

Radio Digest

EVERY WEEK

Illustrated

TEN CENTS

Vol. II

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CHICAGO, ILL., SATURDAY, AUGUST 19, 1922

No. 6

RADIO TO RUN TRAINS

ETHER AND MOVIES GIVE FOREST FIRE

COMBINATION NEW DEPARTURE IN SCREEN SHOWS

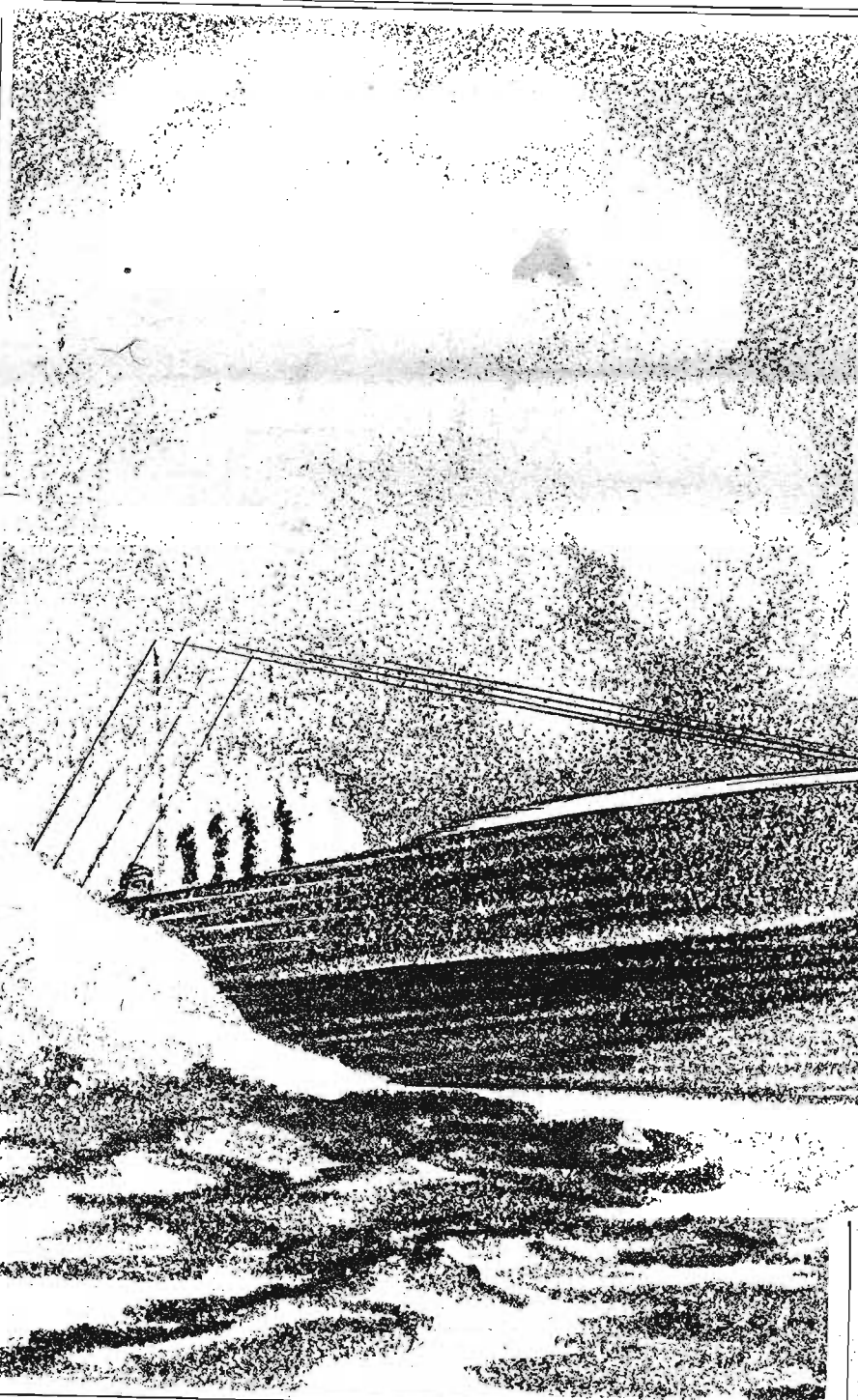
Theater Picks Up Sound Effects of Flames to Accompany Picture

(Special to RADIO DIGEST)

NEWARK, N. J.—Radio audiences have had a chance at a forest fire in full "blast." This demonstration marked the opening not only of the new Radio broadcasting station of Bamberger & Co., WOR, but the beginning of the new Radio time schedule for the second Radio district.

Aside from this it was a departure in moving picture exhibitions. It was one of the first times Radio has been synchronized with motion pictures, and brought to the attention of the people a timely warning on the subject of forest fires.

Albert Britt read an interesting paper on the subject of the use of Radio in the detection and control of forest fires. Fol-



NO ENGINEER AT THROTTLE IN TEST RUN

Big Freight Train Started

Ether Signal from Station KDS Sends Heavy Laden Carrier on Long Journey

(Special to RADIO DIGEST)

EAST PITTSBURGH, PA.—In the presence of an assemblage of business leaders the International Trade Special carrying 33 cars of equipment for the electrification of the Chilean State Railways, was started this week by Radio from the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company.

Following the lecture there was broadcast from the station, for the period of a minute, the sound effects of a roaring forest fire.

A receiving apparatus with loud speaker attachments, installed in the Central Theatre, picked up the forest fire program and synchronized it with the flashes and scenic effects of the picture "The Storm" as they were thrown on the screen.

The station is in charge of the only woman broadcaster in the United States, Miss Jessie Koewing.

HONDURAS PLANT TO SEND LUCKY DRAWS?

TEGUCIGALPA, HONDURAS.—About \$300,000 is being spent on a contract for the construction of a station near Tegucigalpa, in the Republic of Honduras. Operations will not commence before October, by which time it is expected the station will be in working order, with two towers 458 feet in height.

Musical Auto Entertains Louisville Street Crowds

LOUISVILLE, KY.—One of the latest developments in Louisville is a musical auto with an aerial strung above the top of the machine and a receiving set with loud speaker attached, suspended inside. V. H. Nordman and W. R. Cummings, 614 West Oak St., Louisville, who are responsible for the musical auto, seemingly have a good time parading the city streets, and stopping at some point every now and then to entertain the passing throng with concerts from station WHAS.

Thousands Throng South's Initial Radio Exhibition

BIRMINGHAM, ALA.—Thousands of visitors were attracted last week to the first Radio show of the south which was held jointly by electrical concerns and newspapers here. Skill of local amateurs demonstrated at the exhibition was surprising. Every conceivable type of Radio outfit from a tiny set no larger than a thimble to the most powerful apparatus was entered. More than a score of prizes were awarded. The first prize was awarded to Walter E. Bare, of this city.

This is the first time in history that such a feat has been accomplished and it portends the tremendous possibilities for the use of Radio in railroad work.

The International Trade Special was started on its long journey when E. M. Herr, president of the Westinghouse Company, closed a switch on a pole near the

(Continued on page 2)

STARVING ENGINEERS BUSY ON RADIO WORK

NEW YORK.—Radio is proving effective in lessening unemployment in many ways. Chief among them is the direct employment of engineers and technicians in the production and operation of Radio sets and equipment. Profitable employment has been found since January 1st for 900 engineers by one engineering society.

RADIO TO RUN TRAINS

(Continued from page 1)

railroad track on which the train was standing. The closing of this switch closed the Radio electrical circuits and this reacted on the circuits in the locomotive, releasing the controller.

Engineer Takes Charge

The release of the controller by Radio then started the International Trade Special and marked an event unparalleled in history and engineering. After the train was put in motion by the Radio relay arrangement, a locomotive engineer who was sitting in the cab, in accordance with the requirements of the Interstate Commerce Commission, took charge of the train.

