sense in which we think Congress intended the words 'perform publicly for profit,' it is absolutely essential that there be an assemblage of persons, an audience so congregated for the purpose of

ORGAN DUET PROVES STELLAR ATTRACTION



The more important half of the world's greatest organ team, Mr. and Mrs. Jesse Crawford, is shown at her console of the mighty Chicago theater duet pipe organ, said to have taken more than a year to build. The team may be heard by Radiophans tuning in on WMAQ, Chicago, between the hours of nine and ten, Eastern time, on Saturday nights. Mr. and Mrs. Crawford have consoles at opposite ends of a large orchestra pit but wear telephone sets to assure synchronization.

hearing which transpires at the scene of amusement.

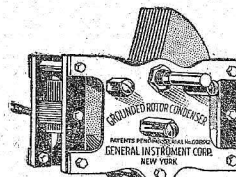
"We simply feel that the rendition of a copyrighted piece of music in the studio of a broadcasting station, where the public are not admitted and cannot come, but where the music is converted into sound waves that are received in the homes of owners of receiving sets, is no more a public performance than the perforated music roll which is a reproduction of copyrighted music."

According to professor H. S. Taylor, of the Department of Chemical Engineering at Princeton University, transmission of power without wires to aircraft, railroad trains, and ships hundreds of miles from the power plant is a possible development in the Radio field.

WAVE LENGTH LIMITATIONS

Are now conquered and it matters not whether you receive at 50 meters or 50,000 meters. All you need is the proper inductance and that means using

THE LOW LOSS GENERAL INSTRUMENT CORPORATION GROUNDED ROTOR CONDENSER



LOW LOSS GENERAL INSTRUMENT GROUNDED ROTOR CONDENSERS

Have Practically No Dielectric Losses and Hence You Get **37% MORE DISTANCE AND VOLUME THAN WITH THE AVERAGE VARIABLE CONDENSER**

CHARLES SREBROFF, operator and owner of station 2 BHY writes, "You can use my name in your advertisements so that other amateurs may profit by my experience with your **LOW LOSS GROUNDED ROTOR CONDENSER**. There is no other condenser to equal yours and I can honestly say that my station is entirely free from any condenser losses since using your **GROUNDED ROTOR CONDENSER**.

"Amateurs can call me any night between 11 p. m. and 1 a. m. on 180 meters—three operators always on watch."

Type	Minimum	Maximum	Price
Type 46X 11 Plate	5 MMFD.	.00025 MFD.	4.50
Type 46A 13 Plate	6 MMFD.	.0003 MFD.	4.50
Type 46D 21 Plate	9 MMFD.	.0005 MFD.	5.00
Type 46F 43 Plate	15 MMFD.	.001 MFD.	5.50

AT YOUR DEALER

Otherwise send purchase price direct to us and you will be supplied

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Goods shipped C.O.D.
Just pay the postman

EVERY ARTICLE SOLD ON WRITTEN MONEY-BACK GUARANTEE

Broadcasting Stations Latest List With MAP

FREE Please address Dept. RD53, and enclose 2-cent postage stamp

SUPERTRON TUBES
Just received a new shipment. Oh, boy, what an amplifier! Better than ever. At this price they'll go fast. The 201 A's are 6 volt, dry cell or storage battery operated, and the W. D. 12 type uses 1 1/2 volt dry cell. Better get your order in now. Both types. **Reg., \$6.50. Special, \$3.43**

VARIABLE CONDENSERS
Just get these points! 1. Heavy moulded end plates. 2. Phosphor-bronze contacts to heavy binding posts. 3. Processed aluminum plates that retain their alignment. 4. And the list price is double what we ask.
11 plate \$1.05
23 plate 1.35
43 plate 1.95
VERNIER CONDENSERS Same as above.
12 plate vernier \$2.65
23 plate vernier 3.00
43 plate vernier 3.50

VARIOMETER
Let's tell you about the new variometer! First of all, it's moulded. Of course, it has pigtail connections for efficiency. And a positive stop. Split? Oh, yes. Can be split for any circuit. Green silk windings and takes 600 meters. **Reg., \$5.50. Special, \$3.59**

SOCKETS
A new process enables us to offer an unheard of value. By this new method a nickel tube is forced into a moulded base under heavy pressure. This assures perfect contact with the phosphor bronze springs. Easily worth 75c each. **45c**

DIALS
Mahogany colored dials with exceptionally heavy brass bushing. Will dress up your set. Change your dials and make your friends think you have a new set. List, \$1.00. **50c**

OTHER SPECIALS
This Week Only
Magnavox, New Type \$32.50
10% Deposit with Order.
Brandes Talker 8.98
Hilco Couplers 6.25
Dictograph Talkers \$16.95
Eria Transformers 4.25
Brandes Phones 5.19
Baldwin Phones 8.95

We acknowledge all orders same day received, and ship same day or next day. Written Money-Back Guarantee with every purchase. We answer all letters we get on same day we get them. This is Radio Shack SERVICE.

THE DE LUXE NEUTRODYNE

A five tube assembly kit which includes everything necessary to build a genuine Hazeltine 5 tube set.

Study this Magnificent List of Parts All Matched—All Licensed

1 DRILLED Radion Mahoganite Panel, Engraved in Gold.	1 30 - Ohm Rheostat with Gold plated Knob to Match Panel.
3 Four-inch Radion Mahoganite Dials, Gold Engraved.	2 Genuine Killark Completely Shielded Audio Transformers.
2 Gold Plated Jacks.	1 Bassboard.
3 Genuine Hazeltine Neutroformers mounted on the famous Comsco Bakelite End Condensers. Positively the only Neutrodyne Kit including these famous Comsco Condensers.	20 Feet Tinned Bus Bar. 1.00025 Freshman Grid Condenser.
2 Hazeltine Neutrodons.	1 Tubular Glass Grid Leak.
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1 E-Ohm Rheostat with Gold Plated Knob to Match Panel.	1 .002 Micon Condenser.
All Packed in Handsome, Large, Partitioned Box which can be used as a tool box. Complete assembly	1 Exact Size Special Panel. Exact Size Special Base. Complete Instructions. Fine, Clear Blueprint.

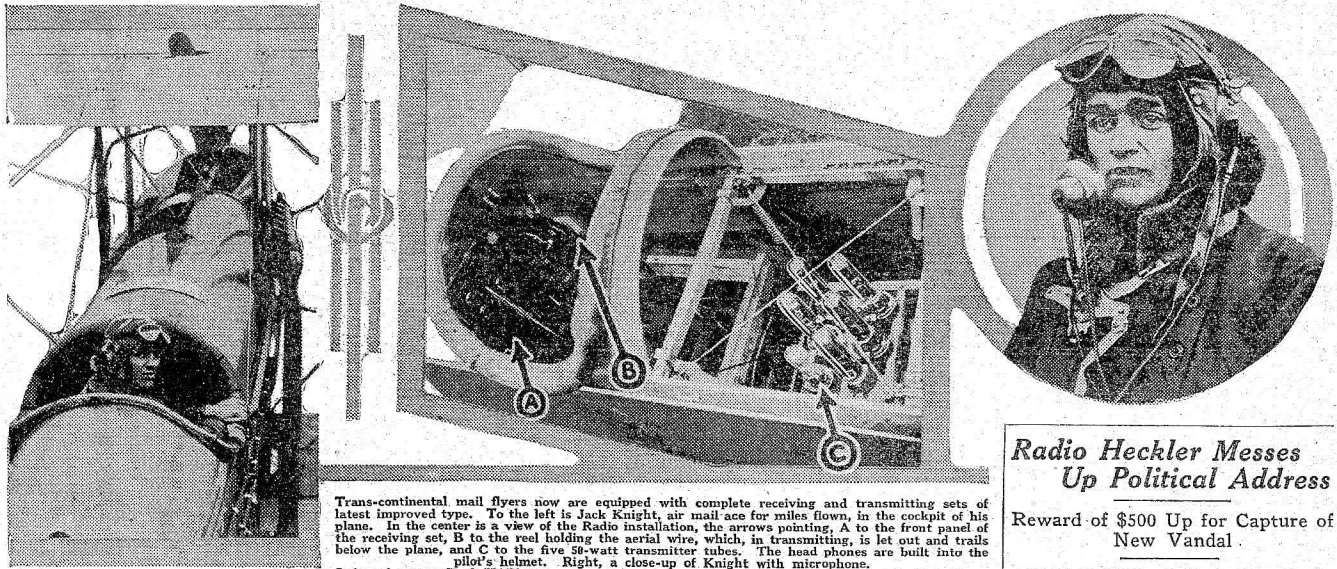
Only \$34.49

ADDITIONAL ACCESSORIES
These accessories, added to the above list of parts, are absolutely all the parts necessary for a complete set in operating condition.
5 Tested Type 201A Tubes \$19.50
2 45-Volt Extra Large Variable "B" Batteries 6.50
1 60 Ampere Hour Storage Battery, Guaranteed 2 Years 11.25
1 Pair Turney 3000 Ohm Head Phones and Cord... 3.75
1 Phone Plug, Double30
1 Antenna Outfit, Complete 1.50
Special \$43.40

FREE—Send in your order Now for
1 5-Tube Kit \$34.49
1 Set Accessories 43.40
Total \$77.89
And we will send you FREE a Beautiful Mahogany Finish Cabinet for the Set, with Our Compliments.

GOLD BUS BAR Most Efficient. Allows high frequency currents least resistance. Used in finest sets. Reg. 15c. 8c	HYDROMETERS Very Accurate. Packed in wooden moisture proof box. Reg. 75c. 39c
TUBE PROTECTORS Impossible to blow your tubes if you attach these to end of socket for 1/4 or 1 amp. tubes. 29c	TRANSFORMERS Audio Frequency, well known standard make. Ratio 4-1. Reg. \$5.50. \$2.89
VERNIER CONTROL For any Dial. Makes a Vernier out of any make condenser. Very efficient. Reg. 75c. 29c	JACKS Single or Double Heavy Springs—German Silver Contacts. Nickel finish. Reg. 30c. 39c
AERIAL WIRE 7 strand tinned copper wire gives excellent results on DX work. Reg. \$1.00. 55c per 100 Feet	LITZ WIRE Most efficient. A double silk covered wire with 37 strands of No. 35 wire, each strand enameled. Wonderful for Coils, Loops, etc. 3c per Foot
PANELS Beautiful high finish panels made by the American Hard Rubber Co. 7x10 \$0.85 7x12 1.10 7x14 1.20 7x18 1.50 7x21 1.75 7x24 2.00 7x28 2.35	RADIO CORPORATION PHONOGRAPH UNITS Complete with cord and plug, they make a truly wonderful showing in both volume and clarity. List, \$18.00. Special, \$8.50

TWO-WAY SET FOR AIR MAILMAN



Trans-continental mail flyers now are equipped with complete receiving and transmitting sets of latest improved type. To the left is Jack Knight, air mail ace for miles flown, in the cockpit of his plane. In the center is a view of the Radio installation, the arrows pointing, A to the front panel of the receiving set, B to the reel holding the aerial wire, which, in transmitting, is let out and trails below the plane, and C to the five 50-watt transmitter tubes. The head phones are built into the pilot's helmet. Right, a close-up of Knight with microphone. Left and center, K. & H. Photos. Right, P. & A. Photo

Radio Heckler Messes Up Political Address

Reward of \$500 Up for Capture of New Vandal.

KANSAS CITY.—Radio heckling is the latest development in political campaigning.

So declared the Democratic city central committee here recently in announcing a reward of \$500 for information leading to the apprehension of a "Radio vandal," alleged to have interfered with broadcasting speeches in the heated city election campaign.

Officials of the station declared some person employed an oscillator attached to an antenna nearby with the result that the program was heterodyned so as to be rendered unintelligible. United States Senator James A. Reed was one of the speakers.

Truck Driver Speaks to Broadcasting Financier

Talks Things Over After Listening with Crystal Set

NEW YORK.—Two prominent men in financial circles were discussing an important question at the intersection of two streets in Brooklyn. A negro, driving a team of horses, was forced to wait at the curb as the traffic officer allowed

vehicles to pass in the other direction. The negro overheard the conversation between the two men and after a few moments stepped down and said, "Pahdon me, sah, ahn't you all the gen'lman, Mr. Vice-president Peter Hamilton, o' the Lawyers' Mortgage company what broadcasts through WEAJ every Monday evening?"

Mr. Hamilton, started, turned at this greeting and answered, "Yes, I am." "Well, sah," answered the darky, "Ah, want to say Ah have enjoyed youah financial talks on mah crystal set and Ah suah am pleased to meet you all." Just then

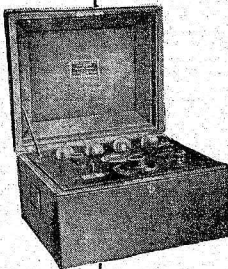
the traffic officer's whistle blew and the colored financial expert assumed his regular duty as charioteer of his express wagon.

Amateur Radio apparatus and parts are being manufactured by about 160 German firms according to Kurt Hildesheimer, clerk to the American commercial attaché. About 100 of these firms are located in Berlin and the rest throughout Germany.

Station WKAQ, San Juan, Porto Rico, has been heard in Glasgow, Scotland.

BRISTOL SINGLE CONTROL RADIO RECEIVER

Using Grimes Inverse Duplex System. Patents Pending



Most Simple to Operate

The set for those who want results with little effort. Anyone in the family can quickly learn to operate it because technicalities and guesswork are eliminated—One Control Dial does it all.

Does Not Interfere With Your Neighbor

Other close by reception is not disturbed when you tune in with this non-reradiating Receiving Set. It gives you a comfortable sensation of freedom to be able to change from one station to another knowing that you will not interfere with your neighbor's receiving.

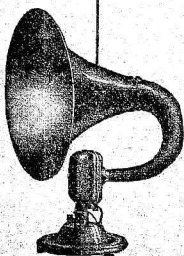
Choice of Aerial or Loop

Where conditions make it difficult to install an outside aerial, as in congested sections of cities, good results can usually be had by using inside Loop. In fact, the directional feature of the Loop often brings in stations not possible with a stationary aerial.

Mounted in solid mahogany case with walnut finish, the Bristol Single Control Radio Receiver is handsome in appearance. The price is \$100.00. Bulletin AY-2013 describing this set will be mailed on request.

BRISTOL TRADE MARK AUDIOPHONE

Loud Speaker

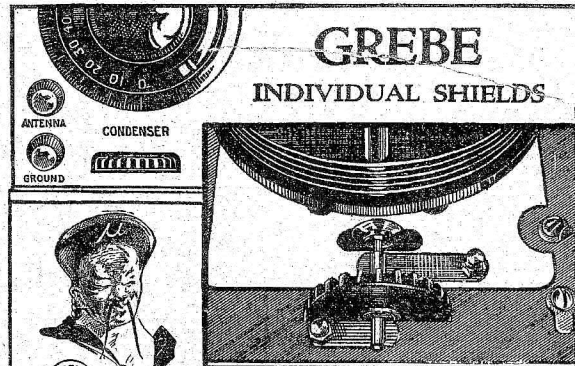


This is known everywhere as the Loud Speaker with the quality tone. Not only is the tone natural and without mechanical distortion, but is sufficiently big in volume to be easily heard in a large room or all through the house. Comes to you ready to use—no auxiliary batteries are required.

Made in three models:
 Audiophone Senior.....Price, \$30.00
 Audiophone Junior.....Price, 22.50
 Baby Audiophone.....Price, 12.50

THE BRISTOL COMPANY, Waterbury, Conn.

GREBE INDIVIDUAL SHIELDS



"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.

Doctor Hys

Grebe Regenerative Receivers are licensed under Armstrong U.S. Pat. No. 1,113,149

CLOSE inspection of many regenerative receivers reveals but one large shield to prevent body-capacity effects. The Grebe engineers believed that this method resulted in the absorption and dissipation of too much precious energy.

As a result of their 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.

A. H. GREBE & Co., Inc.

Richmond Hill, N.Y.

AIRWAVES OUTSPEED ESCAPING FUGITIVES

POLICE TURN TO RADIO TO PUT DOWN CRIME

New Orleans Chief Sees Need of National System of Lightning Communication

(By R. A. Sullivan)

NEW ORLEANS, LA.—The next logical and practical step for Radio is a national system of police communication for the apprehension of criminals, according to Colonel Guy R. Molony, superintendent of the New Orleans police department.

This step, in the belief of experts in crime detection, will be but a move toward keeping a jump ahead of criminals who already employ the swiftest of automobiles, the most accurate of firearms and a skill that challenges the best brains that police departments the country over can produce in the ceaseless game of hide-and-seek between sleuths and crooks.

Swift as the speediest of automobiles bearing thieves away from the scene of a crime, they are making but a snail's pace beside the terrific pace that Radio communication can set.

Rum Smugglers Use Radio

The police superintendent believes the time has come when each police headquarters in every city of size will have its broadcasting station, and that smaller towns also will be so provided.

Already Radio is being used by rum pirates in the Gulf of Mexico. During a recent daring raid, a vast store of liquors that had been brought ashore in small boats from a rum vessel, was found near a Radio transmitter and receiver. Police declare the outfit was used by members of the rum-smuggling band ashore to communicate with their accomplices at sea—an incident in the use of Radio which was reported in Radio Digest at the time the seizure was made.

Although no similar seizures have been made since, police believe no time should be lost in perfecting a system of Radio communication. Colonel Molony proposes to take this important matter up at the next convention of the Police Executives of America.

Wish Crooks Were in One Band

It is believed a need exists for quick work on the proposal. Criminals, trained to keep abreast of their foes, the police, may be at this moment perfecting their own systems of air communication, with perhaps even an elaborate secret code. Given but a small lead, men who hold their lives in their own hands are considered likely to act swifter and surer, at least for a while, more effectively than their organized enemies.

That warning, experts say, should not be taken in the sense that there are two warring factions—a group of police on the one side and a single organization of crooks on the other. There is, in truth, the single group of police. They are, each in their own cities, essaying to protect the lives and property of citizens. The criminals, instead of being one solid organization under one leader, are pictured as being members of hundreds of small groups, and in many instances merely individuals, or in small bodies of twos and threes.

The police are united in the belief the problem of crime prevention would be simplified if all the crooks were, indeed, in one single organization, and with one leader. But, scattered as they are, from one end of the country to the other, the subject takes in many difficult phases, and in attempting to solve their problem, the police are turning to Radio for help.

Asks Science Jury to Hear New Radio Lingvo

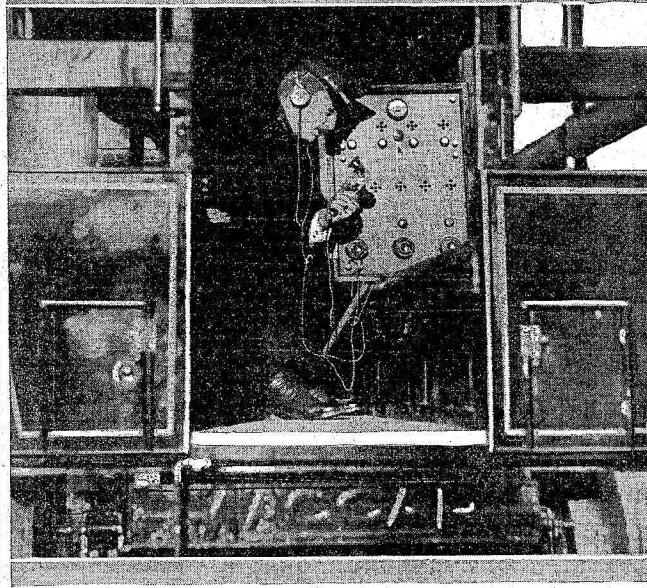
Discoverer of Language Seeks Chance to Demonstrate

WASHINGTON.—Secretary of Commerce Hoover has been asked by Howison E. Hoover of this city to appoint a jury of representative experts, scientists, philologists, engineers and other savants to hear his exposition of a new Radio language.