The assembled guests, although expecting to witness an unprecedented event, were amazed by the facility with which the locomotive was started, and, for a moment, stood silently in wonderment at the feat. Then they started cheering and continued cheering until the long train had left the plant.

The shipment, which was the largest single consignment of electrical apparatus for railroad electrification ever made in the world, was the second complete train of railway electrification equipment to be sent to Chile in the partial fulfillment of a \$7,000,000 contract to electrify the Chilean State Railways.

Attended by Notables

Following quickly upon the shipment of the first consignment of apparatus a few weeks ago, the departure of the International Trade Special was attended by appropriate ceremonies participated in by representatives of the Pittsburgh Chamber of Commerce and other business associations as well as by leaders in the municipal, banking, industrial and newspaper life of the Pittsburgh district. The departure of the long train, bearing the largest consignment of apparatus for electrification purposes ever shipped by an American firm to a foreign country, was heralded by the assemblage as another evidence of the return of a state of normalcy in the business world and an omen of an early return to prosperity.

The train, consisting of 33 cars and measuring more than 1,300 feet, or a quarter of a mile in length, carried equipment valued at approximately \$750,000.

Will Equip Five Sub-Stations

The equipment shipped in this consignment included six 2,000 kilowatt motor generator sets for installation in three sub-stations under construction at Vina del Mar, San Pedro and Llai Llai; transformers, switching equipment for three complete sub-stations, 15 lightning arresters, three switchboards of 20 panels each and 44 circuit breakers. The equipment shipped this week completes all apparatus for the five sub-stations, the apparatus for the two sub-stations situated at Rangué and Quilicura having been shipped with the first consignment several weeks ago.

The total shipping weight of the equipment was about 2,400,000 pounds, and represented one of the heaviest shipments ever sent out of the large plant at East Pittsburgh.

Will Travel Six Weeks

The equipment will be more than six weeks in continuous travel by land and sea before it reaches its destination. Upon leaving East Pittsburgh, the train proceeded direct to the Eddystone plant of the Baldwin Locomotive Works at South Philadelphia, from which point it will proceed by boat through the Panama Canal to Valparaiso, Chile. From this point it will be distributed to the three sub-stations at Vina del Mar, San Pedro and Llai Llai.

The shipment of locomotives for the electrification of the Chilean State Railways will commence shortly. There are 39 locomotives in the \$7,000,000 order, which was the largest single order for railroad electrification purposes ever placed with any one firm.

River to Furnish Power

The waters of the Rio Colorado will be utilized in the generation of the power to



E. M. Herr, president of the Westinghouse Company, turning the switch that for the first time set a train in motion by Radio

be furnished to the Chilean State Railways, the initial electrification of which will include 144 miles of track, 116 miles from Valparaiso to Santiago and 28 miles from Las Vegas to Los Andes. The station generating the power for the electrification will have three 8,125 kilovolt-ampere generators and the 110,000-volt power will be transmitted 37 miles to Santiago, where it will be connected with the system fed by the Florida Hydro-Electric Station and the Mapocho Steam Station, both of which have been operating for several years.

The five sub-stations, which will distribute the power supply, are designed to handle a train movement approximately 50 per cent greater than that existing in 1917 with steam operation and with an ultimate provision for tripling the 1917 demand, if necessary. Each sub-station will contain 2,000-kilowatt, 3,000-volt, direct current generator sets, transformers and switching equipment and each 2,000-kilowatt motor generator is designed to withstand a 200 per cent overload.

BIG MODEL RECEIVERS FOR AIR MAIL PLANES

Manufacturers Experiment to Meet Probable Demand

(Special to RADIO DIGEST)

WASHINGTON.—Commercial companies are working out model receiving and sending Radio sets for air mail planes. The requirements for Radio equipment for air mail planes are not met by any sets now available so special experiments are being made to develop a set.

Economy of space and weight are the first demands for air mail Radio equipment. The transmitter must have a radius of about 200 miles and will use only one wave length. The Post Office Department is interested in the immediate development of Radio equipment suitable to its needs because of the necessity for constant communication in case night flying becomes an actuality.

Uses Radio in Campaign for "Careful Crossing"

TACOMA, WASH.—Radio is being used by the American Railway Association to further its "careful crossing" campaign, according to D. G. Black, district agent of the Great Northern, who is co-operating in spreading the gospel of careful crossing of railroad tracks.

The latest publicity for the careful crossing campaign was given by President J. E. Gorman of the Chicago, Rock Island & Pacific railroad, who told his Radio audience some of the facts that have led to the campaign. The appeal was made to the drivers of automobiles and of teams and to pedestrians to do their part in avoiding crossing accidents. The help of railroad engineers, firemen and crossing flagmen is promised.

RECEIVING RECORDS? WATCH 'EM GROW

THE race continues! Amateurs who are able to BEAT THE RECORDS listed below, or who can claim distance receiving records (100 miles or better) for stations not listed below, but which are given in the broadcasting directory, need only send in their records to be listed along with their names.

One condition exists. Every record aspirant MUST GIVE the NUMBER OF MILES represented by the record, if his letter is to be considered. Otherwise it will be thrown out.

Records to date are given below. —Broadcast Editor.

Station, Miles Record, and By Whom Heard

- AG1-720—R. C. Bryant, Clarkston, Wash.
- CFCA-250—S. W. Farmer, Buffalo, N. Y.
- CHBC-420—A. West, Junction City, Wash.
- CHXC-150—S. W. Farmer, Buffalo, N. Y.
- CJCG-380—G. W. Hutchinson, Santhey, Sask., Can.
- CJNC-400—E. Dahlgren, Rice Lake, Wis.
- CKCE-450—N. Theobald, Attleboro, Mass.
- DD5-1,265—C. D. Mason, Cleveland, O.
- DN4-375—I. M. Hart, Prosser, Nebr.
- DX4-1,000—D. McQuaid, Vacaville, Cal.
- KDAF-560—S. W. Wilkinson, Knoxville, Tenn.
- KDN-1,655—E. Dahlgren, Rice Lake, Wis.
- KDKA-1,175—Wm. J. Lee, Jacksonville, Fla.
- KDOW-3,600—F. Nicholas, Easton, Pa.
- KDYQ-2,250—C. M. Rice, Jr., Worcester, Mass.
- KDYS-1,000—D. McQuaid, Vacaville, Cal.
- KDZH-635—A. West, Junction City, Wash.
- KDZI-145—A. West, Junction City, Wash.
- KDZR-260—G. Whisman, Spokane, Wash.
- KFAC-500—D. McQuaid, Vacaville, Cal.
- KFAD-800—D. McQuaid, Vacaville, Cal.
- KFC-1,660—C. R. Williams, Janesville, Wis.
- KFJ-500—D. McQuaid, Vacaville, Cal.
- KFU-760—D. Lombard, Malden, Wash.
- KFV-600—D. McQuaid, Vacaville, Cal.
- KFZ-335—A. West, Junction City, Wash.
- KGB-250—D. Lombard, Malden, Wash.
- KGC-660—A. West, Junction City, Wash.
- KGW-270—Wm. F. Plaine, Lakeview, Ore.
- KGY-265—D. Lombard, Malden, Wash.
- KHB-650—E. A. Rose, Two Harbors, Minn.
- KHJ-600—Wm. F. Plaine, Lakeview, Ore.
- KHQ-2,400—C. M. Rice Jr., Worcester, Mass.
- KIZ-780—G. Whisman, Spokane, Wash.
- KJJ-740—R. C. Bryant, Clarkston, Wash.
- KJR-290—D. Lombard, Malden, Wash.
- KJS-600—Wm. F. Plaine, Lakeview, Ore.
- KLP-2,125—W. G. Mann, London, Ont.
- KLZ-1,600—E. K. Kitts, Bluefield, W. Va.
- KMC-190—D. Wolfe, San Jose, Cal.
- KNJ-1,150—N. M. Holmes, Chippewa Lake, O.
- KNT-1,800—E. K. Hartenbower, La Salle, Canada.
- KOB-1,550—C. M. Rice Jr., Worcester, Mass.
- KQV-100—D. Ploesser, Canton, O.
- KQW-1,725—W. E. Long, Sterling, Ill.
- KSD-1,000—F. S. Cates, Jacksonville, Fla.
- KUO-3,000—C. M. Rice Jr., Worcester, Mass.
- KUY-610—Wm. F. Plaine, Lakeview, Ore.
- KVQ-650—R. C. Bryant, Clarkston, Wash.
- KWG-1,800—C. G. Munns, Hoisington, Kan.
- KWH-600—Wm. F. Plaine, Lakeview, Ore.
- KXD-120—J. J. Beales, Jr., San Anselmo, Cal.
- KYE-710—Wm. F. Plaine, Lakeview, Ore.
- KYG-550—D. McQuaid, Vacaville, Cal.
- KYI-500—Wm. F. Plaine, Lakeview, Ore.
- KYJ-1,300—H. Wantuck, Fayetteville, Ark.
- KYW-2,200—J. J. Beales, Jr., San Anselmo, Cal.
- KZC-850—J. J. Beales, Jr., San Anselmo, Cal.
- KZM-700—D. Lombard, Malden, Wash.
- KZN-1,875—C. M. Rice Jr., Worcester, Mass.
- KZV-380—Wm. F. Paine, Lakeview, Ore.
- KZY-2,600—A. Galloway, Jr., Grand Rapids, Mich.
- NOF-745—D. R. Bartsch, Galena, Ill.
- WAAB-630—Radio Installation Service, Tenn.
- WAAF-425—S. W. Wilkinson, Knoxville, Tenn.
- WAAK-900—C. M. Rice Jr., Worcester, Mass.
- WAAH-220—D. R. Bartsch, Galena, Ill.
- WAAJ-690—A. E. Taylor, Coldwater, Mich.
- WAAL-600—E. Amos, Chetopa, Kan.
- WAAP-500—R. Booth, St. Louis, Mo.
- WAAQ-400—H. S. Rahiser, Pittsburgh, Pa.
- WAAW-390—E. Dahlgren, Rice Lake, Wis.
- WAAZ-1,150—Warren & Ogg, Fergus, Ont., Can.
- WAH-175—D. Keigley, Miami, Okla.

(Continued on page 6)

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Everyday Analogies for Radio. A continuation of the series by Letson Balliet in answer to many requests from our readers.
Useful Information. Last articles of the series by Peter J. M. Clute.
The Problem of Radio Power Transmission, by Dr. Charles P. Steinmetz, world famous electrical engineer.
Panel Units for Your Receiving Sets. Two additional panels of the standard type. The best way for an amateur to build up his set is by standard panels.
Broadcasting Directory. Gets better and larger each week. The only convenient reference to aid you in finding a station heard.
"How to Make Department." Many kinks every week are interchanged here.
Radio Illustrated. The picture page is the best of its kind.

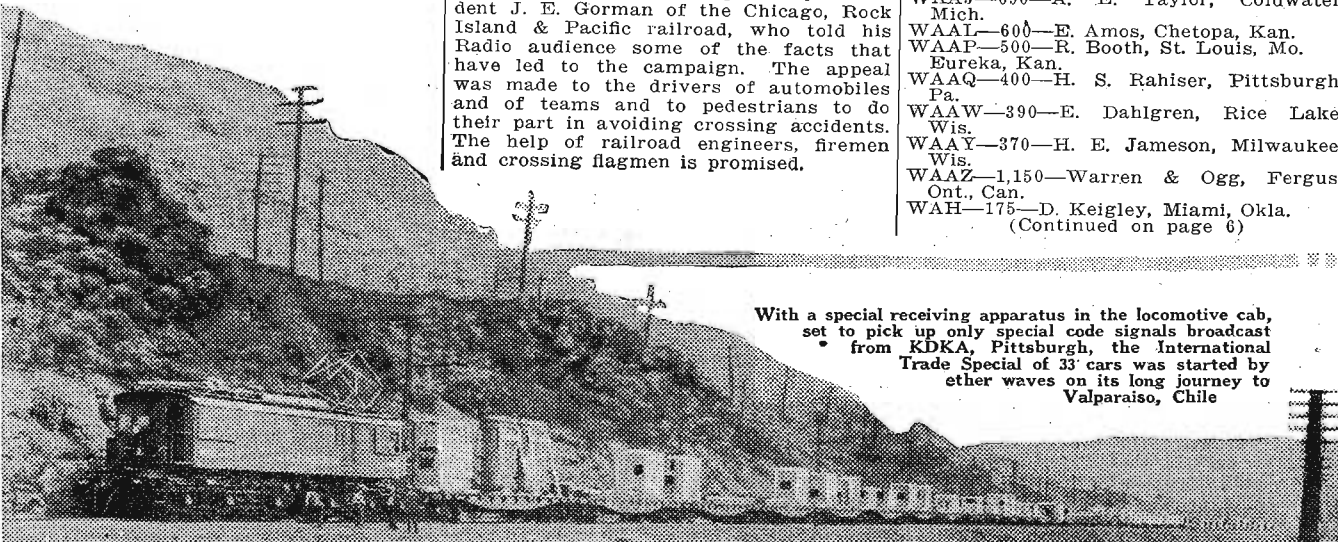
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With a special receiving apparatus in the locomotive cab, set to pick up only special code signals broadcast from KDKA, Pittsburgh, the International Trade Special of 33 cars was started by ether waves on its long journey to Valparaiso, Chile

MARKET NEWS TO DOWN EAST FARMS

NEW ENGLAND GETS REPORTS FOR FIRST TIME

Increased Demands by Farmers Forces Arrangements for Broadcasts from WGI

(Special to RADIO DIGEST)

MEDFORD HILLSIDE, MASS.—Due to the growing demand in Massachusetts and neighboring states, arrangements have been made to broadcast daily by Radio from the Amrad station, WGI, market reports for the benefit of the farm districts of New England. At 1:05, Eastern daylight saving time, a comprehensive report of conditions existing in the Boston farm produce market will be broadcast, the report including information as to local market supply and demand, and market tendencies. It is expected that the information will be of great value to truck farmers in districts around Boston as well as farmers in outlying farm districts who have perishable produce that can be rushed to Boston markets.

At 6 p. m. a more comprehensive report will be given covering the situation in meat, livestock at the Brighton market, wholesale fruit and vegetables, dairy and poultry products. The afternoon report will include Edgemere passings, which is a resume of produce going through Edgemere en route to Boston and gives an estimate of what the next day's market supply will consist. Both reports are furnished by the state division of markets, state department of agriculture. The six o'clock broadcast is a Federal report.

This is the first time market reports have been broadcast to New England farmers, although other sections of the country have had market reports for a long time. Requests have been coming in for these reports since last March.

EXPLORERS' AIR WAVES TELL ARCTIC SUCCESS

Portland, Me., Catches Word from McMillan Outfit

PORTLAND, ME.—A Radiogram from G. Dawson Howell of Boston, with the Donald McMillan, Arctic expedition has been received by George F. Carey, of this city, treasurer of the McMillan Arctic Association. It was dated July 27 and sent from Nascopie, via Fogo Island, Newfoundland, probably with the aid of a messenger and states that observations in terrestrial magnetism were successful. All were well. They began in November and sixteen field stations were established by Howell, who was especially trained for this work by Carnegie Institute.