The writer says that he has discovered, not invented, this universal tongue, which he claims is as old as time and space. He pointed out that it needs no dictionary nor encyclopedia, the words being built up on a logical basis as they are needed. They are readily deciphered by the same process by the one who receives them visually, audibly or electrically, he explains. There are only three basic verbs, and yet it has none of the narrow limitations of any of the national languages.

"It is not an artificial language as Volapuk, Idom, Neutral, Esperanto, Ido or other attempts to solve the question," he adds. The suggested scheme is based upon an underlying principle of nature: "the sounds of nature are a perfect cosmic hieroglyph," and as such are a perfect container of all phenomena.

CATCH CRIMINALS WITH RADIO



Owing to the increase in crime, the Philadelphia police department has installed Radio receiving and transmitting equipment in their patrol wagons for the purpose of aiding police in their constant pursuit of criminals. New Orleans considers installing a similar system. Photo shows Lieutenant Harry Edwards sending headquarters a message.

PROHIBIT ORCHESTRAS BROADCASTING MUSIC

Jerome Kern's Attitude Stirs Band Leader Paul Specht

NEW YORK.—Talking of composer Jerome Kern's attitude that orchestras be banned from playing his music, Paul Specht, renowned band leader and Radio broadcaster, went further to insist that orchestras should be paid by composers for rendering such melodies.

"I receive hundreds of requests for the names of certain songs that I play, and the inquirers make note of the titles in order to purchase the music in some form or other.

"If Mr. Kern holds the band director in such low esteem, why doesn't the American Society insist that the orchestra pay the license fee instead of the cafe, theater or Radio owner?"

"Another thing, I wonder if Mr. Kern realizes that there are more than a few leaders of orchestras that can write songs that compare more than favorably with those of some so-called composers?" asked Mr. Specht.

Listen in for African Broadcasting Programs

British Officials Arrange for Sets in Each Village

WASHINGTON.—There is now no excuse for sympathetic persons bewailing the plight of the poor African. Ever since Britain took over the broad plains and fertile valleys of what was formerly German Africa a succession of developments and improvements have been going on. Now the sophistication of the natives reaches its climax with the proposed installation of Radio receiving apparatus in each village.

\$200

SELECTIVITY

for \$8.50!

We guarantee that the Ferbend Wave Trap, when properly connected to any workable receiving set, will tune out any interfering station

Make Every Night Silent Night!

TRAP OUT THE INTERFERENCE

Selectivity—which is merely the ability to cut out interference—is the dominating difference between the very expensive sets and the moderately priced ones. Why pay \$50.00 to \$200.00 extra for increased selectivity, when for \$8.50 you can get a FERBEND WAVE TRAP which will absolutely cut out any interfering station, no matter how loud, how close by or how troublesome.

Add a Ferbend Wave Trap to Your Set

You will find it a valuable addition. It is designed and manufactured complete by us, after years of careful experimenting. It is not to be confused with imitations hastily assembled from ordinary parts. The price is \$8.50. Shipment is made parcel post C. O. D. plus a few cents postage. If you prefer, you can send cash in full with order and we will ship postage prepaid. Send us your order today.

FERBEND ELECTRIC COMPANY
19 E. South Water St.
Dept. 3 CHICAGO

Descriptive Folder on Request

FERBEND Wave Trap

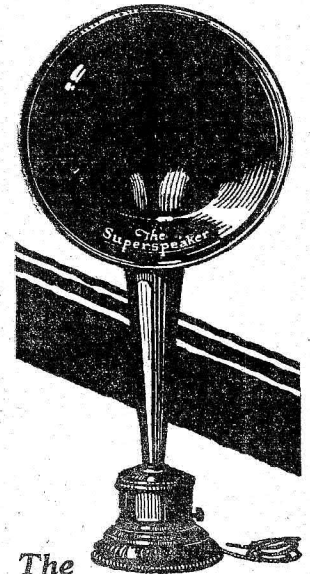
Chauncey Depew's Birthday Talk Heard by Radiophone

NEW YORK.—Passing the ninety-year milestone in the race of life, Chauncey M. Depew, former senator and Chairman of the Board of Directors of the New York Central railroad, was the guest of honor at a banquet tendered him and broadcast from Station WJZ here recently.

He is noted for being one of the most brilliant after-dinner speakers in the country, and the invisible audience had an opportunity to hear him at his best.

Mr. Depew told his audience that the secret of his youth and longevity of life was due to using two sets of brains, one for work and the other for play. This conserves both body and mind. "I would rather have a good laugh than a dose of castor oil for any ailment or complaint," said Mr. Depew.

If a soft, satin finish is desired on the panel rub it with coarse sandpaper, finishing with several rubs of fine steel wool, rubbing in one direction.



The Superspeaker

USE YOUR PET ONE-TUBE SET

to test this revolutionary reproducing instrument. The wider your experience, the greater will be your amazement and delight. On many such sets the Superspeaker is the only equipment that will yield satisfactory results.

On multi-tube sets, Superspeaker results are just as strikingly superior. Exclusive micrometer air-gap adjustment insures range without extra batteries. Big, substantial non-metallic horn—finished in glossy ebony. More good dealers wanted.

JEWETT RADIO & PHONOGRAPH COMPANY
5662 Twelfth Street
DETROIT MICHIGAN

Why Don't I Hear Los Angeles Every Night?

Sets Not Always to Blame for Non-Reception

By Wilson N. Durham

"WHY don't I hear Los Angeles? I have spent \$600 for the best Radio set that I could buy and still I do not get the West Coast." You have all heard these or similar questions, perhaps you have asked them. The answers given have probably been many and varied and possibly disappointing to the listener who thinks that he can always increase the distance over which his set will receive by increasing its sensitivity.

The Radio public seem to believe that long distance reception can always be attained if the receiver is sensitive enough. This belief has very probably resulted from a consideration of the claims of results obtainable by employing Radio frequency amplification, that is, amplifying the incoming energy before it is changed in form by the detector tube. A consideration of the theory of Radio frequency amplification alone would logically lead to such a conclusion. "Increase the sensitivity of your receiver and you will increase your receiving range." This theory alone is not correct and we will try to tell you why.

Speed of Electromagnetic Waves

The electromagnetic energy emitted from the antenna of a broadcasting station is believed to radiate in every direction and to go on and on into space, with diminishing strength, but nevertheless continuing forever at the astonishing speed of 186,000 miles per second. The greater the power of the transmitter, the greater will be the strength of the received signal at a given distance. It is to be noted, however, when considering the amount of power required for Radio transmission that due to absorption, reflection and refraction of the electromagnetic waves the question is almost as difficult to answer as the question, "How far can a man's voice be heard?" Over a quiet lake in the evening a man's voice may carry two or three miles, while on a city street the same voice would carry but 500 feet on account of disturbing noises in the city. Atmospheric disturbances make the range of a Radio broadcasting station almost as indeterminate.

It can be seen then that there are two important factors, in addition to the sensitivity of the receiver, governing the distance over which it is possible to receive, the decrease of signal strength as the distance from the transmitter increases and the presence of atmospheric disturbances of varying intensity. These atmospheric disturbances include the radio frequency electrical noises resulting from the operation of electrical machinery such as motors, trolleys, elevators, arc lights, etc., and static, which is the electrical noise caused by electrical charges in the atmosphere itself, by electrical storms and discharges of electricity between the clouds. This is the cause of

the crashing sound sometimes heard in the headset or loud speaker resembling thunder crashes during summer storms. The ratio between the signal intensity and the static intensity determines whether or not the signal will be heard. If the signal is stronger, it will be heard, if weaker, it may not be heard at all.

Force That Carries Transmissions Through Ether

Let us consider first what affects the strength of the transmission from the broadcasting station. As has been noted, the electromagnetic waves set up by the transmitter are propagated in all directions through the medium we call the ether, at a velocity equal to that of light. As the distance from the transmitter increases their intensity decreases, due to the waves spreading out in ever-widening circles and absorption by the different media through which or over which the waves may travel. Many investigations have been made to determine to what this energy absorption is due, and many interesting facts disclosed.

Signals from a certain station may be very much stronger at night on account of an absorptive effect of light rays on them during the day. At night, due to variations in atmospheric conditions the energy losses in transmission are decreased. In practice it is generally found that transmission is very much more effective at night than in the daytime; the distance over which it is possible to receive being increased sometimes two or three times or more.

Another interesting fact in connection with the variation in transmission is the fact first recorded by Marconi in his early trans-Atlantic tests. When the line of sunrise or sunset is between the two stations, transmission is very difficult and the signal received very weak. This phenomenon is still apparent and considerable interruption is experienced at times even today with our tremendously powerful trans-Atlantic telegraphic transmitting and receiving station. It seems as though the twilight lines act as either a reflector or absorber of the Radio waves.

Strength of Received Signal

The strength of the received signal varies also with the seasons, the effective distance being much greater in winter than in summer. The reason for this seasonal variation of signal strength is considered as being due to the absorption of the waves by vegetation, thus causing a marked decrease during the summer months. This seems to be a reasonable conclusion in view of the fact that trees have been successfully used as antennae, thus demonstrating their energy absorbing qualities. This may also explain why it is possible to receive much greater distances over water than over land with the same transmitting power.

It has been found that there are many

places where it is difficult to receive signals from certain stations, or perhaps from any station. These localities we call dead spots, and can be attributed to many causes. In the cities it often happens that there is a shielding or absorbing effect due to many steel structures. In the country, and the mountains particularly, deposits of ore may greatly reduce the strength of the received signal, for the main energy of the wave is absorbed before it reaches the receiving station.

This effect is also noticeable in ship to shore communication. It is sometimes impossible for a ship located near the north shore of an island to satisfactorily communicate with a land station on the south shore even though the two stations are separated by but a few miles; while it becomes easily possible to carry on the communication when the ship is one hundred miles north of the island. So much for the factors affecting the signals radiated from the broadcasting station. Now let us consider the static.

Atmospheric Disturbances

Seasonal changes also affect the intensity of the atmospheric disturbances due to the electrical charges in the ether. In summer the static greatly increases over its average strength for the winter months and therefore becomes troublesome at times when distance reception is desired. When electrical storms are in the immediate vicinity of the receiving station it may be possible to hear only the local stations.

There is always a great amount of electrical disturbance in the large cities due to the operation of electrical machinery. Its intensity depends upon the locality in which the receiving set is located. Sometimes disturbances of this sort make distant reception impossible regardless of the type receiver that may be employed. Naturally the man who has bought the finest set available expects the finest kind of reception, and it is sometimes difficult to explain to him why he cannot get results in spite of the apparatus he uses. Without knowing the cause of the trouble he immediately puts the blame on the equipment or the unfortunate dealer.

We have seen that the ratio of signal strength to static strength is the determining factor in the distance over which any receiving set will satisfactorily operate, and unless the signal is louder than the static it cannot be heard clearly. No matter how weak the static may appear with the average receiver, it may always be made strong enough to result in the same crashing sound, if a very sensitive receiver is used. Let us suppose that we have such a receiver, a super-heterodyne for instance, which has facilities for obtaining very great Radio frequency amplification; that it is set up for operation in Philadelphia; that it is a favorable night for reception; and that we succeed in picking up the West Coast clearly and with very little static disturbance. Why cannot this same performance be duplicated any night? This is the question many are asking.

Not the Same Every Night

On the following night, perhaps, the same set is tuned to the same station at the same time as on the night before, but, with the same adjustments and the same amplification, no signals are heard. Why? The signal was there the night before and could be tuned in with far less amplification, while tonight increasing the amplification merely increases the crackling in the receivers. If the signal is brought in at all it is so very weak as compared to the noise that it is not enjoyable.

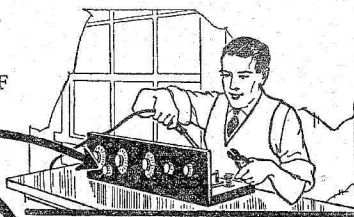
One of two things has happened: Either the signal strength has actually dropped below that of the previous night or the static strength has increased so that the ratio of signal to static is not as favorable as the night before and is so loud that the signals cannot be heard.

This is the answer to our question. Los Angeles cannot be heard tonight because the ratio of signal to static has changed and no receiving apparatus obtainable for home use today can bring through the desired signal. If the sensitivity of the set is increased, the static roar increases and the signal strength increases, but both in the same ratio, and if the signal was not audible before it will be no more audible with the increased sensitivity. Therefore (Continued on page 28)

AT ALL DEALERS

\$1.85

Condenser .00025-MF
35c



Build for Success!

Be sure that your detector tube is working at its highest efficiency by using a Bradleyleak for grid leak control. This remarkable adjustable grid leak has a perfectly smooth and stepless range from 1/4 to 10 megohms and is unaffected by atmospheric changes.

It is highly endorsed by Flewelling, Crosley, Kennedy, Radio News and has been adopted as standard equipment in all Amrad high-priced sets.

Be sure your set is made perfect by installing a Bradleyleak. Try one, tonight.

ALLEN-BRADLEY CO.
290 Greenfield Ave. Milwaukee, Wis.
Manufacturers of the Universal Bradleystat

- Audion (DeForest) DV-5, 2 Megohms
- C-200 2 Megohms
- C-299 2 to 5 Megohms
- C-301-A 2 Megohms
- UV-199 2 to 5 Megohms
- UV-200 2 Megohms
- UV-201-A 2 Megohms
- WD-11 3 Megohms, or more
- WD-12 3 Megohms, or more

Bradleyleak

THE PERFECT GRID LEAK

Magnavox Radio Reproducer M1 can be used with any receiving set, and requires no battery for its operation.

MAGNAVOX Reproducer M1

RESULTS secured by thousands of satisfied users prove that M1 is the *universal* Radio Reproducer, operating equally well under practically every condition, and may be connected as simply as a head set.

Magnavox M1 can be had of good dealers everywhere, \$35.00

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New York Office: 350 West 31st Street

Canadian Distributors: Perkins Electric Limited, Toronto, Montreal, Winnipeg

Hum in the Green Circuit

More Light on This Good Circuit

By Myron P. Green

FOR the benefit of those who have written me regarding the hum and knocking noise present in the circuit, I shall now say a few words.

The click or knocking is caused by one of three things and is often found in sets carelessly put together. It may arise from defective phone connections either at the terminals or in the cord proper, to a loose wire inside the set, or a choked grid condenser. It often happens, after a wire is soldered into place, that it will break away from its terminal as the solder cools. To all appearances it is a perfectly soldered wire, but the joint is not perfect. It cannot be too emphatically stated that as much care should be spent on the inside as on the outside or panel. "A chain is only as strong as its weakest link," you should remember, and a Radio set no better than its weakest point. Impatience will ruin many good sets. A good policy when soldering connections is to use the least possible amount of solder. Look at any factory built outfit and you will understand this statement.

The hum that sounds a good deal like high power voltage sometimes is caused by the wrong A battery connections, in which case switch them. In other instances it may be accounted for by the use of the wrong tube for this circuit. I have found by actual test the only tubes that can be used with any degree of perfection are the UV-200 and the UV-199. It will work much better when the former are used.

If you intend to use dry cells, I suggest the UV-199 and a resilient base to overcome microphonic noises. There is a tube on the market of the UV-199 type

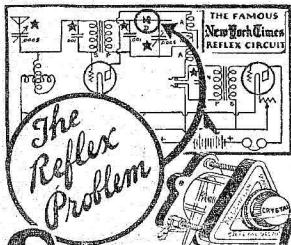
(that to all appearances is a genuine tube, but it is a "bootlegger." It has been found both in Canada and the United States (Canadians who have written me please note).

Should the hum persist even when using the 6-volt tube, there is only one remedy: Ground the minus filament by running a wire from the minus A to the ground connection. This will cut it out entirely. Each set, when made, possesses individual characteristics that sometimes are "goat-getters," but any set, no matter what these characteristics may be, can be made to "come to time" by diligent exploration on the part of the builder. The man who has had sufficient experience in making sets will tell you very few of his first sets worked the minute they were completed.

The writer knows of several instances where the set was completely finished, checked up, and the O. K. mark placed upon it, yet it refused to work. I have tried for a half hour or more without results, but just when I had reached the point of desperation, in would come the signals. There was a choke somewhere, but where?

So, you see, there are many things peculiar to Radio that are difficult of explanation.

Don't mount your tube socket with the grid and plate leads next to the panel. Place this side of the socket to the rear, having the two filament leads next to the panel.



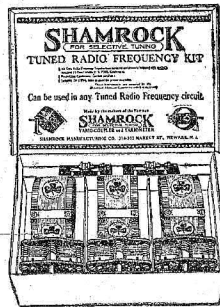
The Reflex Problem SOLVED.
FRESHMAN
DOUBLE ADJUSTABLE
CRYSTAL DETECTOR
The World's Best
for crystal or reflex sets
This crystal detector
makes two tubes do
the work of four!

FREE! Send for Freshman Building Plan of N. Y. Times Reflex—gives panel layout, circuit and parts required. Operates Loud Speaker on two tubes!

FRESHMAN
 Double Adjustable Crystal Detector for panel or base use, complete with crystal.

\$1.50
 Freshman Super-Crystal With Non-Metallic Housing 50c
 No more searching for the sensitive spot, merely turn the knob as you would a dial!

At your dealer's; or send purchase price to be supplied postpaid.
Chas. Freshman Co. Inc.
Radio Condenser Products
 106 Seventh Ave., N. Y. C.



"37 distant stations heard in one night"

IF ANYTHING is good, I sure believe in praising it—and I can't begin to praise your Shamrock Kit enough. I threw out a high-priced regenerative set because of poor selectivity. . . .

"I am enclosing original list taken Thursday, February 28, 1924. At all times at least two Chicago stations were on.

"The month of February I received 577 stations outside Chicago. Of course, these are not all different—but adding up the nights' totals. So far in March (17 days) have received 390 stations. . . ."

A few of the stations tuned in

WOR, Newark; WSB, Atlanta; WEAP, Ft. Worth; CKCK, Regina, Can.; KHJ, Los Angeles; KGW, Portland; WKAQ, San Juan, P. R.

The above is only one of hundreds of letters that we have received praising the wonderful efficiency of the Shamrock Kit. Inspect this kit at your dealer's today. If he hasn't it in stock, send us the coupon below.

Kit, list price \$20

SHAMROCK MANUFACTURING CO.
 Dept. 27, Market St. Newark, N. J.



SHAMROCK MFG. CO.,
 Dept. 27, Market St., Newark, N. J.
 Gentlemen: Please send me detailed information on the Shamrock Kit.

Name _____
 Address _____
 Dealer's Name _____

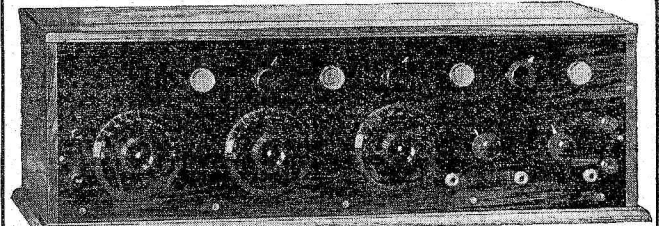
5 Tube Licensed Neutrodyne

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Special Ten Day Offer with Each Set

On account of this special offer you must pay the express



8x26x8, Mahogany, Walnut, Oak, with Piano Hinges

ALL LICENSED PARTS

WHEN you get this magnificent looking set wired and hooked up, you will be able to hear all stations without interference. All parts are same as illustrated in Radio Digest, Feb. 2nd. Panel is mahogany with beautiful mahogany dials—a set fitted for the most exclusive home.

BLUE PRINT FREE
 EASY TO WIRE

\$48.50

SEE BELOW

Mounted on Panel and Baseboard

3 RHEOSTATS, 25 OHMS, HOWARD	2 TRANSFORMERS ALL AMERICAN	4 BEZELS	3 NEUTROFORMERS
1 POTENTIOMETER, 1850 OHMS, FEDERAL	1 GRID LEAK AND CONDENSER, WALNUT	3 DIALS MAHOGANY 4" ON FRONT	1 8 X 26 X 3/16" MAHOGANY PANEL
3 JACKS CARTER	9 READEM BINDING POSTS	5 SOCKETS KELLOGGS	2 NEUTRODONS
2 .006 MFD. FIXED CONDENSERS	24 FT. SPAGETTI TUBING.	24 FT. SQUARE TINNED BUS WIRE	1 7 1/2 X 25 X 1/2 BASE BOARD

Panel not mounted or drilled, only \$45.50 with \$12.50 Cabinet and blueprints FREE.