The Radio receiving outfit, installed on the little schooner Bowdoin, on which they sailed from Wiscasset, Me., a year ago July 16, was ineffective, according to the message, which added that a Radiogram could be sent through the fur trade commission for delivery at Cape Dorset, on the southwestern coast of Baffin Land and the upper end of Hudson Strait.

Paris Toy Shops Sell Listeners

PARIS, FRANCE.—Broadcasting is making great strides in Paris. Even the toyshops are now offering for sale "listen-in" apparatus. A well-made little instrument can be purchased for about \$4, which is capable of receiving the time and other messages from the Eiffel Tower installation. With a more powerful outfit, which is sold at about \$17, it is possible to receive messages from nearly all the Radio stations in France. But for "listen-in" during concerts it is not satisfactory. For \$70 an instrument can be obtained with which concerts given at Th Hague can be heard.

CLOTHESLINE FIXER NOW AERIAL EXPERT

YEARS AGO the "chimney sweep" made regular visits to the homes. Later came the "steeple jack" who is still an important factor, but now comes a new fellow and what shall he be called? He repairs aerials. He at one time did work on backyard clotheslines, but now there is more money in his new vocation. He claims the work is simple compared to climbing clothesline poles, and is much safer.

NEW ENGLISH PLANT REMOTE CONTROLLED

LONDON, ENGLAND.—Radio traffic between England and Spain, which has been handled for some time by land wires to the Poldhu station and thence by Radio, has been greatly improved by the substitution of the new Marconi station at Ongar as the transmitting agency. This station is worked by remote control from London, so that messages filed in that city are sent direct.

NAVAL SET INTERESTS FAIR MISS



One of the chief attractions at a recent Radio Show was the exhibit from the Brooklyn yards. Miss Victoria Merritt, beside J. V. Gartland, is a much-interested "listener in."

© F. & A.

ETH SHORTHAND

STUDENTS POT BROADCAST S

Pittsburgh School Recommends Method as Excellent—Girl Calls It "Real Fun"

(Special to RADIO DIGEST)

PITTSBURGH, PA.—A novel aid in the study of shorthand, the taking of dictation down from broadcast speeches and programs, is the latest means of utilizing Radio receiving sets in Pittsburgh.

Ruth Baker, who lives at 118 East Ohio Street, Pittsburgh, Pa., listens in and transcribes the test of speeches into shorthand notes while enjoying the Radio program broadcast from KDKA, the Westinghouse Electric & Manufacturing Company's Radio broadcasting station at East Pittsburgh, Pa., and thus finds unlimited opportunity for practice.

"It's really fun," Ruth declares. "I like to hear the program and I just take down shorthand notes while I am listening to the speakers. Then, instead of having to study my shorthand after the entertainment, all I have to do is to transcribe my notes for practice. It makes study a pleasure."

The method is recommended as an excellent one by Prof. O. B. Hughes, head of Park Institute, Pittsburgh, where Ruth attends. Many other schools are advising their pupils to employ the radio in similar fashion.

GIRL USES HER HAIRPINS TO BUILD UNIQUE SET

Druggist's Cashier Rigs Aerial on Prescription Balcony

LOS ANGELES, CALIF.—The ingenious mind of a Radio fan whose main desire was to help solve the high cost of receiving, has resulted successfully for Iona Leland, cashier at the Chambers Drug Store, at 100 South Broadway, this city, who by utilizing some of the common commodities which go to make up lady's coiffure, can now listen in on the ether while she works.

By using only a number of hairpins and thirteen small paper clips, a few feet of cotton covered copper wire, a piece of galena, and a paper oyster container, Miss Leland has made herself a complete receiving set with which she is now able to keep tab on what is taking place in the ether at any time that she likes to listen in.

Hanging an aerial wire from the prescription balcony, she leads this to a position above where she sits in the cashier's cage. She listens to the concerts and lectures broadcast from station KHJ located across the street, and all the while her fingers nimbly make change. Since constructing her first successful set, she has up to now completed some half a dozen sets for her friends.

Move to Standardize Radio Outfits

WASHINGTON.—The National Radio Chamber of Commerce is negotiating now with the various government departments with a view to co-operating with those departments in the standardization of Radio apparatus, methods of manufacture, methods of testing, etc. It is planned in the future to have a central testing laboratory for Radio apparatus so that the various members of the chamber and any other manufacturers interested may avail themselves of the services of such a laboratory for the purpose of testing, calibrating and making such researches as may be desired.

WANT NORWAY BAN LIFTED

Increasing Amateurs to Suggest Plan to Government

NEW YORK.—The position of the Radio amateur in Norway is aptly described in a letter from the secretary of the Norsk Radio-Amatorkup of Christiania. In it he says:

"The membership of the club is very rapidly increasing, showing the great interest taken in Radio in Norway, an interest which had been concealed under the government ban on amateur Radio, but which is now at last coming into its own.

"Our plan is to collect the necessary number of members and make the government a proposal that amateur work be permitted under certain conditions. Rules have been worked out by our committee and will accompany our proposal as a base for further consideration from both sides. In this way we hope to get rid of the absurd prohibition of amateur work.

GREET HAYS BY AIR WAVE

Southern Californians Send Ether Welcome to Movie Chief

LOS ANGELES, CALIF.—Radio stepped to the front and officially opened the great public gathering which was held recently in the Hollywood Bowl in honor of Will H. Hays, director-general of the silver-sheet world.

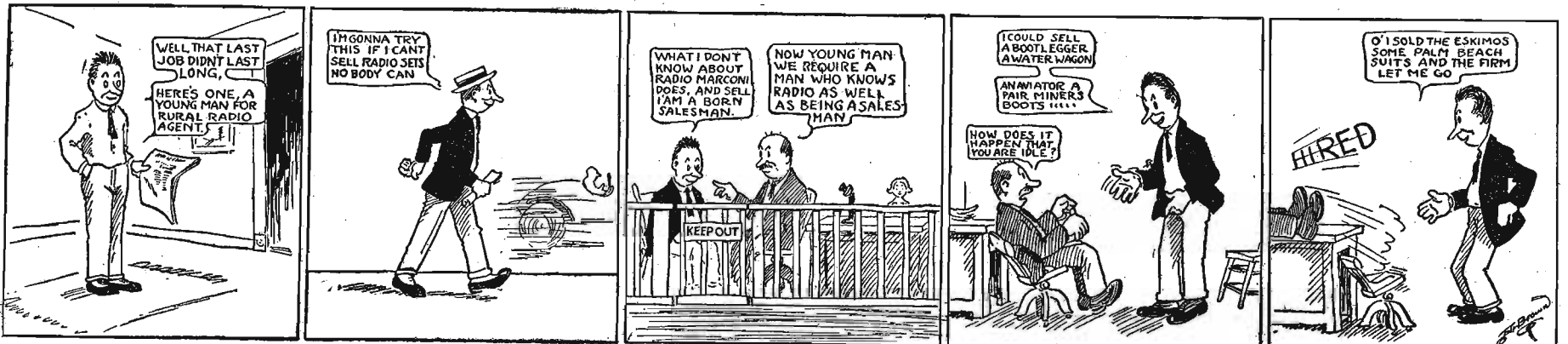
The public had been invited to visit the bowl to learn the future plans of the silent drama. The Los Angeles Times Radio touring car took its place before the stage at the bowl and received, using loud speakers, the welcome greetings of Southern Californians sent to Mr. Hays through station KHJ.

WASHINGTON.—A system of Radio telephony now connects the Turks Islands and the Caicos Islands in the West Indies, the same installations being used also for Radio telegraphy and for communication with ships.

THE ANTENNA BROTHERS

Spir L. and Lew P.

Or Volstead a Shot of XXX



Characteristics of Vacuum Tube Amplifiers

Part X—Design of Amplifiers

By Benjamin F. Miessner

frequency amplifiers for wave-lengths the electrostatic capacity between the elements of the vacuum tubes and between the various wire connections forming the circuits, exerts a considerable influence in limiting the degree of amplification. For this reason various schemes have been developed either to reduce these stray capacities to a minimum, or to secure the desired high amplification by some other method. For cascade amplifiers of the usual types previously described, the actual physical layout of the apparatus and the wiring connections play a highly important part, and that arrangement which reduces the stray capacity to the lowest value will be found to give best results. The length of leads, especially those for the grids, and their degree of electrostatic isolation one

between them. Thus if the incoming signal current has a frequency of 833,000 cycles, and the locally generated current has a frequency of 832,000 cycles, an audible beat or periodic addition and opposition of the two forces will result, having a frequency of 1,000 per second. In this way the inaudible Radio frequency current may be reduced to another current of any desired lower order.

Use of Effect

In order to utilize this beat effect and eliminate the higher frequencies producing it, use must be made of a device that can be actuated directly by the Radio frequency currents such as an electrodynamic telephone, or otherwise rectification must be accomplished prior to actuation of other devices operable only by the lower frequency.

If the beat frequency with such an arrangement be adjusted to some value considerably lower than the signal frequency but still above the limits of audibility, and

tuning. This tuning involves merely the wave length adjustment of the receiver, which in a single circuit receiver may be obtained with one control knob, and the wave length adjustment of the local oscillator for producing the beat frequency to which the amplifier is tuned—an operation which may also be accomplished with one knob.

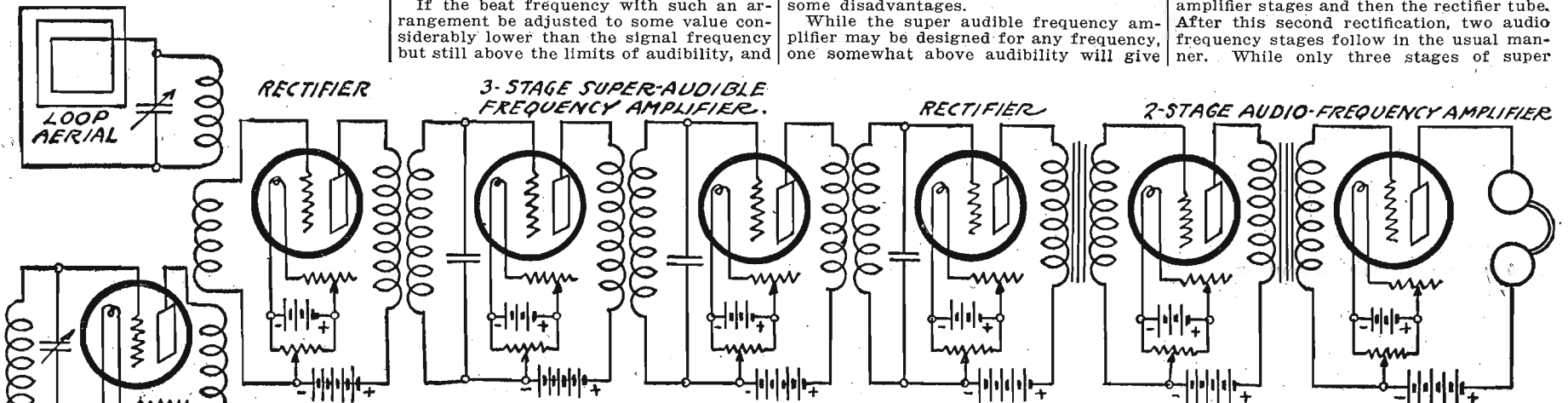
Excellent on Short Waves

Where extremely high amplification is desirable on short or even medium wave lengths up to several thousand meters with simplified controls, this type of amplifier presents a very satisfactory solution. However, the use of two extra vacuum tubes, one for the local oscillator and the other for rectification preceding the superaudible amplification, and their associated circuit arrangements present some disadvantages.

While the super audible frequency amplifier may be designed for any frequency, one somewhat above audibility will give

as will provide the desired wave length range. The parallel inductance coil is coupled to an untuned secondary connected to the first rectifier tube as shown. Coupled also to this untuned secondary coil is another coil connected in the plate circuit of the local oscillator through which is introduced the locally generated Radio frequency current.

The frequency of this current is determined largely by the capacity and inductance in the grid circuit, and may be varied by adjustment of the variable condenser. The plate circuit of the rectifier tube is coupled by a relatively large inductance coil to a secondary circuit tuned to a frequency of say 30,000 cycles which is connected to the input circuit of the first super audible amplifier tube. Following this are two more similar super audible amplifier stages and then the rectifier tube. After this second rectification, two audio frequency stages follow in the usual manner. While only three stages of super



from the other and from nearby conducting bodies, the relative position of input and output leads, and other factors must be given very careful consideration by the designer.

Important in Cascade

With ordinary tubes in cascade connection these precautions will determine very largely the performance of the amplifier. If wires are run in a purely haphazard fashion or in close parallel formation for sake of appearance, or if input and output leads are placed close together, the amplification will probably be inferior, and oscillations in the various stages may be set up which will heterodyne one another, or the incoming signal with accompanying "squealing" or "howling" effects which completely destroy the normal functioning of the apparatus. While these effects are not so important on long wave amplification they are very important for short waves and too great care cannot be exercised in the design of apparatus.

In addition to these stray capacities in the circuit connections, the tubes, as previously mentioned, have a certain amount of capacity between the electrodes and leading-in wires which causes detrimental effects in short wave amplification. The actual amount of this capacity depends largely upon the geometrical design of particular tubes. The length and separation of leading-in wires, and the areas and separations of the tube elements are the chief factors. French and British tube manufacturers have produced some special tubes in which capacity minimization was one of the chief objects. Small size of the tube elements and the use of both ends of the tube for leading-in wires were resorted to in some cases in attaining this end.

Different With Short Waves

Other principles of an entirely different nature have been applied to the problems of short wave length amplification.

The most important of these is the scheme previously mentioned for changing the frequency of the incoming carrier wave to one of a much lower order by heterodyne methods. With such a plan, a continuously acting local source of oscillations is used at the receiving station, the frequency of which is under accurate control. The oscillating currents thus generated locally are made to combine with the incoming signal oscillating in such a way that beats are produced whose frequency may be varied by control of the local oscillator frequency.

This, of course, is a special application of the heterodyne system of beats reception invented by Fessenden. Ordinarily this scheme is used to produce audible frequencies by the interaction of the two Radio or highly super audible frequencies as in continuous wave telegraphy. When two such Radio frequency currents are combined in a receiving circuit, the lower order frequency is equal to the difference

if this combination of the two frequencies with their resultant beat be rectified, a new frequency will result which may be treated as a long wave length current and amplified in a long wave length amplifier. Here then, by the simple expedient of heterodyning, we are able to change a short wave length signal unsuitable for Radio frequency amplification into a long wave length signal especially adapted for amplification of this type.

Design of Amplifier

The design of such an amplifier even with a large number of tubes in cascade connection is a comparatively simple problem. Since the best frequency may be adjusted to the same value for any and all incoming signal frequencies, merely by the adjustment of a condenser regulating the local oscillation frequency, it is evident that adjustment in the Radio frequency amplifier can be dispensed with. The interval coupling devices may be of the fixed frequency resonance type in all stages, and as many stages as desired may be used with a very simple system of

best results, say from 20,000 to 30,000 cycles, which represent wave lengths of from 6,000 to 9,000 meters. Before the currents thus amplified can be transformed into sound by a telephone receiver they must be rectified in the usual manner. After rectification, of course, audio frequency amplification may be used, if desired. Amplifiers of this type have been used with phenomenal success on short wave lengths. With two or three foot loop antennae, signals from low power stations in Europe have been received in the United States without difficulty. When the loop is combined with a small antenna so as to secure a unilateral reception characteristic, static may be much reduced.