COMPLETE WITH ALL EQUIPMENT

IN ADDITION TO ABOVE PARTS

5 Tubes	\$25.00	2 2 1/2 Volt B Batteries	\$ 6.00
1 110 Ampere Storage Battery	18.00		
1 Deluxe Homecharger	18.00		\$56.00
1 Headset	12.00	1 Loud Speaker	12.50
1 Complete Aerial Equipment	1.50		
1 5 Volt B Battery	5.00		
TOTAL		\$88.50	

The above parts and equipment complete would cost you \$159.50! Our Price \$125.00

Written Money Back Guarantee with Each Set

Special Sale on Webster Condensers, Fine for Super-Heterodyne
 Variable Condenser, .0005 (same as 23 plate), \$2.98
 Variable Condenser, .001 (same as 45 plate), \$2.98
 list, \$5.50. While they last—Bargain at \$2.98. Big buy at \$2.98

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 All Orders Mailed Promptly. No Stamps Accepted. Send Check or Money Order.

Quality Merchandise at Low Prices
Economical Radio House
 4600 LINCOLN AVENUE, CHICAGO

We Personally Guarantee All Goods

What's Wrong with Your Receiving Set?

Chapter XI—Tuning the Neutrodyne Receiver

By Peter J. M. Clute

ONE of the most important problems in the Radio game at the present time is the elimination of the use of receiving sets that re-radiate and cause a great deal of local interference. From this point of view, the neutrodyne circuit is ideal, combining in one receiver such desirable qualities as remarkable selectivity, extreme sensitiveness and the prevention of regeneration and oscillation.

The neutralization or balancing-out of the capacity coupling that exists between the various parts of receiver circuits, constitutes the essential principle of the neutrodyne circuit. The relatively small capacity present between the plate and grid elements of the electron tube has been the cause of inferior DX reception and has made impracticable the design of efficient Radio-frequency amplifiers. In this condition, the adjustments and regulations are extremely critical and regeneration will readily occur. The prevention of regeneration, and its consequent re-radiation of local interference is one of the outstanding features of the neutrodyne circuit.

Tuning Regeneration and Non-Regeneration Sets

Before the introduction of the neutrodyne principle, non-regenerative and regenerative receivers were in general use. The latter type called for a rather complicated method of tuning, in that the wave length control had first to be adjusted, followed by variation in the regeneration control, it usually being necessary to patiently vary the control before any signals could be brought in minus bothersome distortion. Furthermore, with regenerative receivers, the adjustment for good reception of signals is practically never constant. In other words, when tuning such a receiver, the operator cannot be sure of getting a particular station by referring to previously obtained dial settings.

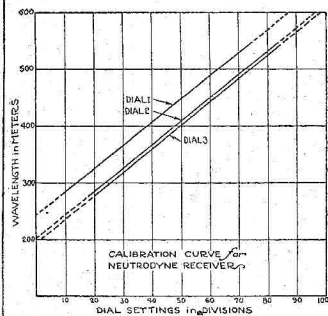
In the matter of tuning or of selecting the program of one station from that of another, the neutrodyne circuit receivers particularly have the advantage over receivers of the ordinary types. In tuning neutrodyne receivers, the programs from the different broadcasting stations will not be picked up by hearing beat notes or by the well-known regenerative whistle to denote the presence of a carrier wave. Inasmuch as the adjustments are rather critical, each stage of Radio frequency amplification must be tuned to the proper wave length before reception may be had. Once the skill of tuning is acquired, the distance from which reception can be heard appears to be unlimited.

Exact Dial Markings May Be Secured

Perhaps the greatest advantage offered by any tuned Radio-frequency amplifier, such as the neutrodyne, lies in the fact that each dial used for interstage coupling may be calibrated for wave length settings. Obviously, this holds true only when the relative position of the dial on the shaft and the rotor of the device remains unchanged. In the preliminary tuning, the neutrodyne dials are adjusted so as to bring in certain broadcasting stations operating at well-defined wave lengths. The settings of the dials are then recorded for future reference, or the various readings for a number of stations are

plotted on a graph sheet, with dial setting as abscissa and the wave length as ordinate. This so-called "graphical selectivity" makes the operation of a neutrodyne receiver almost an automatic process, once the calibration curves for the several dials have been plotted. In most instances, it is only necessary to set the coupling dials at their recorded positions for a specific wave length and perform the requisite fine adjustments by means of the tuning dial in the antenna circuit.

The procedure to be followed in tuning neutrodyne receiving sets differs in many respects from that employed for ordinary



receivers. The detailed tuning instructions given below should be carefully studied, together with the method of adjusting or balancing-out the circuit as previously discussed.

Best Tubes to Be Used

While neutrodyne receivers will operate fairly well employing any of the dry cell types of vacuum tubes, such as the UV-199, C-299, WD-11 or WD-12, it is recommended that wherever possible either the UV-201, C-301, UV-201A or C-301A amplifier tubes be used, in combination with a UV-200 or a C-300 detector tube. When using dry cell tubes, it should not be expected that the signal strength will be nearly as great as with the storage battery type of tubes, because the current that the tube is capable of handling is very much less.

Before inserting the vacuum tubes in their sockets, it is advisable to turn the filament rheostats to the left as far as possible. After the tubes are in position turn the amplifier tubes rheostat toward the right to the correct operating position for the type of tubes being used. With the amplifier tube filaments lit, turn the vernier detector filament rheostat slowly to the right. Indication that the receiver is functioning properly will be manifested by a slight scratching noise in the receivers. Turning this rheostat further to the right will not cause this noise to increase in volume, until a position is reached, near the end of the rheostat travel or adjustment, where a comparatively loud hissing sound will be heard. For best operation, this rheostat knob should be moved back to a point just before the hissing noise starts. Quick adjustment of the rheostat is afforded by the

coarse setting, with very accurate adjustments being made by means of the vernier attachment. Obviously this point of adjustment will vary with different detector tubes, even with those of the same type especially if a soft detector tube is employed. The rheostats have no critical effect upon operation of the set, and after once being adjusted they need not be touched unless the filament battery runs down. Care should be taken to increase the filament current of the tubes until the signal is at its maximum. There will be no advantage gained by advancing beyond that point.

Tuning the Set

To tune the set, three 100-division dials are provided, one for each of the neutroformers. The left-hand dial 1 tunes the antenna circuit and the other two dials 2 and 3 tune the first and second Radio frequency or neutrostages, respectively. When using a long antenna, all three dials will be set very close to the same reading for a particular station. Using a short antenna, the antenna tuning dial will vary somewhat from the others, depending upon the amount of antenna used. Hence, in tuning, set dials 2 and 3 at approximately the same setting and vary dial 1.

The sensitive response in the receivers, in place of a deep silence, will be apparent when the three circuits are in tune, even though no station is operating at that wave length. If no signal is heard, advance dials 2 and 3, or retard both equally, a few degrees and turn dial 1 until the live or sensitive response or the station itself is heard. Repeat the operation in any portion of the dials for obtaining stations operating at other wave lengths. It should be particularly noted that the dials should not be set at widely different settings, as no reception can be expected under such conditions.

The illustration shows the wave length calibration curves for a typical neutrodyne receiver. It will be noted that the settings of dials 2 and 3 are nearly the same and are quite uniform. The settings of dial 1 obviously, will vary from those plotted according to the various antennas used.

With the detector and amplifier tubes operating properly, dials 2 and 3 should be

tuned to approximately the same dial settings. The wave length range of the receiver whose settings are here plotted is such that a wave length of, say, 380 meters (790 kilocycles) corresponds approximately to dial settings of 43 for dial 2 and 45 for dial 3. Next turn the tuning neutroformer dial 1 very slowly over its entire range of divisions. Provided a station is broadcasting on a wave length of 380 meters, it should be heard with maximum intensity when the setting of dial 1 is in the range of 10 or 15 degrees above or below the settings of the other two dials. The wave length range of a properly constructed neutrodyne will be from about 200 to 600 meters, so that all broadcasting stations may be heard.

Increasing Signal Intensity

After picking up a station, it will be advisable to carefully readjust the dials and the vernier detector tube rheostat so as to increase the signal intensity. Dials 2 and 3 should be rotated slowly simultaneously, and approximately in step with each other. With these dials on the setting for a particular station, dial 1 should be turned until the signals are heard with maximum intensity and clarity. In tuning, all dials should be rotated very slowly. The tuning adjustment may have to be changed a little when plugging from one jack to another.

It is recommended that the operator should keep a log of the call letters and the various dial settings at which the different broadcasting stations are heard. Thereafter, whenever it is desired to hear a particular station, it is merely necessary to reset the dials to these same positions. If the station selected is operating at that time, the signals will be heard.

If a chart is made of the various dial settings, similar to that shown, any station within the range of the receiver should be heard by setting the dials for the wave length of the station desired. To find the dial settings from such a chart for a given wave length, run a line horizontally from the left margin until it intersects the three dial curves. The projects of these intersections on the bottom margin will show the dial settings for that particular wave length.

(TO BE CONTINUED)

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The low loss Condenser designed by Flewelling is the utmost in skillful construction and scientific design. Built to last, to stand more than ordinary abuse, it is extra rugged; it is as near electrical and mechanical perfection as human ingenuity can make it. Supplied in .0005 mfd. capacity. Price \$7.00



This Flewelling low loss Tuner is more than an ordinary piece of tuning apparatus; it is designed and constructed with the same painstaking care as all other Buell Parts. It is built to produce satisfactory results and render the acme of service. Price \$8.00



Short direct terminals; contacts of the improved "side-wiping" design are the secret of the Flewelling Socket. This socket is surprising in its performance. The positive contacts assure permanent connections and elimination of so called "tube noises" that many times are the result of a faulty socket. Price \$1.00

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2977 Cottage Grove Ave.
CHICAGO

CONDENSERS TUNERS SOCKETS

AN EVENING AT HOME WITH THE LISTENER IN (SEE INSTRUCTIONS FOR USE BELOW)

Table with columns for Station and City, Met., Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday. Lists various radio stations and their broadcast times.

Instructions for Use—All the hours above are given in Central Standard Time. If your city uses Eastern Time, add one hour to each of the periods stated; if your city uses Mountain Time, subtract one hour; if your city uses Pacific Time, subtract two hours. If in addition, your city uses daylight saving time, add one hour to this result. This table includes only the evening broadcasts, and, on Sunday, the late afternoon program.

Washington I. R. E. Holds First Meeting Since War

WASHINGTON, D. C.—The first meeting of the Washington section of the Institute of Radio Engineers since before the war was held here recently. Much interest was shown and the section was put on a permanent basis with Commander A. H. Taylor, U. S. N., as chairman, and C. B. Mirack, Jr., of the navy department, as secretary-treasurer. At the meeting Major J. O. Mauborgne of the Army Signal Corps described the use of the resonance wave coil in Radio transmission and reception.

At the present time there is practically an absolute prohibition against the erection and operation of Radio equipment in Jamaica, according to Consul Bonaker, Kingston. The local government, however, is endeavoring to draw up a set of rules under which permits may be granted for the operation of receiving sets by private individuals.

WBBG Frequently Heard on Pacific Coast and Europe

MATTAPOISETT, MASS.—Amateur Radio "hams" and broadcast-listeners have chalked up some interesting marks for them to shoot at. Coast to coast reception is becoming common. England has been heard by many. In these cases, however, both the broadcaster and the listener were using high power sets of great efficiency. New comes a mark for broadcasters to aim for. Station WBBG, "The Voice of Cape Cod," located here, transmitting on 250 watts and using storage batteries alone for power has been heard frequently in England and on the Pacific coast. The station uses 2,400 volts and transmits on 240 meters.

WLAG ON WARPATH UPHOLDS ROOSTER

Wants Public to Know "Billy Lag" Has Several New Understudies

By Indi-Gest All hands at Station WLAG are on the warpath because we accused them of cheating and using Joe Maland as a pinch hitter in place of "Billy Lag," their pet rooster.

The worst part of it is that Joe tells us to go join a "Truth Society." F'evens sake, Joe, have heart, that's rubbing it in too much.

WLW Fans Hear Woman in Barrel 'Sawed in Half'

CINCINNATI.—Crosley Station WLW recently succeeded in "sawing a woman in a barrel in half" for the benefit of its listeners, but, after the sawing was over, the lady appeared before the microphone, all in one part as far as the unseeing audience was concerned. George Stock, inventor of the "Girl in the Barrel" referred to erroneously in a previous story as the "Sawing a Woman in Half" trick, was assisted by Powell Crosby in the act of sawing.

Here we are, a full fledged member of the "Order Radio Truth Society," I'll admit we haven't received our 1924 membership card as yet, but we have hopes as it is no doubt delayed in the mail. The "Hired Hand" said he was sending it, but WLAG may have tipped him off, hence the delay.

Dawgunit! tears are flowing all over the place, and the editor threatens to "abandon ship," if he receives any more heart-breaking letters. I ask you, "is that nice?"

What makes it so hard, at the top of the letter is a glaring headline, "The North-west Is Calling You." Can anyone imagine sitting at a desk in an office, with a thing like that staring them in the face. And vacation time four months away.

All I hope is that the "Hired Hand," sees what Station WLAG said about one of his star members. 'At's all, just wait.

New Radio units are to be installed in the giant air cruiser, the Shenandoah, to transmit messages 1,000 miles. The equipment will include two transmitting sets, two receiving outfits and a Radio compass. The call letters are NERK.



Radiotron UV-199 A Small Tube That's a Big Performer

The new UV-199 is proving a mighty popular member of the Radiotron family, particularly for portable sets.

For quiet operation—great ruggedness—uniform operation Radiotron UV-199 is unsurpassed. Each new Radiotron has marked a big step in radio advancement. The RCA mark is the foundation of radio growth—and your protection when you buy. Ask for Radiotrons—and look for the mark.

Radio Corporation of America Sales Offices—Dept. 315 233 Broadway, New York 10 South LaSalle St., Chicago, Ill. 433 California St., San Francisco, Cal.

Radiotrons

2-LO, LONDON, ENGLAND ON ONE TUBE

Another Record for the ELGIN SUPER-REINARTZ

Tuesday, November 27, during the test period between 9 and 9:30 P. M., Rev. E. A. Cole in the residence of J. A. Molver, of Roodhouse, Ill., while operating a set made of materials and in accordance with the hookup furnished by the ELGIN RADIO SUPPLY CO., tuned in 2-LO, London, England, using receivers and but one tube. Later another tube was lighted and the loud speaker used, so that four people could hear the program and concluding announcement. The numbers, time, and the order in which they were played were

Officially Confirmed

by the St. Louis Post Dispatch in conjunction with the National Association of Broadcasters, who had charge of the tests. (See page 34, St. Louis Post Dispatch, Dec. 2, 1923.) This same hookup has been advertised extensively as the one which brings in stations 2000 miles overland on a loud speaker and one tube; and this has been demonstrated so often as to need no repetition.

Send a two-cent stamp for circular giving one, two, and three tube hookup, and price list of parts for this remarkable circuit. Address the

ELGIN RADIO SUPPLY CO. 207 Chicago St. ELGIN, ILL.

Advertisement for Forest Radio Tel. & Tel. Co. featuring handwritten text: 'The Forest and Audion parts are as good as the best Radios phones'. Includes address: DE FOREST RADIO TEL. & TEL. CO., Dept. R. D. 9, JERSEY CITY, N. J.

30 Minute A-B-C Lessons for Radio Beginners

Chapter VIII—The Key to Radio Circuits

By P. E. Edelman

IN this series of articles the story of Radio is told in so simple a manner that the uninitiated can follow theory and practice whether he knows anything about electricity or its application to broadcasting and reception or not. The series consists of twenty-five chapters, of which the five next will be Chapter IX—Radio's Cast of Characters. Chapter X—What a Vacuum Tube Does. Chapter XI—The Shorthand of Radio—Diagram Reading. Chapter XII—Catching Radio Waves. Chapter XIII—The Radio Detective.

THE new broadcast listener is soon able to read and understand Radio diagrams when the essential circuits are known. A circuit is a complete path for a flow of electrons called an electric current. A Radio circuit is usually made up of several individual and co-operating circuits.

To understand a circuit it is first necessary to know what object is to be accom-

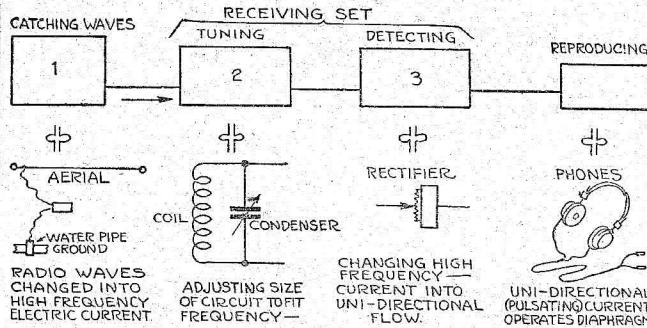


Figure 84.

Another method much used is termed regeneration. Referring to Figure 88, a portion of the Radio frequency current from the tuning device number 1 will not be rectified by the detecting unit but will be suitably returned or fed back ahead of the detector. In this way a feeble Radio current can be made to build itself up much like a dog chasing his tail. Electrically, regeneration is accomplished by coupling a plate circuit to a grid circuit, usually tuning both to the desired frequency.

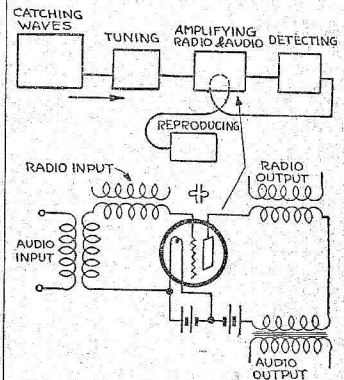


Figure 87.

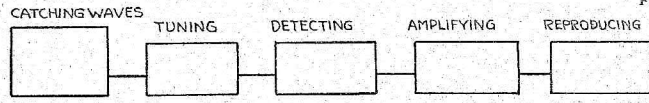


Figure 85.

plished thereby. The purpose of a receiving circuit or system is to catch a portion of the broadcast wave energy and translate it back into the form of sound.

Receiving Process

In Figure 84, a simple receiving process is diagrammed. First Radio waves are intercepted or caught. This can be done by means of an antenna wire called an aerial and a ground connection. When the incoming waves cut this aerial they set up in it a high frequency or Radio current. Next, there is placed a convenient and proper sized path for this Radio frequency current. This is called a tuning device, and may consist of a coil and condenser. The purpose of tuning is to fit the receiving apparatus to receive the particular Radio frequency of the particular broadcast waves desired.

Detecting and Amplifying

So far, one has merely brought the



Figure 86.

Radio frequency into the form of Radio frequency current. It is now necessary to change this Radio frequency current from its present form, flowing back and forth at inaudible rate, into a pulsating form which flows in one direction. This is called rectifying. Then this pulsating

current can actuate a telephone receiver diaphragm. In a receiving set one deals with electric currents and changes of form thereof.

Now there are variations of this simple process. One can add an audio frequency amplifier to boost the fluctuating current

taken from the detector output so as to operate a loud speaker. This is illustrated in Figure 85.

Radio Amplification Before Detection

If a distant station is to be brought in, the incoming waves therefrom may be too

feeble to actuate the detector. A certain minimum amount of energy called the "threshold" value is required before a detector can operate. For this purpose a Radio frequency amplifier or booster is employed. The output of this amplifier will have the same frequency of current flow but with a much greater value than the Radio input. The difference is obtained from the local source of power or battery used. When a Radio amplifier is used, Figure 86, very tiny and feeble Radio waves can be built up into form loud enough for the detector to be operated satisfactorily.