Circuit Diagram Explained

In Figure 34 is shown a circuit diagram of a loop receiver providing three stages of super audible frequency and two stages of audio frequency amplification. The loop is connected in parallel with an inductance coil of approximately equal value and a variable condenser of such capacity

audible amplification are shown, more may be used if precautions are taken to avoid self oscillation in the amplifier circuits. It is also possible, of course, to use carrier frequency amplification previous to heterodyning and rectifying, so that amplification on three different frequency ranges may be used, i. e. carrier, super audible, and audible. Loop receivers of this type have been used commercially for several years with excellent results. To the ambitious experimenter it offers splendid possibilities for long range low power communication.

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Amplifying Transformers
 Two years of successful use all over the world guarantees permanent satisfaction. Radio and Audio Frequency.
 SEND FOR CIRCULARS
RAULAND MANUFACTURING CO.
 35 South Dearborn Street Chicago

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OCTOBER 11th to 14th

CINCINNATI, OHIO

Cincinnati Radio-and-Electrical Exposition

October 7th to 14th, CINCINNATI, OHIO

An Exhibit

of your product will enable you to show what you have to sell, not only to a great many thousands of people—but also to the trade.

Electrical Contractors and Dealers from all over the country will be in Cincinnati during Exposition week

Write or wire for display space in the

CINCINNATI RADIO-AND-ELECTRICAL EXPOSITION

1005 Keith's Theatre Bldg., Cincinnati, Ohio

NEW \$12,000 DENVER PLANT LEADER WEST OF CHICAGO

Construction of KFAF Finished; Station Now In Daily Operation

Features Wide Program

Fame of KYW, Windy City Broadcaster, Predicted for Colorado Station

(Special to RADIO DIGEST)

DENVER, COLO.—One of the most powerful broadcasting stations between Chicago and the Pacific coast—a \$12,000 station, equipped with two 50-watt tubes and two 250-watt tubes—is the new Western Radio Corporation-Denver Post station, which has just been completed and which is now in operation.

Elden F. Horn, who supervised the construction of station KYW, in Chicago, and who had charge of the operation of KYW until May of this year, has constructed and will personally operate the new station, whose assigned call is KFAF.

KFAF is built along lines similar to KYW and it is expected that in time it may become just as famous.

Conceives Idea of Station

Although Denver has been favored with several large stations, it remained for an ex-newspaper man, George S. Walker, to give the city one of the best stations west of Chicago.

Recognizing the fact that Radio is here to stay, and that it has long since passed the experimental stage, Mr. Walker, early this year, began a close study of Radio, its commercial possibilities and the opportunities it opened for entertaining countless thousands of people in the western states.

Going to Chicago, Mr. Walker engaged Elden F. Horn, who has spent practically his entire time since boyhood in Radio investigations and research, as his engineer-in-charge to construct the station here. The great towers for the new station, which are declared to be the biggest in the west, may be seen for blocks.

Has Broad Program

News flashes and bulletins from the Denver Post, baseball scores, grain and livestock market reports, weather conditions and some of the most fascinating entertainment and educational programs ever arranged are being broadcast from the new station.

Famous vaudeville artists of the Pan-tages circuit, stage concert programs of exceptional interest to lovers of the theater. The splendid concerts arranged formerly for the old Fitzsimmons hospital station, DD5, are now being microphoned from the KFAF station.

Music Company Furnishes Songsters

The Charles E. Wells Music company furnished the artists' studio at the big station with a Haddorf piano and a Victrola, together with an elaborate assortment of up-to-date records. The company is also furnishing a program of local talent and occasionally players and artists of national reputation.

KFAF is one of the first broadcasting sets to be constructed using a hook-up permitting the increase of power without changing the design of construction. The station is using one 50-watt tube as a



View of the broadcasting room of station KFAF, Denver, showing part of the control panel, with Engineer Elden F. Horn at the microphone, George D. Walker operating the wave meter and George S. Walker standing

modulator, a second 50-watt tube as a high frequency pilot oscillator. Two 250-watt tubes (the only tubes of this size in the whole Rocky Mountain region), are also in use.

Magnify Singer's Voice

Minute variations in electrical current caused by a singer's voice striking the microphone are greatly magnified by the three-step amplifier before passing to the 50-watt modulator. From this tube the voice variations of electrical current are impressed upon the high frequency output of the oscillator tube. The output of the oscillator tube is fed into the grid circuit of the large power amplifier—the two 250-watt tubes. The output of this large power passes directly into the antenna and out into the ether.

The aerial is a flat-top "T" type of six wires, supported on twenty-four-foot spreaders. The lead-in is of the cage type. The entire aerial is supported by the two towers which rear their heads 120 feet above the street.

Studio Made Comfortable

The studio is commodiously and elegantly furnished, and the walls are draped with heavy fabric to absorb confusing echoes, so that the voices of artists will be transmitted true to life.

Every convenience possible has been provided for the entertainers. The station is equipped with receiving apparatus of the most modern design, consisting of a short-wave regenerative tuner and two steps of audio-frequency amplification; also a three-step Radio frequency amplifier for extreme distance reception on short waves. Stations from Los Angeles to New York are picked up daily by these receiving sets.

Mr. Horn, chief engineer of the new plant, is a graduate of the Crane Municipal college in Chicago, where he completed chemical, electrical and Radio engineering courses. Since 1909 he has been active in Radio. For one season he was chief operator on one of the steamships navigating the Great Lakes. Later he became

associated with the Westinghouse Electric and Manufacturing company's Radio department in Chicago, where he supervised the construction of station KYW. He had charge of the operation of this station until Mr. Walker secured his services for the construction and operation of KFAF.

Formerly Chicago Amateur

Mr. Horn, constructed and operated a spark station in Chicago before the days of the Radio craze. His Chicago station, 9AJA, was accorded much publicity a few years ago because of its wonderful efficiency and the great distance covered on the small power. His little station was frequently heard at points from Toronto, Canada, to Orlando, Fla., on voice transmission.

In the fall of 1921 Mr. Horn installed a 100-watt continuous wave station, which was heard in Alaska, the canal zone, Yokohama, Japan, Honolulu, and by ships at sea 1,700 miles east of New York. Nightly conversations with amateurs in practically every state in the union were carried on.

Pike's Peak Hears Concert from WHAS of Louisville

LOUISVILLE, KY.—WHAS station is elated over the fact that it has been heard plainly high up on Pike's Peak in Colorado, and was also able to carry through its regular program the other night notwithstanding rain and an electrical storm, sending out a speech on accident prevention and reports of a boxing contest at the Broadway Athletic Club as well as carrying out the usual musical program.

Chas. R. Long, Jr., wealthy manufacturer of Louisville, who is spending the summer in the Rocky Mountains, wrote in to the Courier-Journal that he listened in on Pike's Peak to one of the evening programs, and that the concert was clear and plain.

Bare-Wall Studio Concerts Poor; Drapes Will Be Hung

PHILADELPHIA, PA.—Bare walls are not the best thing in the world for the Radiophone broadcasting studio. Recently, one of the leading studios here moved into a large room, with paneled walls and smooth ceiling. Previous to that time, the studio held forth in a room of a factory office, where the bare walls were hidden with draperies and rugs, while the ceiling was broken up by beams. However, the results obtained with the old studio room were excellent, for there was practically no echo or sound reflection from the walls and ceiling. The new studio room will now have to be provided with some form of hangings to reduce echo.

Airphone Sunday School Lessons

BIRMINGHAM, ALA.—Two new features inaugurated by station WSY of the Alabama Power company here are the broadcasting of the Sunday School lessons and a series of Uncle Remus stories for children by Joel Chandler Harris.

D. R. Price, manager of the Birmingham Sunday School association, has charge of the Sunday School lesson which is given every Sunday night just after the musical program.

So far as known no other station has inaugurated the Sunday School feature. The Uncle Remus bedtime stories are very appropriate for this district as the late Joel Chandler Harris lived in Atlanta.

Alabama Schools to Get 200 Sets

State University Will Rig Station as Part of Extension Service

BIRMINGHAM, ALA.—As a part of the extension service, the University of Alabama situated at Tuscaloosa will soon install a broadcasting station. Col. B. L. Musgrove, one of the trustees, had just returned from New York where he placed an order for the outfit. The contract also calls for 200 receiving sets which will be distributed to the secondary colleges, high schools and city schools throughout the state. Extension agents are now employed by the university to visit all sections of the state. They will now be assisted by lectures, reports and lessons as broadcast from headquarters.

The fifth Radio broadcasting station in the state is being erected here by the Matthews Electric Supply House under supervision of Donald Beatty. When completed its service will dovetail in with that of WSY, Alabama Power company station of this city. Mr. Beatty is now engaged in testing out the station.

Appeal by Radio for Poor Kiddies Moves Cottagers

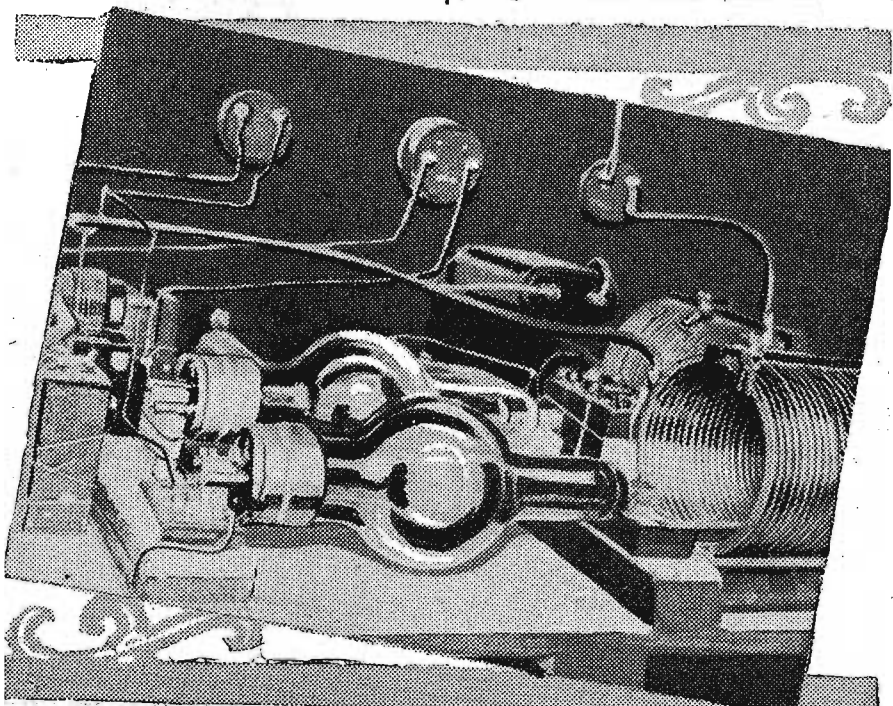
TORONTO, ONT., CAN.—Down on the Rouge River, near Toronto, a group of cottagers have found a summer paradise—pleasant breezes, blue water, unbounded sunshine and every night the Radio to pluck entertainment from out the twilight sky.

A few nights ago the air brought not only entertainment, but an appeal from a local newspaper in behalf of Toronto's unfortunate kiddies, for whom summer means only heat and dust. The Radio's message made the Rouge River colony think. A few minutes later someone passed around a hat from veranda to veranda and this morning eighty-five dollars came in to the fund as the generous result.

Dress Shops Install Phones

NEW YORK.—A number of fashionable women's shops in New York have installed Radio apparatus in the dressing and waiting rooms for the amusement of customers while waiting for fittings or for the attention of salesladies. The innovation has proven very welcome, especially to the salesladies.

PITTSBURGH, PA.—The Radio Electric Company here has recently been assigned call letters WHAF for their broadcasting station. Scheduled programs will begin about September 1.



The squash-shaped devices are the 250-watt tubes that scatter music originating at KFAF, Denver, all around Pike's Peak

FEATURES

Capacity Cut Out on Front Panels

on Employed Permits
to Make Additions
without Difficulty

(See diagram on facing page.)

The standard receiving set illustrated on page 7 is the Elmco tuner type S-1, and two-step amplifier, type A-3, manufactured by the Electric Machine Corporation of Indianapolis, Ind. The receiving set has a wave length range of from 175 to 750 meters, and the amplification is audio frequency. One of the salient features claimed for the units is that they are entirely free from body capacity effects due to their construction which employs aluminum panels on the fronts and several kinds of interior shielding.

Other advantages possessed by the apparatus are its unit system, which permits the owner of such a set to make additions to his receiving equipment at any time without bringing about unsightliness, and the vernier adjustment with which each operating control is fitted. Verniers are not only provided for tuning adjustment but for the filament heating rheostats.

Description of Units

The unit shown to the left (front view) is the tuner. It contains a variocoupler with tap switch and variable coupling, and a secondary variable condenser fitted with a small vernier adjustment condenser. The aerial is connected to the left upper binding post and the ground to the post just below. The aerial for best results should be approximately one hundred feet long and as high and free as possible from external obstructions, such as trees and neighboring buildings.

The ground lead should be a copper wire soldered or clamped to a cold water pipe as close as can be to the point where this pipe leaves the house and enters the ground.

When it is desired to receive wave lengths up to 3,000 meters, the vertical strip connecting the two right-hand binding posts on the upper half of the tuning unit and the vertical strip connecting the two left-hand binding posts on the lower half of the tuning unit, are removed and replaced by two suitable loading coils provided by the manufacturer.

Connections to Batteries

Two leads connect the tuning unit (left half of front view) to the detector and two step amplifier unit (right half of front view). The top lead or strip, connected as shown, goes from the secondary of the tuning unit to the grid leak and condenser of the detector tube, while the lower strip connects the other side of the secondary circuit to the filament of the detector vacuum tube.

The four binding posts on the upper half of the detector-amplifier unit are for connection to B batteries as shown. Although two separate B batteries, on a 22½-volt, and the other a 45-volt battery, are shown for simplicity sake, one 45-volt battery tapped at 22½ volts will suffice. One 6-volt filament heating or A battery is connected to the right hand lower binding posts on this same unit with polarity of leads as shown.

Three jacks are provided at the bottom of the right-hand unit for the purpose of plugging in the telephone receivers or loud speaker. The jack on the left cuts in the detector alone without amplification, the center jack cuts in the detector and one stage of audio frequency amplification, and the jack on the right cuts in the detector and two stages of audio frequency amplification.

Operating the Set

To operate the set after all the indicated connections have been made, the filament rheostats (two large knobs on the right-hand or detector-amplifier unit) are turned clockwise until the tubes are at incandescence but not over-brilliant. Just below these large rheostat knobs are vernier rheostat knobs which are used for fine adjustment after the station desired is tuned in.

After lighting the tubes, tuning must be accomplished. To do this, the knobs indicated "for Wave Length Control" and "for Coupling Control" in the photo diagram are turned to the zero reading of their respective scales. The small knob indicated "Controlling Taps on Primary" is then turned clockwise or counter-clockwise until the desired station's signals come in the strongest.