Reflex in Radio

If one can amplify Radio frequency and audio frequency independently, why not together? When this is done in a single unit or vacuum tube circuit, Figure 87, the process is known as reflexing. By proper design of the circuit the two great-

Kinds of Circuits

Radio circuits are also spoken of according to the kind of tuning. A single circuit may thus have several circuits, but the tuning is accomplished by one circuit, as illustrated in Figure 89. Such a single

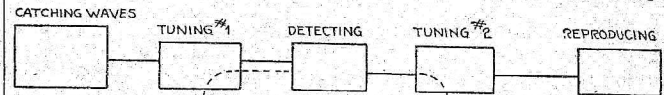


Figure 88.

ly different frequencies, Radio and audio, do not interfere. The energy value is thus built up both before and after rectification in the detector. The point to remember is that there can be both Radio and audio frequency inputs and outputs for an amplifying device.

circuit really has a tuned aerial circuit, a grid input circuit and a plate output circuit. In Figure 89, the addition of a Radio feedback circuit in the plate output makes a so-called single-circuit regenerative circuit.

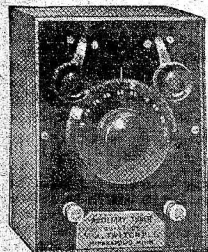
(Continued on page 26)

The Twitchell Auxiliary Tuner

Patents Pending. Name Registered.

MORE THAN A WAVE TRAP

A TWITCHELL AUXILIARY TUNER connected to any make of tube receiving set will positively cut out any local broadcasting or code stations so you may tune in all long distance stations any time regardless of local conditions.



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These TUNERS are in daily use within 400 feet of large broadcasting stations and enable their owners to easily and completely cut out the local station and bring in distant stations at any time on a loud speaker.

This instrument will also enable you to bring in programs sent out on longer waves than you can tune in without it, thus bringing all the broadcasting stations within the wave length range of the many sets of limited range now in use.

Copyrighted diagram of this tuner, 50c, or with all parts, \$9.00. Complete instrument in walnut cabinet, ready to use, \$15.00.

A New and Wonderfully Efficient Coil for the Reinartz circuit for those who want the best. Price \$4.00, or with blueprint for either one or three tubes, \$4.50.

This circuit brings in both coarse loud and clear and is the most successful Reinartz modification yet produced.

All goods prepaid. These instruments are easy to build, easy to operate. Everything clearly shown

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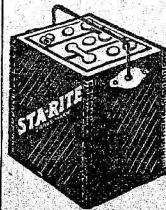
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Be a Good Sport

Take Heed to the Rules of the Game

YOU are all familiar with the expression "the rules of the game." It refers to that great accumulation of unwritten laws governing the conduct of a gentleman in any branch of sport. A man who lives up to these laws is known as a "good sport," and enjoys the respect of all who know him. Such a man would never take an unfair advantage over his opponent even when to do so might make the difference between winning and losing the game. In other words, it is the practical application of the "golden rule." We see it everywhere. At the theater, the ladies remove their hats so that the people behind them can see more easily. At the concert, only the thoughtless ones talk and whisper during the playing of a number.

How do the rules of the game apply to Radio reception? Every night several hundred broadcasting stations send out their best concert available. This entertainment is free to all who own a receiving set. That it is free does not alter our obligation to the other members of the audience, who have just as much right to an uninterrupted enjoyment of any program they may select as we have. Unfortunately such is not the case at the present time. There are many people who are just as much annoyance to their Radio neighbors as the man who keeps time with his feet is to those who are near him at the movies. And most of the people do not realize that they are creating a disturbance.

There seems to be three ways in which the interference can be greatly decreased or practically eliminated. One way will occur to many people immediately, and that is to legislate against the use of any receiving set that is capable of interfering when properly operated. A second and more desirable way is to educate the operators of receiving sets and to acquaint them with their moral obligations to their neighbors. The third way is to gradually eliminate all receiving sets capable of interfering by a process of development rendering them obsolete.

Only a Few Scoffers

The Seats of the Scornful Not Filled

TO be able to sit at home on dreary days and hear a sermon from across the continent, musical entertainment a couple of thousand miles away or an important address by the president of the United States, is a pleasure that cannot be measured in terms of ordinary enjoyment.

Radio is truly the marvel of the age and its uses are broadening so that it has come to be an accepted means of communication.

There was a time when scoffers laughed at the Wright brothers for trying to fly without wings; when they ridiculed the idea of a buggy running down the street without a horse hitched in front of it; when they scorned the suggestion that anyone could communicate with another many miles away without the use of wires.

Some scoffers are still having their inning. They have not been convinced yet that Radio is here to stay, but knowing their propensities to see only the dark side of every effort at progress, those of us who believe that modern inventions are the best ever conceived, will not be dismayed by their predictions of failure.

Radio is a wonderful invention, and it will be improved immeasurably. There is no doubt about that. It will be perfected just as automobiles and airplanes have been made more practical year by year.

Fascinations of Radio

Surprises Are the Major Element for Fans

THE element of surprise is generally conceded to be one of the major fascinations of the Radio. When one puts a record on a phonograph he knows exactly what he will hear; he may have listened to the same tune many times. On the other hand, the Radio receiver, like Pandora's box, is full of mystery. When one turns the dials on his set he opens the door to the unexpected. What he hears gives him a thrill. If a distant unexpected station comes in, the thrill is still more exciting.

RADIO INDI-GEST

A Radio Set and an Easy Chair

When a touch of frost creeps in the air
And the north wind's roaring bugles blow,
When the long, gray evenings gather down
From the hills that shadow the walled-in town;
When the dripping eaves in a bleak refrain
Chant the wail of a winter's rain,
Oh, where is the poet left to sing
The song of dream in the Land of Spring?
The song of dream that may compare
To a Radio set—and an easy chair?

When the wild blasts howl and the shadows fit
Over the wall where the fire is lit;
When the snow drifts deep or the driving rain
Sings its song at the window pane;
When the dim world lies in the pit of night,
As the grey ghosts shriek in the mad gales flight,
Oh, where is the poet left to praise
The gleam and dream of the summer ways?
The gleam and dream that may compare
To a Radio set—and an easy chair? SPIDER WEBB.

George Is It. We Let Geo. Do It

Dear Indi: Who writes the clever little epithets under the photos in the Digest? Artists sending me photos for magazine publication always enclose lengthy spicels about themselves to accompany their pictures. I'm reminded of the cultid gent who was "tuned in" on a campaign speech. Said he:
"Yes-suh, day sho do rekommend demselves mos' highly!"
MAMA HAYMES.

Move Away from Sandusky Immediately

Dear Indi: Here's a true one that happened the other day in Sandusky. Now, we aren't so far removed from civilization that some excuses could be given for us, but anyhow:

A lady who works in one of the local electric companies noticed one day in the Radio programs that that evening Schenectady was to have Silent Night. Turning about to me she sez, sez she, "Oh, goody, I just love Christmas carols. I must go to someone's house tonight and listen in on their Radio set, because that New York station is going to have Silent Night."

What to do? What to do? Urs trooly.
SQUIBBELABELLIUM.

Mrs. Partington Speaks Out

Dear Indi: Mrs. Partington says she thinks we are to have a awful dry spell this season, for she's heard Wendall Hall's weather report from all over the country.

She says, "Please tell her if the leader of the W. O. S. prison bandits is married?" She says he seems like a good, steady kind of feller and she believes he would make somebody a good husband, and there's a chance that he'll be on his good behavior for quite a spell after they let him out of where he is.
SIGNING OFF.



Then and Now

Life today is vastly different
From the life of long ago;
Our ancestors were handicapped
Communication being slow.

Railroads served to lessen distance
For those living far away;
Telegraph e'en cut it shorter,
But they both have lived their day.

Then, a man with business pressing
Had some distant place to go;
Now, he does his business dressing,
By the use of Radio.

Then, those wishing entertainment
Sought the dance hall or the show;
Now, these forms of joy and gladness
Come to us by Radio.

Then, but few e'er thought of travel
For they moved so awful slow;
Now we all seek distant places
Carried there by Radio.

Life's forever bringing wonders,
May it please you all to know;
Soon the joys of this existence
Will be lived by Radio.
FINIS.

No. Tige Was Looking for Oil

Dear Indi: Why not have a vote among your many readers to find out which number is the most popular, and from what station it comes? If you start the contest count my vote for "Paw in Paw Through Catnip Land," from KYUU.

P. S. I wonder if Mrs. Coolidge's Tige went looking for Catnip Land?
PUSHOMETER.
P.

WGN Listener writes that static is "a great big chunk of loose electricity, all dressed up and with no place in particular to go—just looking for trouble." Be that as it may, we won't have any this summer, 'cause the Radio manufacturers say so.
INDI.

Go Sit on a Tack!



Condensed

By DIELECTRIC

We still hear criticism of those ministers who deem it right and helpful to broadcast their regular services, or special services, so that "shut-ins" may take part in worship. No doubt this will continue, for some believe listening at home keeps many folks from attending a church. Special attention was given this Easter to providing religious programs to Radio audiences. A Presbyterian minister in New York city broadcast the Good Friday holy communion so that afflicted listeners might partake of this service in their homes. Judging from the number of telephone calls received, a great many shared the service.

Paul Revere could have saved himself a long ride on horseback one hundred and forty-nine years ago, had the "mike" of today been at hand. This famous ride was reenacted but brought up-to-date, when a squadron of army planes helped spread the alarm and "Revere" himself stopped, en route to Arlington and Lexington, to address more minute men than could have been reached in a month of riding in those days. He walked into the studio of WGI whence his warning sped through the ether. Just the little touch Radio gave to the celebration of Patriot's Day made that an occasion the more memorable.

How far Radio may be applied to therapeutics and surgery no one is in a position to state at present. However, it seems certain that use may be made of the one science in aid of the other. One of the most dreaded of all diseases is cancer. Dr. Schmidt, of Chicago, has employed a "Radio knife," which may render virtually bloodless operations for this malady. When the knife is applied to human tissue, resistance to the current is offered causing generation of heat, so that the knife burns itself through skin and muscle quickly. Yes, Radio is a luxury!

San Francisco ferry boats are likely to be guided in their course across the Bay by means of crossed coil Radio beacons, a product of the bureau of standards. Boats may follow a true course by means of ether "lines" and an ordinary receiving set. The service rendered by these ferry boats is an important one and needs protection. Fog is so thick at times the three and one-half-mile trip is rather dangerous, especially with strong tidal currents. Be sure to tax the receiving sets!

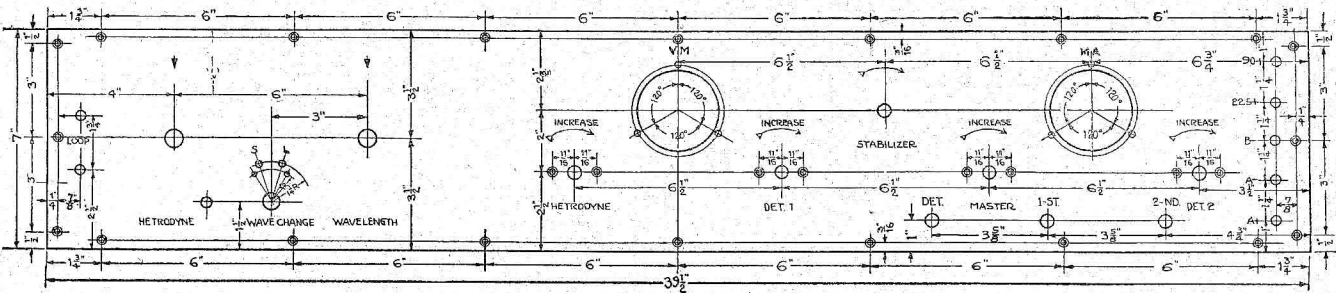
Emmanuel college, at Berrien Springs, Mich., has a broadcasting station which has attracted considerable attention to itself during the short time it has functioned. This station is on the air four days a week with programs that elicit praise from those capable of tuning it in. There is one feature about this new station worthy of mention. The directors of the studio appear to have settled upon a policy which would debar from all programs jazz music and coarse humor. Neither of these are essential to the success of a broadcasting station, say I.

So far as Lopez orchestra is concerned with broadcasting—it isn't! Vincent Lopez has been ordered to desist from further entertaining those people who would rather listen by Radio than attend Keith's theater. It's quite a journey for some folks to the metropolis of New York—save via ether. But, of course, it will not do to have all the theaters and moving picture houses and grand opera companies go out of business just to make money for the broadcasting stations. If you are content to get all your amusement by Radio, then something IS wrong.

How to Construct a Super-Heterodyne Receiver

Part II—List of Parts and Panel Layout

By Allen C. Forbes



THE subject of parts might well be divided into three main classifications—namely good, bad and indifferent. Under the heading of good parts we could classify all those essentials that go to make up any set in the construction of which the manufacturer has kept in mind the fact that the purchaser of his part intends to use the part in the construction of a delicate instrument.

Under the heading of bad parts, we ought to classify all parts that do not come up to the good standard and yet leave room for the third classification—indifferent, which should include all those parts that are obviously made only to sell. You who contemplate the building of the super-heterodyne set must keep in mind this one thing if nothing else. If you buy poor parts you must expect poor results. If you get fair parts you will get fair results, but if you get the best parts it is possible to get, then and then only, will you get the best results.

Cost of Parts

Don't misunderstand me when I speak of "best" parts: I mean the best from an electrical and a mechanical standpoint. It does not always follow that the best part costs the most. It is possible to get excellent material to use in the super-heterodyne set at a reasonable figure if you just think before purchasing the parts. The most important parts of the super-heterodyne, given in the order of their importance are as follows:

The oscillator coupler and condenser, the filter coils and fixed condensers, the intermediate frequency amplifying transformers, the audio frequency amplifying transformers, the potentiometer, the rheostats, the grid leaks and all various fixed condensers, the tubes, the loop and loop condenser, the loud speaker, the B batteries, the A batteries, the C batteries. Taking these various parts in the order of their importance in the set let us analyze them and see if we can't determine what we want before we get it, also see why we want it.

First, then, is the oscillator coupler. We know that it must have enough inductance to cover the bands we wish to receive, that it must be well insulated otherwise we will have leakage. It is desirable that the coil have low distributed capacity because we want all the capacity in the condenser. Now, knowing these essentials it is easy for us to look over the

various makes of oscillator coils and pick out the one that comes nearest to approaching and fulfilling these requirements as to inductance and capacity. Of course, you must not lose sight of the fact that the coils have to be mounted somewhere. Therefore, after satisfying yourself as to its electrical characteristics, make certain that its mounting and distribution is such that the coil will stand a reasonable amount of handling and that it will stay put.

The Variable Condenser

Second on the list of importance is the variable condenser that controls the frequency generated in the oscillating circuit. In order to choose this condenser we must consider what it has to do. We know that the oscillator must generate a high frequency current. We also know that this frequency must be varied to suit the incoming oscillation. We also know that in varying this frequency we must "split hairs", that is, we must tune extremely sharp, a difference of a 1/16-inch movement of the condenser in rotating the movable plates being sufficient to eliminate one station and bring in another. We also know that where it is necessary to do such tuning we must be able to record the setting and then go back to that setting at any time and be able to pick up the station.

Furthermore, with only the one variable control on the oscillator, if we are going to have a good range on the circuit we must have a condenser with a low minimum capacity range. To make this perfectly clear let us assume that we have an oscillator coil the inductance of which is such that without any condenser across it it would respond to a wave length of 150 meters. We know then that if we are going to tune in or rather cover all the wavebands lying between 250 meters and 600 meters, we must get a condenser that has a capacity large enough to load the coil up to 600 meters and low enough to enable us to tune to 250 meters. Loading the oscillator is easy; it simply means the changing in circuit of a condenser of the right capacity. If the condenser does not have a low minimum capacity you will be able to tune to 600 meters all right but you will not be able to get below 300 meters. Now you see why it is so essential to have a condenser with a low minimum capacity.

Micrometer Adjustment

Knowing all the above facts, it is easily seen that we must have a variable condenser capable of micrometer adjustment with low minimum and high maximum capacity. The so called "fly leaf" variable condenser will operate correctly but, owing to the micrometer adjustment and necessity for being able to go back and "pick up" the station again it is not desirable. This leaves a choice between the "rubber" geared and the "mechanical" geared types. The rubber gets hard and fails to grip, so that eliminates it, leaving only the mechanical geared type which is most desired.

The filter coils have been thoroughly discussed in the previous article so that it is not thought necessary to go into detail regarding their function in the circuit except to say that we must be sure they have the necessary mechanical support to hold them in place. Honeycomb or heringbone coils answer the purpose very nicely.

The transformers for amplifying the intermediate frequency should be designed to give maximum amplification on the fre-

quency it is intended to pass. It is preferable to have a transformer that has the ends of both windings coming out at the side or bottom so that the shortest possible lead can be made to them from the grid and plate of the tube sockets.

Audio Frequency Transformers

As the function of the audio frequency transformers is so well known and so many articles have been written on them it is not considered necessary to mention them further except to say that inasmuch as the signal is so highly amplified before it reaches the audio stages, it is not necessary to construct special "push-pull" or "power" amplifiers to further operate the

(Continued on page 24)

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Monday, May 12

(Continued from page 18)

tuning-in number, Duo-Art. Address: Speaker from Kansas University, Lawrence, Kan., 8:00-8:30 p. m.; Fritz Hanlon's Trio, 8:00-8:30 p. m. Formal program of popular, classical and comedy numbers presented by the University of Kansas, directed by Meleio Smith, 11:45-1:00 a. m., Night-hawk Frolic, "Merry Old Chief" and Coon-Sanders Orchestra.

WEAG, Columbus, Ohio (Central, 360), 1:30 p. m., Garden talk, member Ohio State University faculty.

WEAF, New York, N. Y. (Eastern, 492), 2:35-1:00 p. m., James B. Carey, pianist; 4:00-4:30, James Bore Orchestra; 4:30-4:35, American Olympic Committee; 4:35-5:00, James Bore Orchestra; 5:00-5:30, Women's Orchestra; 7:30-7:40, Thurston Fisher; 7:40-8:00, Harry Janes, pianist; 8:00-8:15, Talk on making moving pictures; 8:15-8:40, George Hirota, baritone; 8:40-9:30, Arline Thomas, soprano; 9:05-9:30, Edna Croome, pianist; 9:30-10:30, Gypsy String Ensemble.

WFAA, Dallas, Texas (Central, 476), 12:30-1:00 p. m., Address, "The Moon and Things Mundane," Dr. A. D. Laugenour; 8:30-9:30, Song recital, Sanger Bros. Choral Club, Austin, Texas.

WFJ, Philadelphia, Pa. (Eastern, Daylight Saving, 395), 1:00 p. m., Meyer Davis Believe Stratiore Concert Orchestra; 6:00, Sunny Jim, the Kiddies' Pet; 6:30, Meyer Davis' Stratiore Concert Orchestra; 7:00, Music Lessons for Children, by Eliso Alexander.

WGR, Buffalo, N. Y. (Eastern, 319), 12:30-1:00, George Albert Bouchard, pianist; 7:30-8:00, Dinner music, Vincent Lopez' Hotel Stratiore Orchestra; 8:00-8:30, Vincent Lopez' Hotel Stratiore Concert Orchestra; 8:30-9:00, Vincent Lopez' Hotel Stratiore Concert Orchestra; 9:00-11:00, Vincent Lopez' Hotel Stratiore Concert Orchestra; 11:30, Super-dance music, Vincent Lopez' Hotel Stratiore Orchestra.

WGY, Schenectady, N. Y. (Eastern, 380), 1:00 p. m., "Chorus for small Electric Appliances," Society of Electrical Development; 7:45, Polish program, Liberty Bell Male Chorus; M. Szalwinski, soprano; Edmund Slawka, pianist; 8:00, G. Grabowski, violinist; Mrs. Stanley E. Grabowski, accompanist; Alexander Koszalka, violinist; "The Polish Song," Stanislaus Belinski.

WHAS, Louisville, Ky. (Central, 400), 4:00-5:00 p. m., Walnut Theater Orchestra; Alamo Theater Orchestra.

WHAZ, Troy, N. Y. (Eastern, 380), 8:00 p. m., Corintha Children's Orchestra; Entertainment, pupils Edna B. Towne; 8:45, Garden talk, John Jeannin, Jr.; 9:00, Concert, Merrill Ham, pianist; 9:30, Monthly Trans-continental and International program, Rensselaer Polytechnic Institute Students' Symphony Orchestra.

WHB, Kansas City, Mo. (Central, 411), 2:00-3:00 p. m., Ladies' Hour program by the Sweeney Radio Orchestra; 7:00-8:00 educational features and vocal and instrumental numbers.

WHY, New York, N. Y. (Eastern, Daylight Saving, 360), 2:15-4:45 p. m., Irving Berlin Music Co.; Al Novins and Clint Sommer; Chester Frost's Bostonians; Harry Koff Entertainers; 7:30-11:00, Brassfield's Club De Luxe Orchestra; People's Popular Concert, Marcia Schupac, director; Dan Gregory and his Danes Central Orchestra; Hot-Cat Orchestra; Terrace Orchestra; Listen! In with Jack Shack Hoge and Thora; 12:00-2:00 a. m., Midnight Dance.

WIP, Philadelphia, Pa. (Eastern, Daylight Saving, 509), 1:00 p. m., Gimbel Brothers Tea Room Orchestra; 4:00, Radio Lesson in Mah Jong; 7:05, Monte Cross Baseball Game; 8:15, Walter Schwarz' Orchestra from Venetian Cafe; 7:00, Uncle Wip's bedtime stories.

WLAG, Minneapolis-St. Paul, Minn. (Central, 417), 10:45-11:15, "Household Hints," 11:35-12:00, m., Surprise Hour; 2:10-2:30 p. m., "Twentieth Century Housekeeping," Barrie Bell; 4:00-4:30, Dorothy concert; 4:30-4:50, Magazine reading; 5:30-6:00, Children's stories, Tess J. Coopersam; 6:00-8:15, Short Hour "Shorties"; 8:15-8:30, "Firm lectures." Dinner concert; 7:30-8:15, "Firm lectures."

WLW, Cincinnati, O. (Central, Daylight Saving, 309),

8:00 p. m., Address, "Citizens' Military Training Camp," Ralph Davis, Phillips; 8:15-8:30, "The Community Chest," Cincinnati Zither Quartet, Charles Hobb, Ruth Hobb, Adolph Koschitzki, Louis Weger, 8:30, Vocal solo, Joseph Koch, piano solo, Miss Dorothy Stolzenberg, Instrumental Trio, Oberst Neely, violin, Karl Ferrer, violin, Milton Dookewiller, viola; 9:00, Theatrical review, concert, Woody Meyer's Cincinnati Orchestra.

WFO, Memphis, Tenn. (Central, 500), 8:00 p. m., Program, Prof. Gaspar Pallardo and his Hotel Gayoso Orchestra.

WGD, Omaha, Neb. (Central, 526), 8:00 p. m., Bert Smith Comedy Players of Empress Theater; 6:30, Randall's Royal Orchestra; 9:00, Oakland (Ia.) Concert Band, Joseph J. Anderson, director; saxophone; Howard Johnson; reading, H. L. Bender.

WGO, Davenport, Ia. (Central, 424), 12:00 p. m., Chimes; 2:30 p. m., Lecture; 5:45, Chimes; 6:30, Sandman's visit; 7:00, Lecture; 8:00, Music; 10:00, Program.

WHD, Philadelphia, Pa. (Eastern, Daylight Saving, 502), 11:00 a. m., Organ recital, Mary E. Vogt; 12:02 p. m., Wanamaker Crystal Tea Room Orchestra, Robert E. Golden, director; 4:45, Organ recital, Mary E. Vogt; 7:30, Havana Casino Tea Room Orchestra, Vincent Rizzo, director; 8:00, Weekly Health Talk, Bureau of Health of Philadelphia; 9:10, Fox Theater Grand Orchestra, Erno Rapee, director; 10:03, Organ recital, Mary E. Vogt; 10:30, Havana Casino Dance Orchestra from Hotel Sylvania, Vincent Rizzo, director.

WJAN, Kansas City, Mo. (Central, 360), 8:00-9:00 p. m., Popular music concert, Edison phonograph; 7:30-8:00, Educational and musical program.

WJW, Newark, N. J. (Eastern, Daylight Saving, 405), 2:30-2:45 p. m., Charm Magazine presents a talk on Gardening; 2:45-3:00, Piedmont Trio Concert; 3:00-3:15, August Kottler; 3:30-3:45, Piedmont Trio Concert; 8:00-8:15, Hollywood McCohee; 10:15-10:30, Les Friedman Entertainers.

WOS, Jefferson City, Mo. (Central, 440.9), 8:00 p. m., Musical program.

WSE, Atlanta, Ga. (Central, 429), 8:00-9:00 p. m., Angel Caramez, Cuban pianist; 10:45, Bernard and Robinson, Dixie stars.

WV, Detroit, Mich. (Eastern, 517), 3:00 a. m., Set-tling-up exercises, St. Hortor; 3:00 a. m., Detroit News Orchestra; 7:00, Detroit News Orchestra.

Tuesday, May 13

CKAC, Montreal, Can. (Eastern, 425), 7:00 p. m., Kiddies' stories in French and English; 7:30, Rex Battle and his Mount Royal Hotel Concert Orchestra; 8:30, Latest English popular numbers, White Star Dominion Light "Romantic" Orchestra; 10:30, Joseph C. Smith and his Mount Royal Hotel Dance Orchestra.

CKY, Winnipeg, Can. (Central, 458), 8:15 p. m., Concert, Mason & Bitch Piano Company.

KFKX, Hastings, Neb. (Central, 341), Rebroadcasts program of KDKA.

KMFB, Shenandoah (Central, 266), 7:30 p. m., Shenandoah High School Band, director of E. O. Strom.

KGO, Oakland, Calif. (Pacific, 312), 4:00-5:30 p. m., St. Francis Hotel, "Swentien," KGO Players; Action Trio; 10:00-1:00, St. Francis Hotel Dance Orchestra.

KWV, Portland, Ore. (Pacific, 492), 12:30 p. m., Civic Music Club extension series.

WAAW, Newark, N. J. (Eastern, Daylight Saving, 255), 7:00-7:30 p. m., "Star-Spanned Banner," Stamford Instrumental; 7:30-8:00, Jimmy King and His Broadway Melody Entertainers; 8:00-8:15, Arline Pelzer, concert soprano; 8:15-8:30, Arundel Center of Wall Street Journal of Prominence in Finance and Industry; 8:30-8:45, Mercedes Gilbert and Alice Carter; 8:45-9:00, Dalton Sweeney; 9:00-9:15, Dalton Sweeney; 9:15-9:30, Young Men's Christian Association Brass Band; 9:30-9:45, Russell Morgan, tenor; 9:45-10:00, Marguerite Barton, pianist; 10:00-10:30, American Warblers; 10:30-11:00, Knickerbocker Novelty Orchestra; 11:00-11:30, Robert S. Williams, John Hill and the Triton Melody Ensemble.

WAAW, Omaha (Central, 560), 8:00 p. m., Markets; 8:00-8:30, "Lectures and services, Fort Worth Trade Association, H. D. Graham, director.

WBAF, Fort Worth, Texas (Central, 476), 7:30-8:30 p. m., Concert, Leah and Rachel Parker, Greenville, Texas; 8:30-9:45, Concert, Fort Worth Trade Association, H. D. Graham, director.

WBAV, Columbus, Ohio (Eastern, 390), 12:00 p. m., Piano music, The Lorchs, Owens.

VCAL, Northfield, Minn. (Central, 10:00), 10:00 p. m., Anniversary program, Gertrude Bee Oberly, soprano; Clara Orest, pianist; Obed Grindor, tenor; Ella Bjertans, contralto.

WGX, Detroit, Mich. (Eastern, 517), 6:00 p. m., Dinner concert; 10:00, Red Apple Club.

WDAF, Kansas City, Mo. (Central, 411), 3:30-4:30 p. m., Musical Matinee, Joseph Black's Sexton Cafe Orchestra; 6:00-7:30, School of the Air, Piano tuning-in number, Duo-Art; Address, Speaker from the National Livestock and Meat Board; The Tell-Me-a-Story Lady; Fritz Hanlon's Trio; 8:30, Barton Orchestra; 9:00, Night-hawk Frolic, "Merry Old Chief" and Coon-Sanders Orchestra.

WEAG, Columbus, Ohio (Central, 360), 1:30 p. m., Garden talk, member Ohio State University faculty.

WDAP, Chicago, Illinois (Central, Daylight Saving, 360), 7:00-8:00 p. m., Drake Concert Ensemble and the Blackstone String Quintet; 8:30, Barton Orchestra, played by Ralph Emerson; 9:00, Parrham Trio, Rosemary Hughes, Frederick W. Agard, Frank Greif, Jack Chausman's Orchestra.

WDAR, Philadelphia, Pa. (Eastern, Daylight Saving, 395), 11:45 a. m., Daily Almanac; 12:00 p. m., Organ recital, Stanley Thoner; 12:30, Arcadia Cafe Concert Orchestra; 2:00, Arcadia Cafe Concert Orchestra; 4:30, Fashion Talk, Betty Logan; 7:30, Dream Daddy's bedtime stories; 7:40, Special features from Stanley Theater; 8:05, Moving Picture review, James Nassau; 9:30, Oratorio, Stanley Theater Symphony Orchestra, Joseph Eastmarch, director; 10:30, Howard Lanin's Dance Orchestra from Arcadia Cafe.

WEAF, New York, N. Y. (Eastern, 492), 11:15-11:35 a. m., Elsie S. Bowser, soprano; 11:35-12:00 p. m., Talk on Motion Pictures; 4:00-4:25, Harriet Young, soprano and Emile Goetzke, pianist; 5:00-5:30, Children's Program; 7:30-7:40, Thurston Fisher; 7:40-8:00, Fannie Todd, soprano; 8:00-8:30, Corn Products Orchestra; 8:30-9:00, Brooklyn Eagle News Review; 9:00-9:30, Blue Ribbon Mayonnaise; 9:30-10:00, Bernice Kazouoff, pianist; 10:00-11:00, Eveready Program.

WFAA, Dallas, Texas (Central, 476), 12:30-1:00 p. m., Address, DeWitt McHenry; 3:30-4:30, Recital, Waxaladine Choral Club, Miss Daley Peck, director; 11:30-12:00, Recital, G. Havin Jones, director and members of the First Presbyterian Church Choir; 12:00-1:00, (Wednesday morning) Operatic program, Leading Dallas Musicians.

WFI, Philadelphia, Pa. (Eastern, Daylight Saving, 395), 1:00 p. m., Meyer Davis Believe Stratiore Concert Orchestra; 3:00, piano solo, Loreta Kerr; 6:00, Sunny Jim, the Kiddies' Pet; 6:30, Meyer Davis Believe Stratiore Concert Orchestra; 10:05, Charlie Kerr and his Symphonic Dance Orchestra from Hotel Majestic.

WGR, Buffalo, N. Y. (Eastern, 319), 12:30-1:00, George Albert Bouchard, pianist; 7:30-8:00, Chamber music program; 8:00-8:30, Chamber music program.

WGY, Schenectady, N. Y. (Eastern, 380), 1:00 p. m., "The Police Woman, a Social Constructive Force," Marguerite Thompson; 7:45, Modern Phases of Dramas, Dr. Edward E. Hild; WGY orchestra; Comedy, "Billeted," WGY Players.

WIAA, Iowa City, Iowa (Central, 484), 8:00 p. m., Concert, school of music faculty of the University of Iowa.

WHAS, Louisville, Ky. (Central, 400), 4:00-5:00 p. m., Walnut Theater Orchestra; Alamo Theater orchestra.

7:30-9:00, Louieville Synopsators, Donald Colchoun, director; Paul Phelps, pianist; Ken Robinson, Trumpeter; Roy Lawrence, trombonist; Charles Gray, banjo; William Grant, bass; Agricultural Tabloid talk; "Radio in General," Henry F. Yorkman.

WHB, Kansas City, Mo. (Central, 411), 2:00-3:00 p. m., Lectures Hour Program, Eastern and popular selections, Sweeney Radio Orchestra; 8:00-10:00, First part of the program, under the direction of Miss Kathryn Halpin, consisting of classical vocal selections; Reading, Mr. Horras Taylor, Second part, popular selections by the Sweeney Radio Orchestra.

WHN, New York, N. Y. (Eastern, Daylight Saving, 360), 2:15-5:30 p. m., Edward E. Marks Music Co.; 9:30-10:00, Glimbel Brothers Tea Room Orchestra; 10:00-10:30, The Entertainers; Golden Glades orchestra; 9:30-10:45, Fletcher Henderson's Alabam Club Orchestra, Eleanora J. Goodman, conductor.

WIP, Philadelphia, Pa. (Eastern, Daylight Saving, 509), 1:00 p. m., Gimbel Brothers Tea Room Orchestra; 7:00, Dick Regan's WIP Ladies' Symphony Orchestra; 8:00, Uncle Wip's bedtime stories; 9:00, Philadelphia Police Band; 10:15, The Women and his Recordmaking Orchestra from Cafe L'Aiglon.

WJAX, Cleveland, Ohio (Eastern, 390) Program arranged by Cleveland News-Leader; 6:30 p. m., Bedtime story, B. G. Johnson; Radio Carlton Talk, Don Palmer; 8:00 p. m., Selections, Radio Cleveland Orchestra; Ivan Prapcic, director; 8:00, Concert, Trina-ciota Opera and Concert Orchestra, Raul Borek, director; 8:30, Selections, Radio Cleveland Orchestra; Maria Chirocista, Anne Book, George W. Glorin, Sam Schokler; Choral numbers, Chorus of twenty; 10:30 p. m., Dance program, Philip Sotolary's Havana Edge Restaurant Orchestra.

KHJ, Los Angeles, Calif. (Pacific, 395), 12:30-1:15 p. m., Albert Program, Albert Program, Barker Brothers; 1:00-1:30, Children's program, Prof. Walter Silverster; 2:00-2:30, Children's program, screen, juvenile, Jeanne De Bard, 5 year old singer and pianist; Bedtime story, Thee John; 8:00-10:00, Program, Caudron Club, Pasadena.

WLW, Cincinnati, Ohio (Central, Daylight Saving, 309), 12:00 p. m., Special program, Educational Order of Eagles.

WMAQ, Chicago, Ill. (Central, Daylight Saving, 447.5), 2:00 p. m., Fun, Fun, Fun, Guna School of Music; 5:00, Stories from "Child Life," Marjorie Barrows; 8:00, Harry Hansen; 8:30, The Loom Orchestra; 9:15, Lecture, U. of Chicago; 9:30, Weekly Lyon & Hoby concert.

WMB, Memphis, Tenn. (Central, 500), 8:30 p. m., Program, auspices, St. Luke's Episcopal Church; 11:30, Midnight Frolic, Prof. Hall Hawthorn Orchestra.

WDAW, Dallas, Texas (Central, 526), 8:00 p. m., Speakers' half hour; 6:30 p. m., Ken Baker's Omahans; 8:00, Recital from studio of Walter B. Graham; 8:30, Recital from studio of Walter B. Graham; Bess Watson, Adelyn Specht, Doris Atack, Blanche McClellan, Alice Mae Christiansen, Mrs. Harry Hanson and Gertrude Smith; contraltos, Mrs. Dick Grotte and Russell Mosley; tenors, Gerald Brown, Otto Lambart, Herbert Boling and Hiram Selsbrier; bass, M. V. Grossjan; pianist, Regina Franklin; reading, Bess Watson.

WOD, Philadelphia, Pa. (Eastern, Daylight Saving, 509), 11:00 a. m., Organ recital, Mary E. Vogt; 12:02 p. m., Wanamaker Crystal Tea Room Orchestra, Robert E. Golden, director; 4:45, Organ recital, Mary E. Vogt.

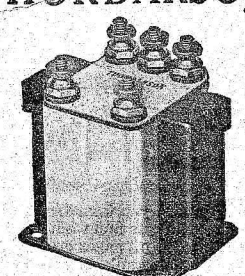
WOK, Kansas City (Central, 360), 3:00-3:30 p. m., Popular and classical musical program, Edison phonograph and Wurlitzer piano; 8:00-9:30, Popular program, Edison Phonograph.

WOR, Newark, N. J. (Eastern, Daylight Saving, 405), 2:30-2:45 p. m., William Wikoff, soprano; 2:45-3:00, Dorothy concert; 4:00-4:30, Lillian Wikoff; 3:45-4:00, Ralph W. Tar; 6:30-7:00, Man in the Moon Concert for Children.

WOS, Jefferson City, Mo. (Central, 440.9), 8:00 p. m., American Journalist Week.

WV, Detroit, Mich. (Eastern, 517), 3:00 a. m., Settling-up exercises, St. Hortor; 3:00 a. m., Fred Slaw, pianist; 3:00 p. m., Detroit News Orchestra; 7:00, Detroit News Orchestra.

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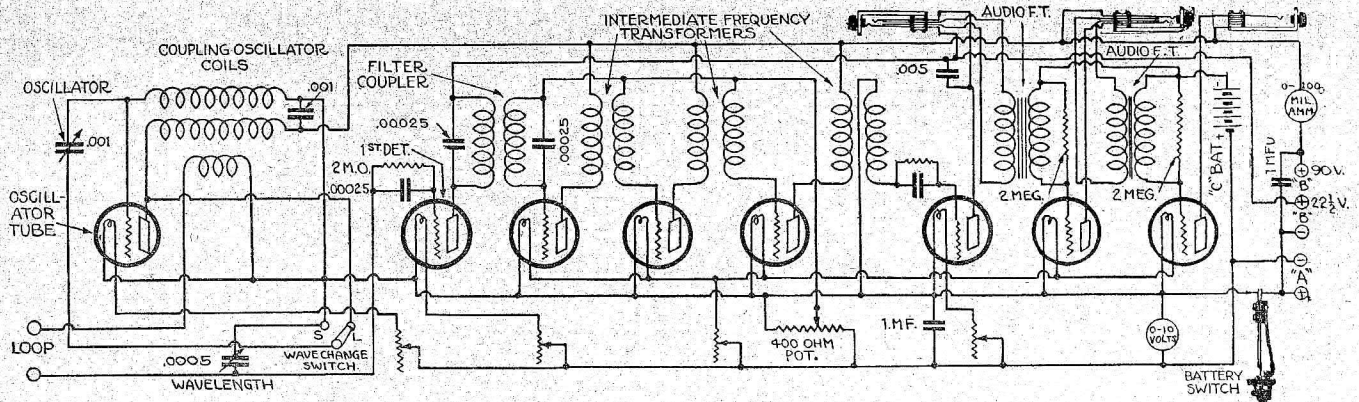
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WALNART ELECTRIC
1480 Broadway, Corner 42nd St., New York City



SUPER-HET DETAILS

(Continued from page 21)

loud speaker. A good high-grade efficient transformer of a four to one ratio for the first stage and a three to one ratio for the second stage should give quite sufficient "power" to operate any of the "good" loud speakers.

The potentiometer is a very important control and should be of not less than 400 ohms' resistance. Its mechanical construction should be rugged enough to give a good contact throughout its entire operating scale without giving "scratches." The wire should be heavy enough to stand considerable wear.

- 1 Panel, 7" x 7" x 3/8".
- 1 Base board, 5/8" x 8" x 3/8".
- 8 Vacuum tube sockets.
- 4 Rheostats.
- 3 Transformers, range from 100 to 20 kilocycles.
- 2 Audio frequency transformers.
- 4 Grid leaks, 2 variable and 2 fixed.
- 2 Condensers .00025 mf. fixed.
- 2 Condensers 1.0 mf. fixed.
- 1 Condenser .002 mf. fixed.
- 1 Condenser .005 mf. fixed.
- 2 Two circuit jacks.
- 1 Single circuit jack.
- 1 Switch.
- 1 Set of filter coils and condensers.
- 1 Oscillator and coupler coil.
- 1 Variable condenser .001 mf. (Oscillator).
- 1 Variable condenser .0005 mf. (Loop).

Rheostats must be selected with great care. Too often we are apt to slip up on this part of the set and install cheap rheostats that have neither the required resistance nor mechanical strength to do their work properly. The writer has used the carbon compression type with very good results because it gets away from the movable contact arm.

The Grid Leaks

The grid leaks, of course, should be variable so that they can be adjusted for the particular tube used but it is not absolutely necessary. Leeway can be allowed here in the selection of a detector tube as it has been my experience that a hard tube will function just as good as a soft tube as a detector. The condenser is the principal thing to watch and a good high-grade condenser made by a reputable manufacturer can nearly always be

depended upon to be what he says it is. Under no circumstances should the so-called pencil mark grid leak be used as it will give you all sorts of trouble in trying to get the required amount of resistance.

So much has been said about tubes that there is very little more to say. However, the writer recommends either the type 120 or the 201A, both being very good, the latter, 201A, giving the louder signal. The one tube, that should be watched is, of course, the oscillator. This should be a tube that will give maximum plate current. The detectors should be sensitive and it follows as a matter of course that the three intermediate frequency and the two audio frequency am-

- 1 Potentiometer, 400 ohms.
- 2 Four-inch dials for variable condensers.
- 7 Binding posts.
- 40 Feet Number 14 tinned copper wire.
- 14 Screws, wood No. 6 3/4-inch (to hold cabinet and panel).
- 20 Screws, wood No. 8 3/8-inch (to mount transformers).
- 16 Screws, wood No. 5 3/4-inch (to mount sockets).
- 4 Screws, wood No. 6 3/4-inch (to mount coupler and filter).
- 36 feet varnished cambric tubing (optional).
- 1 Voltmeter scale 0-10 volts (optional).
- 1 Millimeter, scale 0-100 mil-amperes.
- 1 Loop.
- 1 Wave change switch.

plifier tubes should be good so as to give maximum plate flow.

The Loop

The loop should have sufficient inductance so that when the condenser is connected across it, it will cover the desired wavebands. Sliding contacts on the loop should be examined very carefully and unless so made that a positive contact is assured they should not be permitted, because if the contacts do not "make" you will get noise in the set.

A straight line condenser should be used if possible although a good condenser will answer the purpose. It must, however, have a low minimum capacity and good mechanical construction and insulation. The vernier is not necessary.

Nothing will be said here on loud speakers, A, B or C batteries as they are al-

ready so well known that anything the writer might say would only be repetition.

List of Parts

The complete list of all parts necessary for the construction of the eight tube set is given, and the purchase of which should be easy bearing in mind what has been said in the foregoing article. The A battery will depend upon what kind of tubes are going to be used. The B battery should be 90 volts and preferably storage type as the set with eight tubes uses considerable plate current and, unless the dry batteries are paralleled, you will not get maximum life out of them. The type head set and loud speaker are left for the user to decide as to which of the many is more to his liking. An adjustable loud speaker should be used as this will better enable you to handle the output.

Laying Out the Panel

In laying out the panel have it cut to the correct size then lay it aside and do not touch it until you have made a pattern out of a piece of paper and marked all the holes exactly as laid out for you in the figure. Remember this, panels cut to as large a size as this are expensive and you will save yourself money by laying out the panel first on paper.

When ready to lay out the panel get all the rheostats, binding posts and variable condensers and check up the measurements as given on the figure with the actual measurements of the piece of apparatus you intend using. Lay out the rheostats and variable condensers in a straight center line, then lay out the jacks and switch meters and potentiometer in a center line. This makes a straight line job and looks good and is neat. Avoid changing the positions of the various pieces of apparatus to other than a straight line because it makes a complicated looking front and in designing a set of this kind you want and should have a good looking set as well as a good working set.

After laying out all the apparatus on the paper pattern, securely fasten the paper to the panel with six small clamps. Clamp the panel with the paper layout on it to the table or workbench. Then take

a sharp center punch and lightly tap the center of hole as marked. Look carefully after you have tapped them to see that you have not missed any. Now remove the clamps and paper pattern and go over all the small light taps with the center punch and punch them in hard.

The reason for this is that in case you should have made a mistake in some hole you can easily fill in a light tap but if you had started in and made heavy marks, then discovered a mistake, you would have a difficult job trying to fill it in.

Now drill all holes and ream out with a reamer to size fitting each piece of apparatus to its own hole as you go along. When you come to the holes for the meters, better take the panel to a shop and have it done because it is a rather difficult job to do a large hole correctly. After fitting all apparatus then take it to some shop and have it engraved. It should only cost five or six dollars and the improvement it looks is worth fifty dollars. Engraving makes it a real job. After it is engraved you can assemble the apparatus on it and tighten up everything. Now you are ready for the base board assembly. Tell you all about it in the next article.

(TO BE CONTINUED)

Bringing In Distance Stations

There are nights, rare in winter but common in the summer, when it is impossible to bring in distance stations. This is due to atmospheric conditions beyond our control. The condition should be met philosophically as something that can not be avoided, and not used as the basis of a complaint to the Radio dealer who sold you your set.

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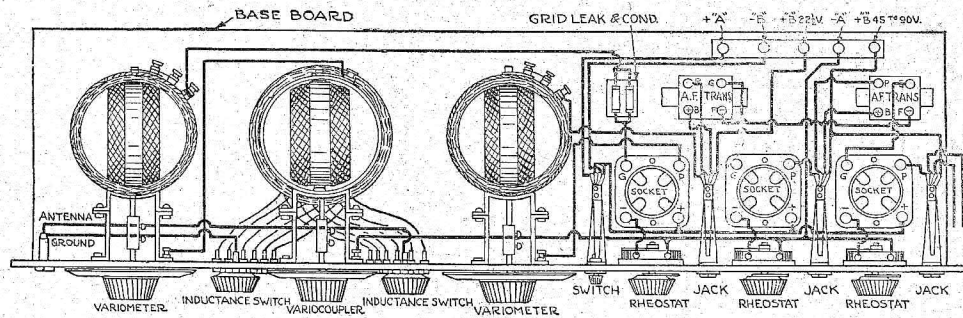
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Premier Electric Company
3810 Ravenswood Avenue Chicago

Old Stand-by Short Wave Regenerative Hook-Up

Part II—Assembling and Tuning

By Major R. C. Schoonhoven



THE rotor of the variocoupler is connected to the negative A and to one side of the grid variometer, while the other connection of the variometer goes to the grid leak and grid condenser, which is connected to the grid binding post on the detector socket. The size of the grid leak required will depend on the type of tube you expect to use in the circuit, as follows: WD-11, WD-12, UV-200 and C-300 tubes about one megohm, UV-201A and C-301A about 1 1/2 to 2 megohms, and the UV-199 and C-299 dry cell tube about three megohms.

The plate binding post of the detector socket is connected to one side of the plate variometer with the other side connected to the bottom of the detector jack.

Transformer Connection
The secondary of the first step transformer is connected to the grid of the first step socket and negative A with the plate of the first step socket connected to the bottom of the first step jack. The next to the bottom of this jack goes to the plate on the second step transformer similar to the connection from the detector jack. The next from the top going to the positive B on the transformer and the top member being connected to positive B, 45 to 90-volts binding post on the battery strip.

By connecting the rheostat of the first step similar to the detector, the first step will be finished. The second step is similar to the first except the inside connection

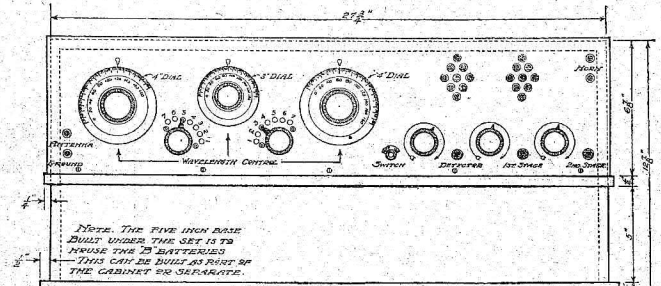
Soldering Hints
In soldering you should not use an acid, and if using paste, be careful not to use any more than is needed. Remove any that might remain, as acid or paste will soon cause a short circuit if allowed to get on coil or between the connections on the jacks.

As it will give you considerably more pleasure and better results, I suggest you use only high-grade material and take your time in the construction and wiring of your set.

The cabinet can be made of 1/2-inch material with a space below for the B batteries. A door can be made on the rear so you will be able to remove the batteries without removing the set from the cabinet. The top should be hinged so that any slight change may be made in the set without removing it from the cabinet.

Tuning
Having completed the set, you should check over each connection, making sure they are tight, free from soldering paste and as shown on the circuit drawing. After this has been finished the set is ready to connect to the antenna, ground and batteries. In connecting the batteries to the set, I suggest you first try the A battery on the B battery taps and test the tubes. If they light, you have a short circuit and the B battery should not be connected until it is located as the B supply would burn out the tubes. If no light occurs you can connect the A battery to the regular binding posts marked negative A and positive A on the battery strip on the rear and see if the filament circuit is satisfactory by turning the rheostats which increases the heat for the filament. You can now turn off the rheostats and switch and connect the B battery to the binding posts in the rear marked negative B and positive B 22 1/2 and 45 volts. The average detector tube will require about 18 volts, but this will vary according to whether hard or soft tube is used.

Phone Connections
The receivers are now connected to the phone plug and the plug placed in the detector jack. The detector rheostat can now be turned on until a slight hum is heard in the head phones.
The inductance switches can now be set with the tap on the smallest amount of turns on the primary, which will be the low wave lengths. Set the plate variometer.
(Continued on page 26)



The connection next to the bottom of the jack is connected to the post marked P or plate on the first step transformer with the second from the top connected to the positive B on the transformer. This leaves the top connection to be connected to the positive 22 1/2-volt B battery binding post on the strip marked for battery connection.

The rheostat is connected in series on the negative A line with negative F on the socket, and positive F on the socket with positive A supply from the switch, which is connected from the negative B and positive A binding post on the battery strip. This will complete all of the wiring as far as the first tube or detector.

connections on the second step jack goes to the loud speaker binding posts on the upper right-hand corner of the panel.

The positive A wire can run direct from the switch to the three connections marked plus on the sockets with negative A connected to the three rheostats with a tap to the two transformers. Some readers might want to use a C battery, and in that case the tap would go to the positive of the C battery and the negative of the C to the transformers.

If using transformers of different ratio it is preferable to use the one with the largest ratio in the first step and the one with the smallest in the second step.

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NORTH—Received coils O. K. If I have same results with these that I had with last will be wanting more. I am 500 miles from nearest station and have picked 56 to date. Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND. Lunenburg, Canada.

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THIRTY MINUTE A-B-C
(Continued from page 19)

Two Circuit Tuning
Similarly, two circuit tuning means that

reflex operation. Referring again to Figure 90, it is possible to adjust the feedback so that enough energy is transferred to the grid circuit to set up oscillations, or a powerful locally generated Radio free-

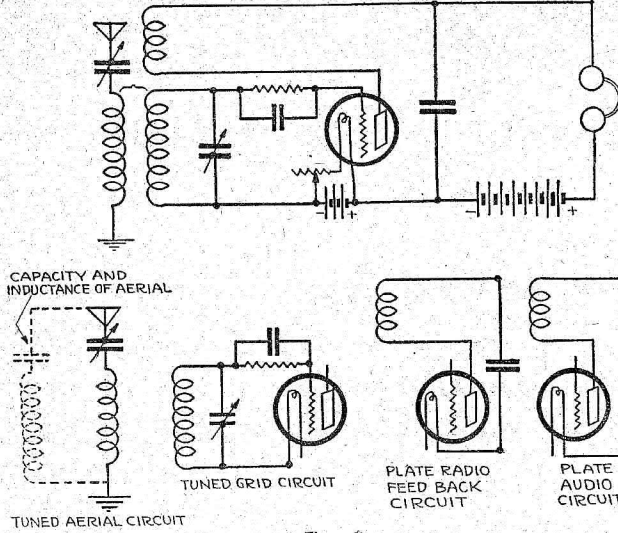


Figure 89.

the grid input circuit is tuned and coupled to the aerial tuned circuit, as shown by Figure 91. The equivalent individual circuits thus made up into a whole are shown in the lower portion of Figure 91.

Three Circuit Tuning

When three circuits are each tuned to the incoming frequency, as in Figure 92, still better selection or restrictive path for the Radio energy is provided. This might be further complicated with four circuit tuning, etc., but the increasing number of adjustments makes such multiple circuit tuning complicated. In Figure 92, the tuned plate circuit is tuned in connection with the natural condenser comprised inside of the vacuum tube used, by using a variometer as an adjustable inductance.

The number of different forms and combinations of circuits made possible from the principal actions is very large and for example, tuning can be combined with regeneration, with reflex and with audio frequency amplification, as well as with

OLD STAND-BY RECEIVER

(Continued from page 25)

eter at minimum inductance so as to produce no regeneration; tune the secondary circuit to the same wave length by the adjustment of the grid variometer and the rotor of the variocoupler, so as to keep the primary and secondary circuits in resonance while tuning in the signals. After the primary and the secondary circuits have been tuned to the desired signal the rheostat might have to be retarded when the plate variometer is slowly rotated in order to amplify the signal by means of regeneration. Care should be used in adjusting the plate variometer and the detector rheostat, as the tube can be caused to oscillate by a very small turn, and this will cause poor reception on your set as well as interference for other sets near by.

By increasing the number of turns of the primary circuit higher wave lengths can be tuned in, following the same instructions given above.

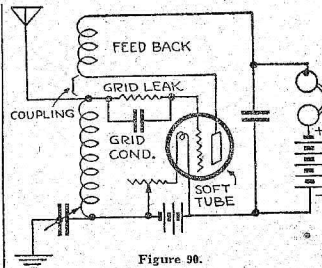
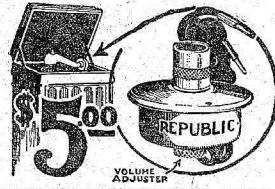


Figure 90.

quency current. The receiving vacuum

Radio Phonograph Unit
LOUD SPEAKER
(Clear as a bell)



A loud speaker that is guaranteed to reproduce remarkable volume and mellowness of tone. Save money on your radio by making your phonograph the loud taker. Will fit any make of machine.

SEND NO MONEY. Pay postman \$6 plus a few cents postage on arrival.
Mail Orders promptly filled, with Money Back Guarantee.
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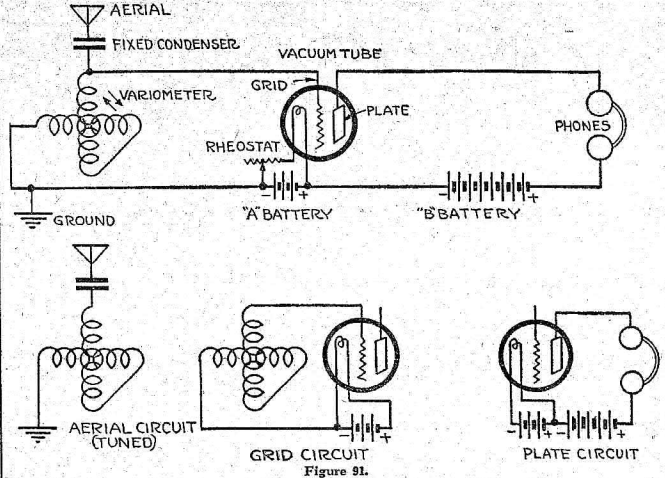


Figure 91.

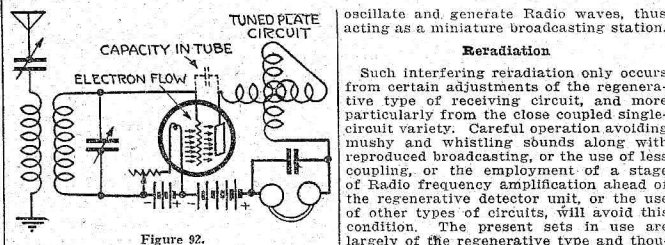


Figure 92.

tube can thus act as a transmitter and radiate considerable Radio energy. That is what happens when neighbors switch the dials of their tuners or receiving sets of this type back and forth. At certain adjustments such regenerative receivers

oscillate and generate Radio waves, thus acting as a miniature broadcasting station.

Radiation

Such interfering radiation only occurs from certain adjustments of the regenerative type of receiving circuit, and more particularly from the close coupled single-circuit variety. Careful operation avoiding mushy and whistling sounds along with reproduced broadcasting, or the use of less coupling, or the employment of a stage of Radio frequency amplification ahead of the regenerative detector unit, or the use of other types of circuits, will avoid this condition. The present sets in use are largely of the regenerative type and thousands are in the hands of people who more or less innocently broadcast a swarm of interfering Radio waves to neighboring receiving sets.

(TO BE CONTINUED)

The Dependable Radio Receiver

FADA "ONE SIXTY"
with the
NEUTRODYNE CIRCUIT
The FADA "One Sixty" is the four-tube Neutrodyne radio receiver that in selectivity, volume, distance and clarity equals the best results of any five-tube set of any type or make. Owners say, "If we don't get 'em on the loud speaker, we don't count 'em." Consistent performance on loud speaker from stations 1500 to 2000 miles away and sometimes much further.

Price \$120 at dealers.
Extra for tubes, batteries and phones
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FADA RADIO

91 1/2%
of all tubes are
Needlessly Destroyed

RADECO SAFETY FUSES
GIVE
COMPLETE PROTECTION
Price 50 cts. each
Dealers write for proposition.
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Dubilier Duratran
reduced from
\$5.00 to \$4.00

Increased production has lowered manufacturing costs of the Dubilier Duratran—the radio-frequency transformer that brings in all the stations loud and strong—not just a few. And you receive the benefit in a big price reduction.

At all good dealers.
DUBILIER CONDENSER & RADIO CORPORATION
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Price 50 cents everywhere

Never sold at cut prices

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Loud Talking Crystal
Sold only by reliable dealers and at full price. The Premier Crystal of the Radio World today. Ideal for REFLEX or CRYSTAL sets. Order, if possible, from your dealer. If he does not have it, send to us for one. Price, 50 cents postpaid.

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3.50 Fisher, Large, 90°..... 2.75
2.75 Fisher, 130°..... 2.25
4.25 Special Bank Wound Coupler for Hayman Circuit (with diagram)..... 3.25
7.00 Ambassador Coil (with diagram)..... 5.50

VARIOMETERS
\$3.50 Workrite.....\$2.95
5.00 Pathe Moulded..... 2.25
3.50 Fisher, Large..... 2.45

CONDENSERS
\$2.00 R. C. 11 plate.....\$1.05
2.35 R. C. 23 plate..... 1.35
3.75 R. C. 43 plate..... 1.65

VERNIER CONDENSERS
\$4.00 R. C. 23 plate.....\$2.25
5.00 R. C. 43 plate..... 2.95

PHONES
\$18.00 DR. SEIBT IMPORTED "SUPER" \$6.90
HEADSET.....\$12.00
\$12.00 N. & K., Imported.....\$6.90

The above items are just a few of our numerous attractive priced articles, which are contained in our **BULLETIN OF RAD PARTS**. Gladly sent to you upon request.

We specialize in the **FAMOUS AMBASSADOR LONG DISTANCE CIRCUIT**. Write for list of parts for this set. Either single or three tube set. Price of parts for single tube set.....\$15.00
Price of parts for **THREE TUBE SET**..... 23.00
We are headquarters for "Radion" and "Bakelite Directo" Panels. The best panel material available. Mail orders promptly attended to. All orders amounting to \$5.00 or more will be shipped prepaid. Will ship C. O. D. unless remittance accompanies order.

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6-Volt 11 Plate, \$12.25	6-Volt 60 Amps. \$ 8.50	6-Volt 80 Amps. 10.00	6-Volt 100 Amps. 12.25
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12-Volt 7 Plate, 17.00	6-Volt 150 Amps. 16.00		

Special 2-Volt Storage Battery for W.D.I. and 19 tubes. Will run 200 hours on one charge. Rechargeable. \$8.00.
Special 4-Volt Storage Battery for U.V. 199 tubes. Same features as 2 Volt. \$8.00.
Shipment express C.O.D. subject to examination. Discount for cash in full with order.

2-Yr. Guarantee Bond in Writing
With Each World Storage Battery
proves satisfactory World performance. Mail this ad with your name and address and we will ship battery day after tomorrow and give you a 45-Volt "B" Battery and Hydrometer Free with each battery purchased. Write today.

World Battery Company
Dept. L, 60 E. Roosevelt Rd.
CHICAGO

Selective Split-Variometer Circuit

**Cuts Out Interference;
Gets Long Distance**

In the accompanying diagram I show a split variometer with a combination of coil, that will make wave traps sit up and wink at its sharp tuning capability.

WORKSHOP KINKS? EARN A DOLLAR—

There are many little kinks worked out at home that would aid your fellow Radio worker if only he knew about them. There are new hook-ups, new ways of making parts and various unique ways of operating sets that are discovered every day. Radio Digest is very much interested in obtaining such material. Send them in with full details, including stamped envelope, so rejected copy may be returned. The work must be entirely original, not copied.
RADIO KINKS DEPARTMENT,
Radio Digest,
123 W. Madison St., Chicago

Besides doing all the stunts without ground and aerial. Recently I brought in W.V.K. Havana, Cuba, 2500 miles distant from here.

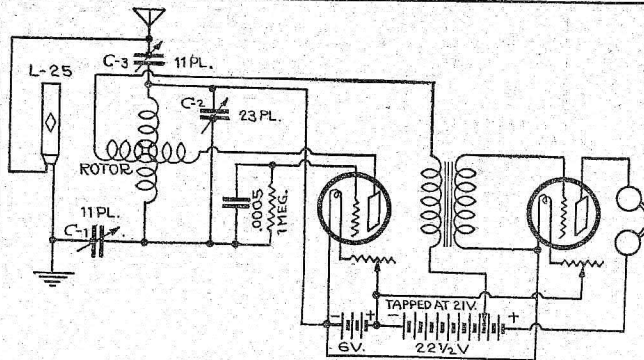
Let the fan who hasn't had good results with a split variometer start by building this hook-up with condenser C 1 only, leaving out the other two variable condensers and honeycomb coil. Now just a word in regard to the variometer. It takes a little time and patience to master the rotor. I would like to impress upon you that when you are adjusting your variometer take for granted you are adjusting the rheostat, because their action on the set is much the same. Please remember this.

The rotor should be set at right angles from stator that means cross-wise; from this position it should be moved only slowly and slightly, not more than 10 or 15 degrees, just enough to increase the signal. If it squeals, back up a little; if a louder signal is required try advancing it a little. After you get, thoroughly acquainted with the working of your set, don't get in a hurry; spend a few more nights on the rotor of the variometer until you find the spot that brings in the loudest signal and its relation to the rheostat.

You are now ready to add condenser C 2. This will give you increased wave lengths and sharper tuning. The rotor plates of this should be kept all the way out most of the time; otherwise you have too long a wave length and you will get nothing. Vernier condensers should, by all means, be employed on these two condensers. Do not delude yourself with the idea that you can replace these condensers with a 3 and 43-plate. A 3-plate is nothing more and nothing less than a vernier on a condenser. And a 43-plate with too long an aerial is so often the trouble when you can't get down below 400 meters. Use size of condensers as specified.

After you get your bearing with this condenser, as with the addition of each rearrange your dials, add condenser C 3 and honeycomb coil. This will now give you that sharp tuning with condenser C 2 that I had to hunt for my local station; 5 to 10 degrees will tune it out completely with proper adjustment of your other dials. Yes, you can tune out the other fellow,

COIL ACROSS AERIAL AND GROUND



not only one broadcasting station—two or three if required, if they are not on to close wavelengths; yes, and leave that music clear and without cutting down your possible stations that were within your reach.

The rotors of the condensers should be connected as indicated. If properly hooked up there is absolutely no body capacity; you can sit on top of it without any part of it being grounded or shielded, and there will be no effects. Tap your transformer on 21 volts on the B battery. If you wish to run this on 22½ volts, you simply can't bring out the volume.

Although I show this hook-up with ground and aerial, you can get good reception up to 25 miles without ground or aerial; 200 miles without aerial, and from 500 to 1000 with aerial only. If you are a "doubting Thomas," just give her a trial.
—O. P. Klein, Leduc, Can.

Best Results from Tubes

While the vacuum tube is the most important part of a set, no two of them, even of the same make, give exactly the same results. By this is meant that it is frequently necessary to change the B battery voltage to get results from tubes that are apparently exactly alike.

8 TUBE SUPER-HETERODYNE

Genuine UTRADYNE Parts

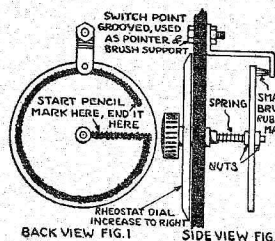
COMPLETE, including 30 in. MAHOGANY CABINET with Drilled and Engraved Panel (less Tubes and Batteries).
\$85
Immediate Delivery.
Literature on Request.

Any Type of Set
BUILT TO ORDER

BROADCAST SERVICE CO.
1 Union Square, New York City

Variable Grid Leak

The pencil mark form of a grid leak may be used in this variable type. A disk of hard rubber is mounted on the shaft end of the switch. So that it can be turned with the knob. Connections

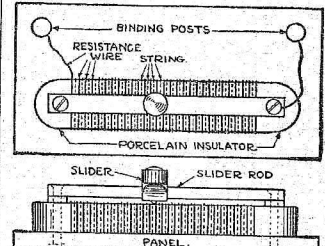


are made as shown in Figure 1. The cross section view is shown in Figure 2. A brush connection is made to the pencil mark through an arm bolted to the panel.
—George Dale, Ames, Iowa.

Homemade Slider Type Rheostat for Tubes

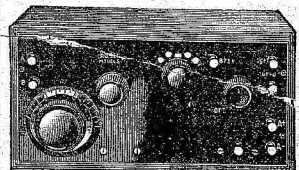
Procure about 18 inches of resistance wire, a porcelain cleat insulator, two binding posts, a slider rod and slider, two wood screws or bolts, and 18 inches of waxed thread. Wind the waxed thread on the insulator, leaving ½-inch between turns. Fasten the ends securely, then by passing the cleat through a flame melt the wax so as to fasten the thread to the cleat. Wind the resistance wire between the threads, keeping the wire hot all the time as winding proceeds so that it will tighten on when it cools. Make sure that the coils of the windings do not touch. Do this quickly for after the winding is on the coils cool and the wire becomes tight.

Cut the slider rod to the proper length and drill holes over the ones in the insulator. Fasten the slider and slider rod on the rheostat by means of wood screws.



Drill holes in the base and attach the parts. Place two binding posts on as shown and run a wire from one end of the slider rod to one of them and the resistance wire to the other. Connect in series with the A battery and the filament. The current is varied by means of the slider.—N. E. Fry, Valdosta, Florida.

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Get our big catalog—sent ONLY to dealers. Ask for A1002. No others need apply.

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to hear concerts from out of town. If you want to get new stations, **ON YOUR CRYSTAL SET**

write me today. I get new records every day from people using my plans who hear programs on Crystal from stations 400 to 1000 MILES AWAY

No tubes, batteries or amplifying apparatus necessary. I hear KDKA (Pittsburgh Pa.) on Galena. You may already have everything you need and just have it connected up wrong. Send self-addressed envelope for picture of my set, and reasons why you need my plans.
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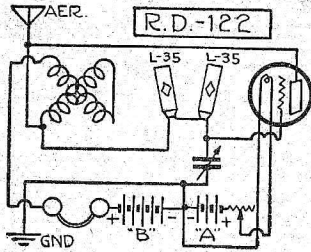
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201 A TYPE ¼ AMP. 5V
\$3.50

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Dealers and Agents' trade solicited

VARIATION OF THE ULTRA-AUDION SET



Mr. Robert L. Dahleu, of 4837 Columbus Ave., Minneapolis, Minn., wanted to know if there was anything unique about his hook-up. No, but it is interesting because it presents still another variation of the popular Ultra-Audion Circuit. He is able to obtain very good results with it in long distance work and its selectivity in cutting out the local stations.

LOS ANGELES NIGHTLY

(Continued from page 11)
the factor which limits distant reception in addition to the sensitivity of the receiver is the signal-static ratio.
Do not think, however, that this condition will never be overcome, as there are systems in use at the present time in our large trans-Atlantic receiving stations which greatly improve this signal-static ratio by balancing and other methods. It is but reasonable, therefore, to conclude that before very long such systems will be simplified so that they may be used for home reception.
Let us not be discouraged by the limitations of today—but rather, let us look forward hopefully to the developments of tomorrow.

PORTABLE SET FOR AUTO

(Continued from page 23)
wires trailing all around the outside of the car, nor shall they take up any of the very limited room inside of the car.
A glance at the illustrations will tell the story. Use some flexible covered lamp cord that can be purchased in any electrician's supply store. Insulators are desirable but not necessarily essential.
The covering of the wire is stripped back only at the points where the cross wire connections are made at the front end of the top cover. This cross wire is the lead-in and should be left long enough to connect to the antenna post of the set.
With an aerial of this type the fundamental wave length is rather low, so there should be no series condenser in the primary circuit. If there is a variable condenser in the antenna circuit it should be connected in shunt across the primary inductance.
With his aerial taken care of the summer fan has overcome his biggest difficulty in automobile reception.

The Type of Set

The question of which set is best suited for automobile installation of this nature should by no means be a difficult one to solve. Practically any of the modern type of receiving sets will give very satisfactory results. Those that employ one or two stages of Radio frequency are to be preferred because of the ability to build up the slightly weaker signals characteristic of an antenna of the type described. Any of the numerous reflex circuits, or the popular neutrodyne can be used. The reflex type of neutrodyne is especially

well adapted because of the more compact arrangement that is permitted. Naturally the space available is very limited so the set cannot be very bulky.

Location of the Set

There are numerous methods of installing the set in an automobile. Room is usually available in the rear seat section of the touring car models but popular demand indicates a general desire to put sets somewhere in the front. Some are placed just above the instrument board, but this is usually in the way and obstructs the vision. Another position is to suspend the set from the front bow of the top—this, however, is only possible with sets that have a very low panel depth, that is not over six inches.

The most convenient and logical location is just under the right hand side of the instrument board. Provided the height of the cabinet is not too much, there still remains sufficient room for the feet underneath.

Installation

Most sets can be especially fastened by means of two or three angle brackets fastened to the top and side of the cabinet and the instrument board and side of the car. In a further article details of a spring suspension will be presented. Although it is now becoming general practice to cushion mount the sockets a further cushioning of the set itself in the installation is recommended.

Connections

There is no necessity for the use of dry cell tubes. The use of A type tubes is recommended. Every car is equipped with a storage battery and a charging generator, so the problem of filament current consumption no longer presents any difficulties. The A battery leads from the set should then be left sufficiently long to run to the storage battery wherever its location happens to be.

The B batteries can be kept in the cabinet of the set, or stored away in some convenient space in the car. In extreme cases they can be placed in a box which can be fastened underneath to the body of the car.

The antenna wire, of course, connects to the antenna binding post of the set.

Ground Connections

There are two possibilities of a ground connection. While the car is standing still a stake driven into the ground will be sufficient. When running the set is usually grounded to the body of the car. When this is done the following precautions are advised. It is customary to ground one side of the storage battery to the body of the car, then only one set of wires is required. Care should be taken to see that the side of the battery that is grounded corresponds to that called for in the hook-up of the set which is in use. If this isn't taken care of the "A" battery may be shorted.

All leads should be heavily insulated as the vibration of a car while running will produce considerable wear which in time will develop short circuits.

Loud Speaker or Headphones

If headphones are used, a double wire

extension can be run from the set to the rear seat terminating in a jack. A multiple phone plug can be used where more than one set of headphones are desired.
In the event that a loud speaker is to be used, the horn can be fastened to the right hand windshield upright, pointing toward the rear seats. This will permit short leads to the set immediately below. The horn should, however, be removable as the temptation to passersby of obtaining a good loudspeaker without cost might be rather strong. A lock on the cabinet of the set might also be advisable.
(TO BE CONTINUED)

Review of Books

The Armstrong Super-Regenerative Circuit. By George J. Eitz, Jr., E. E. This is a De Luxe edition of this famous circuit. Profusely illustrated and fully explained. Fifty-two pages. Price, \$1.00.

Experimental Wireless Stations. By P. E. Edelman. Simple directions are given in this book for making Radio equipment for the transmission of messages over long distances. Price, \$3.

Vacuum Tube Receivers. By O. F. Heslar. A book that tells how to make a simple set. How to make the cabinet. It includes a 27 by 26-inch layout blueprint. Price, 75 cents.

The Radio Amateur's Handbook. By A. Frederick Collins. A new revised edition of this book is just out. It is a complete authentic and informative work on Radio. Fully illustrated. Price, \$1.50.

How to Retail Radio. A new book telling of tested plans and methods and policies for the dealer in Radio. Financing, location, store equipment and arrangement. Price, \$2.

Home Radio—How to Make It. By A. Hyatt Verrill. This book is particularly adapted for the amateur who desires to know how to make Radiophones. Twelve full page illustrations and diagrams. Price, 75 cents.

Radio for the Amateur. By A. H. Packer and R. R. Haugh. The underlying principles of Radio thoroughly explained in simple language and understandable illustrations. This book will teach you how to construct and operate a receiving set successfully. Price, \$1.50.

Radio Communication. By Ellery W. Stone. A splendid, well connected, complete, accurate and up-to-date discussion of every phase of Radio telegraphy and Radiotelephony. Written in simple language. The subject is presented from the physical rather than from the mathematical standpoint, avoiding the use of higher mathematics. Price, \$2.50.

Ideas for the Radio Experimenter's Laboratory. By M. E. Sleeper. This book tells in a simple way, the how and why of Radio apparatus. Comprehensive data are given on such necessary laboratory instruments as the oscillator, wavemeter, direction finder, Radio compass, vacuum tube, characteristic measuring set and detailed advice given on the winding of various kinds of standard inductance coils. Price 75 cents.

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Need Good Tools

After one becomes interested in receiving broadcast concerts and the novelty of just listening wears off the experimental bug usually gets a headlock on most every one, and then comes the time when the new and sensational hook-ups are tried. Now in order that these diagrams may be properly constructed into sets there are certain tools that should be used and that should always be at hand.

The first is the soldering iron. This should be preferably an electric iron, because it will stay hot and one can solder twenty or thirty wires at the same time without running from the stove to the set all the time. Then some soldering flux and some strip solder. Never use acid core solder. Rosin core solder is the best but it takes much practice before it is possible to use it.

Next would be a few pairs of pliers. The first pair to be bought is a pair of combination cutting, pressure and jaw pliers. These are the most handy things for any kind of work. Then comes a pair of cutting pliers. These should be fairly small so that one can cut in tight corners. A pair of flat pliers with long nose is the next accessory. These are handy in most any ticklish position. Then comes the round nose pliers for making loops in the wire to fit over bolts or binding posts. Screw drivers are most important for various uses. There should be at least three sizes.

MAGNATRON! If you insist upon that name when you buy tubes, you are insisting upon obtaining the very best in vacuum tubes. You are assuring yourself of better results from ANY set!
The MAGNATRON DC 201A and the MAGNATRON DC 199 are leaders in their respective fields. At their list price of \$5 they are an outstanding value.
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NEW COCKADAY DISTORTIONLESS AMPLIFIER. Complete parts exactly as specified by Mr. Cockaday. \$32.00 List. \$40.00

\$80 Fred Eisemann
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COCKADAY 4 CIRCUIT RECEIVER. Genuine complete stand exactly as specified by Mr. Cockaday. \$53.00

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Parts No. 167-A Sealed in Fada's Factory Complete parts None Shipped C. O. D. \$49.00

N. & K. PHONES, 4000 Ohms. Imported Model D. List \$8.50. \$5.85
Genuine Lavite Resistance, 48,000 ohms. \$1.10
The Bargains Offered in Our Last Week's Ad Still Hold Good—Order Now!!!

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Orders on credit. Money orders or C.O.D. If it is not listed here, ask us; we have it at reduced prices.

GET DX YOU ARE MISSING

Your set is probably bringing in DX stations you never hear because your rheostat cannot control your filament action. The FIL-KO-STAT gives infinite adjustment and enables you to magnify weak stations and bring them in strong and clear. Write for
Improved Radio Reception Through Scientific Tube Tuning
This new FRED DX radio has it all! How to stop reradiation. How to control regeneration. How to tune your tube as well as your hook-up, etc. Published by
DX INSTRUMENT CO., HARRISBURG, PA.
Who make and guarantee

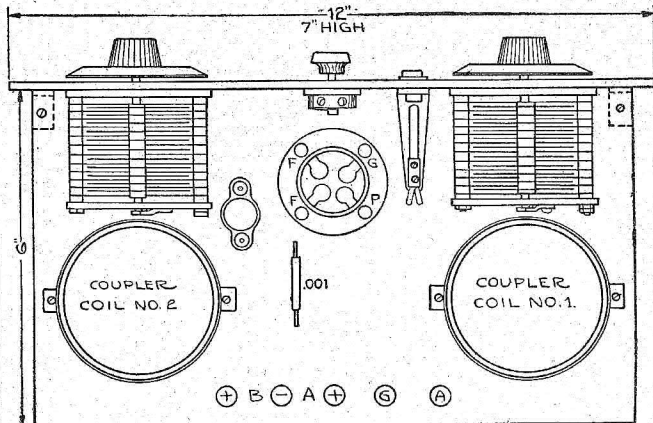
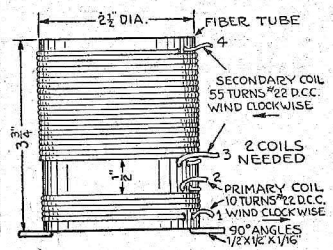
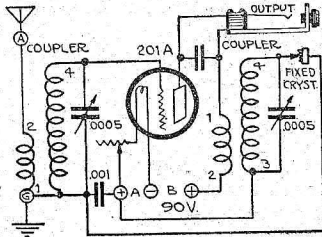
FIL-KO-STAT
Sole International Distributors
RADIO STORES CORPORATION
The Scientifically Correct Radio. Rheostat
215 West 34th St. New York

Construction of a One Tube Reflex Receiver

Clear Tone Produced with Great Volume

AN INEXPENSIVE one-tube set giving much more than usual volume and clear from distortion or trouble to your neighbors is shown in the accompanying illustrations. The coupler coils are

fiber tubes $2\frac{1}{2}$ inches in diameter by 3 inches long; $\frac{1}{4}$ -pound wire; two 23-plate condensers; two mica fixed condensers, .001 and .002 mfd each; tube socket; rheostat; one 201A tube (preferred);



shown in detail. No audio transformer is essential, as this circuit affords Radio amplification in a fixed detector or crystal, and direct reflexed audio amplification. The coupler coils are easily wound and prevent undesired close coupling effects. This is an easy set to wire and use. Materials needed are one panel; six binding posts; two coupler coil sets, using two

three or four dry cell A batteries, and four small B batteries giving about 90 volts for plate supply, and one output jack. Total cost with aerial equipment and phones should run about \$16.00. Both condensers tune together about same positions. The direct feedback gives an audio variation current on the grid, and good efficiency is obtained. A stage or two

of audio amplification may be added if desired and will leave little more to be wanted by the average listener who is looking for an efficient yet inexpensive set.

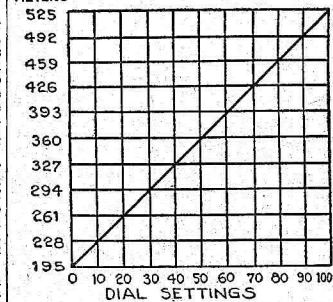
Calibration Chart for Logging Station Signals

If you are using a single-circuit tuner or a two-circuit with an untuned primary, such as a neutroformer, you will find this chart a great help for tuning in desired stations immediately without having to tune in several stations to see if you have the one wanted. By following the same principle practically any set may be calibrated but it involves more complicated figuring.

I am using a neutroformer for a tuner with 16 turns on the primary and about 45 turns on the secondary. The dial of the secondary condenser is divided into 100 points of division and the chart should be begun by marking the squares as shown. If your dial is divided into 180 parts mark off 18 squares instead of 10.

Tune in some station on the wave length of, say 360 meters and note the dial setting. On my set this would be exactly 50. Tune in some other station of a different wave length, say 492 meters, and note the dial setting. On mine it would

be 90. Between 492 meters and 360 meters there is 132 meters and 40 points of division on the dial, therefore for



every point of division there is approximately 3.3 meters or for every 10 points

of division 33 meters. (Of course this is only with my set). Consequently by the process of addition and subtraction the whole wave length of the set may be calibrated. Although this calibration cannot be absolutely accurate it is near enough to be of great help in getting the desired station and I feel anyone making the chart will be amply repaid for the small amount of work put on it.—R. E. Smith, Portland, Ore.

The Hydrometer

Under some conditions hydrometer readings may be misleading as to whether a battery is charged or not, or as to the extent of the charge. For example, when fresh distilled water is added to a cell to bring up the level of the electrolyte, the additional water does not actually combine with the electrolyte until the cell has been on charge for some time. Consequently, if a hydrometer reading were taken of that particular cell just after the

water had been added, the test, owing to the low specific gravity reading obtained, would show the cell to be nearer the fully discharged state than it actually was.

If fresh electrolyte or acid had been added to the cell just before taking readings, the hydrometer would show the cell to be fully charged, although the reverse might actually be the case.

In taking hydrometer readings always be careful to return the electrolyte taken out by the hydrometer to the same cell it was taken from. Failure to replace the electrolyte in the same cell from which it was drawn will result in destroying the uniformity of the cells. For instance, if electrolyte has been drawn from cell A and discharged into cell B, the amount taken from A must later be made up by adding water and the solution in cell A will be that much weaker, while that in cell B will be correspondingly stronger.

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1500 Miles for \$9.75

Ben Franklin Air Key, Single Tube Knockdown Set. \$9.75

This outfit consists of the following material, packed in an individual carton, necessary to build the famous Ben Franklin Air Key Triple Circuit Set:

Ben Franklin Air Key Coupler

- 1 Pausin 23-Plate Condenser
- 1 7/12 Hard Rubber Panel
- 1 Rheostat, 1 V. T. Socket
- 2 3-inch Dials, 1 Mica .00025 Condenser
- 1 Grid Leak, 4 Lead-in Bus Bars
- 2 Marked Binding Posts, 1 Phone Condenser
- 1 Wiring Diagram

These parts will build the famous Ben Franklin Triple Circuit Non-radiating Set; has a receiving range of 1,500 miles.

Ben Franklin Air Key, 3 \$19.75

Tube Knockdown Set. \$19.75

This outfit consists of the same material as the 1 tube set with the addition of 2 audio transformers, 1 7x18 panel, 2 extra sockets, 2 extra rheostats, 3 jacks. Will bring in distance on Loud Speaker.

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A TWIST of the thumbscrew, three taps with a hammer—and you're ready to drill your panel accurately for any instrument. No more spalled panels!

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Miller-B-Metal
Crystal

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The formula for Genuine Miller-B-Metal was originated by A. H. Miller

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Duo-Reflex

Tube for Tube—the Most Powerful Circuits Ever Built. Write for free Bulletin No. 16

Electrical Research Laboratories
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ELECTRAD VARIOHM

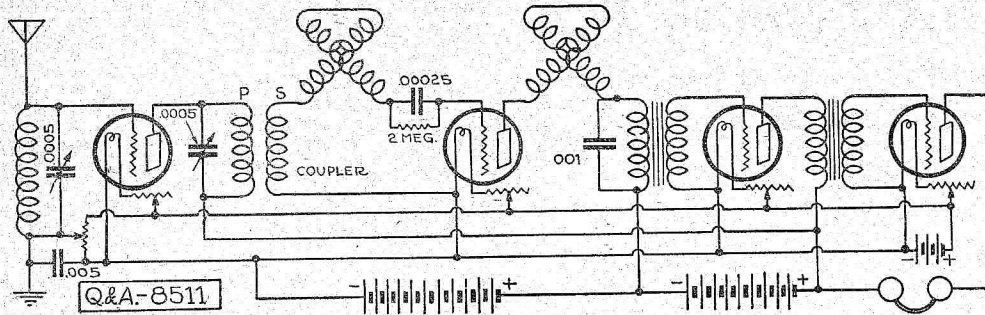
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Correct grid resistance for your tubes and set. From $\frac{1}{4}$ to 30 Meg-ohms by simply turning the knob. Once set, stays permanently. Moisture proof, and non-phonetic. Can be used with any standard fixed condenser.

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Questions and Answers



One Stage Radio Frequency
(08511). G.W.B. Boone, Iowa.

Would you please give the hook-up of a three-circuit set using two variometers and variocoupler, with one stage of tuned Radio frequency, detector, and two stages of audio frequency amplification? Using the UV-200 tube for detector and the UV-201A tubes for amplifiers, what resistance should the rheostats be for best results with these tubes? What resistance should the potentiometer be? What capacity should the grid condenser be in this circuit? What capacity should the phone condenser be?

Would it be of any advantage to have separate B battery for the detector tube? If so, please show same in the hook-up.

A sketch of circuit conforming to your specifications is shown.

A six-ohm rheostat is indicated for the UV-200 and a fifteen-ohm for the UV-201A tube. Potentiometer is a 400 ohm resistance.

A .00025 mfd grid and a .001 mfd phone condenser are the correct capacities.

It is not necessary to employ separate B batteries for detector tube.

Regenerative Receivers
(06019) CBH, Smiths Falls, Ont., Can.

Circuit used is conventional three-circuit, honeycomb coils, detector and two steps audio amplification; .001 condenser in primary circuit on series-parallel switch, .0005 condenser across secondary coil.

1. When primary condenser is cut out, making circuit a periodic, certain powerful stations, such as KDKA, can be heard anywhere on the secondary dial, through the whole 180 degrees of movement, under certain conditions, and the tuning altogether becomes much coarser; it is also noticed that the higher wave stations can be reached (480 up to 538) with the primary condenser cut out, though they cannot be heard at all if it is in series or parallel. Will you please give the explanation of this; coils used are 35-50-75 for primary, secondary and tickler.

2. My rheostat is a very fine vernier, taking 40 full turns of the knob from "off" to "full on." As I am controlling a 4-volt detector and using 6-volt storage battery, there is, of course, not that many available for tuning, but I find considerable difference at times in the filament current required for different stations; is this natural or a freak?

3. Is it better when desiring a certain volume of signal to raise the filament current and decrease the regeneration coupling, or the reverse? I find either will get the volume, and the quality seems about the same. Is it considered preferable to use high filament current in detector, amplified by one step, or lower detector amplified by two steps, from the point of view of tube economy?

4. I use two 2 1/2-volt B batteries in

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Latest nationally advertised loud speaker with electric modulator. List, \$35. Introductory, \$24.75. Our large quantity purchases saves you \$10. Order now before it is too late. Radio Central, Dept. RG, Abilene, Kans.

20c FOR LATEST BOOK OF INFORMATION REGARDING Super-Heterodyne and Neutrodyne Circuits including wiring diagrams FREE BARGAIN PRICE LIST Federal Radio Co.
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VT-1 TUBES. Genuine Western Electric Signal Corps in original package. While they last, only \$6.75. Wegner & Larson, Two Harbors, Minn.

RECTIFIERS—10 Aluminum Plates, 6"x2"x1/8", ready to use, \$1.00 postage paid. F. Hamar, Birch Cliff P. O., Ontario, Canada.

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PATENT ATTORNEYS. Booklet free. Highest references. Best results. WATSON E. COLEMAN, Patent Lawyer, 644 G Street, Washington, D. C.

MORE DX—MORE VOLUME from UV-199 or C-299 tubes. No matter what your hook-up, you can obtain a marvelous increase in power. Parts may be purchased from any dealer for about 50 cents. No radical change necessary. For simple instructions send your name and address with One Dollar to George Schultz, 719 West 180th Street, New York City.

PATENTS procured. Send sketch or model today for examination, prompt report and advice. No charge for preliminary advice. Write for free Booklet and blank form on which to disclose your idea. Highest references. Promptness assured. Clarence A. O'Brien, Registered Patent Lawyer, 200-C Security Bank Building, Washington, D. C.

series, tapping 16 or 18 for detector and running the whole 45 to the amplifiers. Does the first battery wear down faster in this case, or do they run out about the same time, or would the second one last with, say, two in succession in first place? Would it be preferable to use one 2 1/2-volt unit for the detector, and a separate 45-volt for the amplifiers, not connected to each other at all other than by their negative lead to the positive A. In this case, would the 45-volt, feeding to two amplifier tubes, wear out at approximately the same time as the 2 1/2-volt, feeding to detector alone?

5. Being interested in a type of fixed coupler designed and used by M. B. Sleeper, and described in various articles over his name, I would one to his specifications, which are briefly as follows: 3 1/2-inch diameter tube; primary, 7 turns; secondary, 63 turns, making step-up ratio of 9 to 1. This secondary, if crossed by .0005 condenser, would reach to 600 meter wave length, or a substantial margin over broadcasting waves as now in use. The set described as using this coupler has no provision for primary condenser, the idea being that the winding given, in series with the average antenna, will provide the necessary inductance. My antenna is a single wire inverted L, about 135 feet long including lead-in, and another 15 feet to ground. I have been unable to raise even a whistle with this coupler, though the set was built exactly as specified, with variometer in plate circuit to furnish the regeneration. It has occurred to me that the primary circuit does not contain enough inductance, considering that in the honeycomb coil set referred to above, I get my best range of wave length on untuned primary consisting of the same antenna and the 35-turn coil in series, and there is certainly more winding in the 35-turn coil than in the primary of the fixed coupler than mentioned. Incidentally I tried a 25-turn coil in series with the latter to raise the inductance, but without result. I also tried winding the primary on the tube first

at one end, slightly separated from the secondary, as directed, and afterward right over the middle of the secondary, but without result. As this fixed coupler is undoubtedly giving results elsewhere, I am at a loss to account for my lack of them, and any advice you can offer will be appreciated. My idea is to get a little set together with the minimum of controls, suitable for the children to operate, and this single condenser idea seemed the best.

A.—The broad tuning of your description is noticeable in the most efficient circuits and is incidental to incorrect procedure in operation of controls.

The action of filament of tube, as stated, is not normal. You should be able to hear all stations on the same adjustment of rheostat. Tuning must be accomplished with condenser, etc.; not with rheostat.

If it does not cause distortion, regeneration, not filament current, should be increased for greater volume. It is advisable to employ two stages of amplification with low filament current. This is an economy.

All batteries, in the arrangement suggested, will wear out at about the same rate. The current consumed by the detector is negligible as compared with that consumed by the amplifiers.

In your coupler we would recommend the addition of 25 or 30 turns on the primary. Seven turns are hardly sufficient to induce an appreciable amount of energy into the secondary circuit.

R. D.—102
(05920) P. F. O., Biglerville, Pa.
Am an active reader of your magazine

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Can also be operated to put expression in musical numbers, to modulate tones of human voice and to secure natural tonal quality without distortion.
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and list of broadcasting stations, all on sheet 17x28 inches. Space opposite each station for dial settings.
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Rossville Station Newark, N. J.

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76 Springfield Ave., Dept. H, Newark, N. J.

SUPER-HETERODYNE PARTS \$71.50
SEND FOR PRICE LIST SETS MADE TO ORDER
FORBES RADIO CO.
127 North Dearborn Street, Chicago, Illinois

and would like to know more about the reflex circuit (R. D-102) as published in your issue of November 10.

The variocoupler. How many turns on stator and rotor and how tapped?

The transformers. What ratio, and what make is best?

What do the two coils represent at right of transformer and crystal detector, and what size are same?

Crystal detector. Should this be fixed or adjustable?

Will a UV-199 tube be as satisfactory as a UV-201A, as used by Mr. J. P. Flaherty?

Will the set operate a loud speaker?

I am interested in making a "book" type variable condenser. What size sheets of tinfoil should be used for different capacities, and should a mica sheet be between them?

A.—A standard variocoupler is indicated. This can be made by winding primary with 56 turns of number 20 wire, tapped at every seventh turn, and secondary with 50 turns of number 28 wire.

Any standard audio frequency transformer of rugged construction and five-to-one ratio will serve.

The coils you inquire about are Radio frequency transformers and should be of a special reflex type for best results.

A fixed crystal detector is recommended. The UV-199 tube can be used, although the UV-201A is more effective.

The circuit will operate a loud speaker for local reception only.

Three by four-inch sheets of tinfoil separated by a thin sheet of mica will approximate sufficiently a .0006-mfd. condenser.

A.C. Rectifier
(07215) RH, Dover, Ohio.

Is it possible to use the aluminum and lead plate rectifying jars to rectify 110 volts A.C. to D.C. for the plates on a 3 tube reflex set?

A.—It would not be a satisfactory method to rectify alternating current for operation of receiver, as the hum incurred would greatly interfere with reception, in fact would drown out D X signals.

NEW BOOK—RADIO TROUBLE SHOOTER—
For correcting weak, distorted, scratchy reception or receiver failure. Any type receiver. Test systems, trouble shooting, progress from common to more elusive and complex difficulties; remedies; prevention of trouble; efficiency hints; secret DX reception; indispensable to listeners, especially those lacking access to first-class radio repair shops; twelve chapters. Postpaid return mail, 50c. Radio Information Service, Box 278-H, Galveston, Tex.

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12 INCHES DIAMETER
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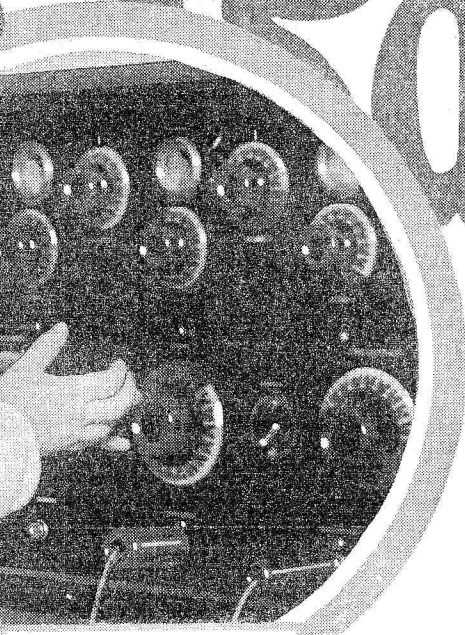
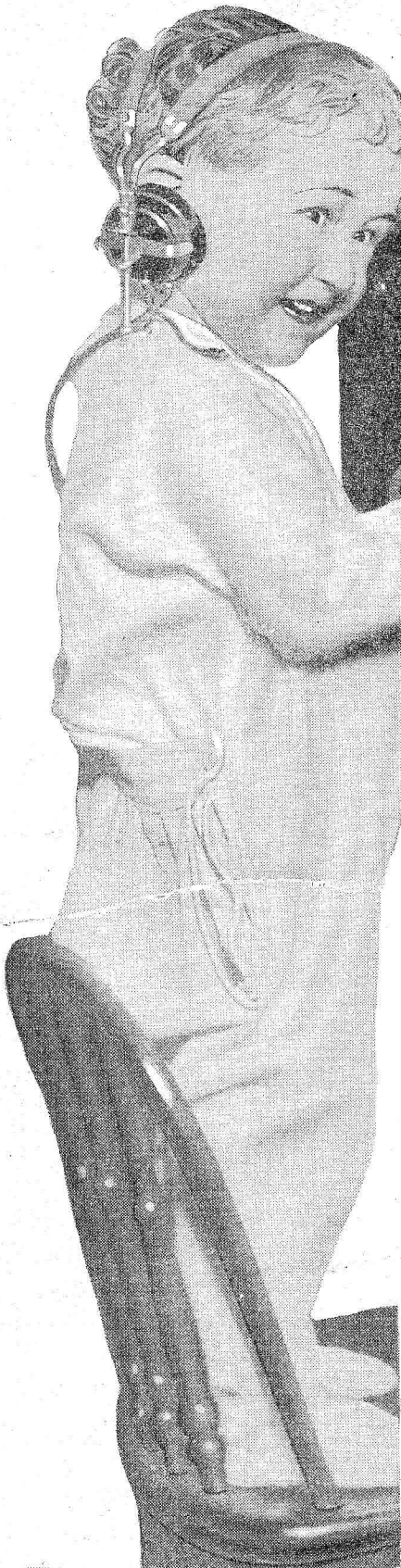
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STANDARD
Complete \$8
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Postpaid. Use your headset for two purposes—conventional communication—value every part of phones tested.
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Transformers, Types A and B, each \$5.00
Tuning, Oscillating Coils, per pair \$4.00
Full instructions and Blue Prints furnished with each kit. Absolutely guaranteed. Type B Transformers are suitable for any Super-Heterodyne circuit.
Put up in handsome kit display box. Special discount to dealers. Prompt delivery. Write for special circular.
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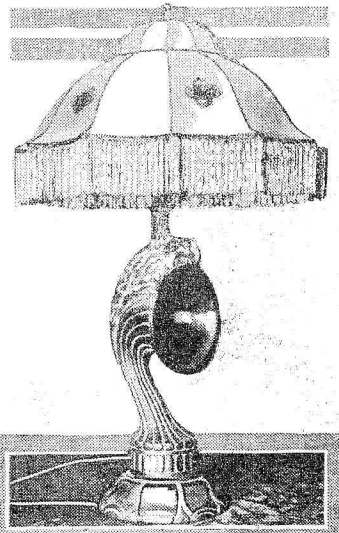
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RADIO PRINTERS, Dept. 45 Mendota, Illinois

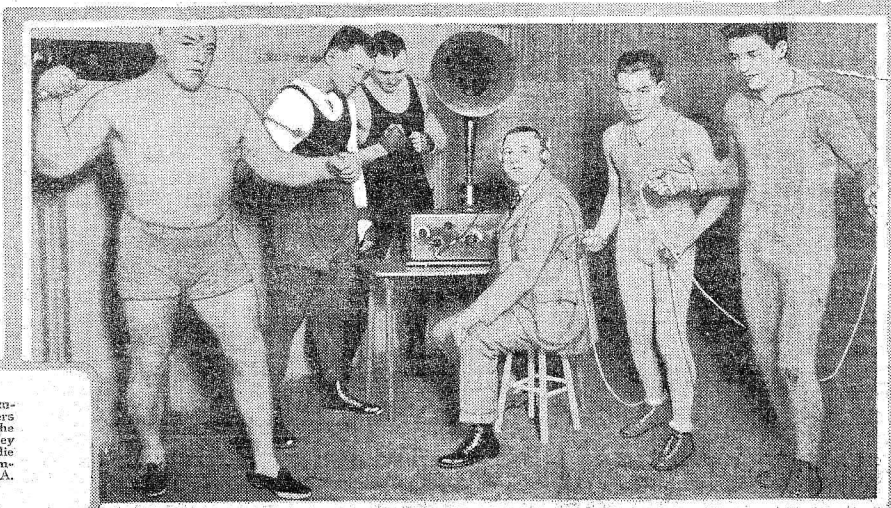
Radio Illustrated



Two and a half year old Violet Overfelt of Terre Haute, Ind., listening to the bedtime story from KDKA. Little Miss Overfelt listens in every night before going to bed.



Above: A novel combination of loud speaker and table lamp. World Wide
Flo Hart, dainty Follies girl, took her receiving set to the hospital with her to help while away the time. P. & A.



A receiving set has been installed in the Arcade gymnasium, Chicago, to furnish music for the boxers while they train, and to receive the returns of all the big fights. The photo from left to right shows Stanley Szobysco, wrestler; Jack Malone, middleweight; Eddie Welsh; Howard Cary, owner; Connie Curry and Sammy Mandel, lightweight. P. & A.