The knob "for Wave Length Control," which really is a variable condenser shunted across the secondary and controlling its wave length, is then turned clockwise until the point is found where the signals are loudest. Fine adjustment is now made with the small knob just below the one adjusted. In order to tune out interfering stations or undesired signals, the knob "for Coupling Control" is turned clockwise until this is accomplished.

After having made these adjustments, the vernier rheostats (knobs just below the large rheostat knobs adjusted at first), may be turned until signals are best.

STOCK READINGS SHOW POPULARITY OF RADIO

Upward Trend Attracts Financial World's Interest

NEW YORK.—It has invariably been proven that the great barometer of industry in this country are its stock exchanges. The recent reading of Radio shows a jump in nation wide popularity that is a little more than startling. The general upward movement in Radio stocks during the last few weeks has created great interest throughout the financial world. One report reads: "General Electric and Westinghouse are in a position to gain a good deal, as they have already done from the active business in receiving Radio equipment which is in so large a demand that one can buy it now only as a special favor from the dealers in such goods."

IRISH REBELS WRECK PLANT; TRAFFIC SHIFTS

Canadian Station Forced to Work with London

LOUISBURG, N. S., CANADA.—For two days the Louisburg Radio Station has been working direct with London, England, instead of its accustomed transatlantic corresponding station, Clifden, Ireland, destroyed by Irish rebels. Two days ago the messages from Clifden suddenly ceased and shortly afterward came instructions to work with London. This caused no inconvenience to the station here, but the London station is not a transatlantic station, and its power plant was exerted to the utmost to carry on the additional service.

Week of July 31-August 5 Sees 23 Licenses Issued

CHICAGO.—Twenty-three limited commercial licenses were issued to stations erected for public service broadcasting from July 31st to August 5th. The list follows:

WIAU, American Security & Savings Bank, Le Mars, Iowa; WJAG, Huse Publishing Co., Norfolk, Neb.; WIAT, Leon T. Noel, Tarkio, Mo.; WJAC, Rodoll Co., Joplin, Mo.; WIAW, Saginaw Radio & Elec. Co., Saginaw, Mich.; WJAJ, Y. M. C. A., Dayton, O.; WIAK, Capital Radio Co., Lincoln, Neb.; KFBG, First Presbyterian Church, Tacoma, Wash.; WIAV, New York Radio Laboratories, Binghamton, N. Y.; WKAA, H. F. Paar & Republican Times, Cedar Rapids, Ia.; WKAC, Star Publishing Co., Lincoln, Neb.; WJAK, White Radio Laboratory, Stockdale, O.; WIAZ, Woodward & Lothrop, Washington, D. C.; WJAM, Central Park Amusement Co., Rockford, Ill.; WIAZ, Electric Supply Sales Co., Miami, Fla.; WJAP, Kelly-Duluth Co., Duluth, Minn.; WKAD, Charles Loeff, East Providence, R. I.; WJAR, The Outlet Co., Providence, R. I.; WJAN, Peoria Star & Peoria Radio Sales Co., Peoria, Ill.; WJAX, D. M. Perham, Cedar Rapids, Ia.; KDZT, Seattle Radio Ass'n, Seattle, Wash.; WJAL, Victor Radio Corp., Portland, Me.; WKAF, W. S. Radio Supply Co. & Wm. Schack, Wichita Falls, Tex.

Ask Bids on Army Apparatus

WASHINGTON.—The Surplus Property Division of the War Department has announced that sealed bids will be received here on August 25 for about \$40,000 worth of surplus Radio apparatus, including head sets, tubes, etc. The apparatus was in the hands of the Air Service of the Army.

RECEIVING RECORDS

(Continued from page 2)

WBAB—230—W. E. Thomas, Altoona, Pa.
WBAD—1,175—N. Theobald, Attleboro, Mass.
WBAH—655—C. D. Mason, Cleveland, O.
WBAJ—600—C. F. Lovely, South Amboy, N. J.
WBAK—750—H. Walrath, Cedar Rapids, Ia.
WBAO—530—E. S. Bee, Brookhaven, Miss.
WBAQ—125—H. E. Jameson, Milwaukee, Wis.
WBAW—500—E. B. Wagle, Geneseo, Ill.
WBAX—800—C. C. Dancer, Chicago, Ill.
WBAY—715—H. E. Jameson, Milwaukee, Wis.
WBL—1,450—C. H. Vale, Providence, R. I.

All Parts for the ARMSTRONG Super - Regenerative CIRCUIT

Prices Reasonable : Send for Circular

Kramer Radio Company
4713 Sheridan Rd., Chicago, Ill.

WBT—450—R. U. Waite, Vineland, N. J.
WBU—800—W. A. Knight, Hudson, Mass.
WBZ—1,175—R. O. White, Villisca, Ia.
WCAB—325—H. S. Rahiser, Pittsburgh, Pa.
WCAC—550—N. G. Garlock, Galena, Ill.
WCAG—1,460—K. McNeil, Ottawa, Ont., Canada.
WCAK—665—S. W. Wilkinson, Knoxville, Tenn.
WCAL—130—E. Dahlgren, Rice Lake, Wis.
WCAP—130—E. B. Wagle, Geneseo, Ill.
WCAT—590—E. Dahlgren, Rice Lake, Wis.
WCAU—285—D. Ploesser, Canton, O.
WCAW—125—E. B. Wagle, Geneseo, Ill.
WCAX—700—Mrs. A. C. Wright, Kewanna, Ind.
WCE—220—D. R. Bartsch, Galena, Ill.
WCK—200—C. Miller, Veederburg, Ind.
WCM—1,500—C. M. Rice, Jr., Worcester, Mass.
WCN—1,000—W. L. Lerne, Elkhart, Ind.
WCX—900—L. P. Hurd, Madison, Minn.
WDAB—690—N. Theobald, Attleboro, Mass.
WDAC—350—F. W. Steffen, Hartley, Ia.
WDAD—1,470—N. Theobald, Attleboro, Mass.
WDAE—400—M. Owen, Starrville, Ga.
WDAF—1,040—C. A. Winchell, Cortland, N. Y.
WDAJ—780—T. R. Gentry, Dallas, Tex.
WDAK—1,220—R. Hastings, Atchinson, Kan.
WDAL—1,500—M. M. Cardwell, Republic, Kan.

(Continued on page 14)

Carter Radio Co.
233 E. STATE STREET
CHICAGO

CARTER TU-WAY PLUG takes TWO head sets at same time; takes ALL types of cord tip terminals. Price \$1.50 each.

If Your Jobber Is Unable to Supply, Write Us

Reduced Prices

Send for summer price list on our complete line of standard radio equipment

OAK PARK RADIO COMPANY
110 North Oak Park Ave., Oak Park, Illinois
Telephone O. P. 2417

RADIO MAILING LISTS

6900	Retail Radio Dealers covering the United States, by states, price per thousand . . .	\$ 7.50
838	Radio Manufacturers per list	10.00
1022	Radio Supply Jobbers per "	10.00
260	Owners of Radio Stations per "	4.00
14000	Radio Amateurs and Managers of Radio Stations per M.	7.50

These are neatly typewritten and ready to send you on receipt of remittance covering the amount. Guaranteed 98% correct. Trade Circular Addressing Co., 166 W. Adams St., Chicago, Ill.

Book Reviews

The Thermionic Vacuum Tube and Its Applications. By H. J. van der Bijl, M. A., Ph.D. This book supplies the first comprehensive and reasonably concise treatment of principles of operation and the more important phenomena exhibited by the passage of electrons through high vacua. Price, \$5.00.

Radio Communication, Theory and Methods. By John Mills. The fundamental principles and methods upon which recent developments are based are emphasized. The vacuum tube is treated in a simple, fundamental and up-to-date manner. Present methods and tendencies of the art are explained in a chapter which is non-mathematical. Price, \$2.00.

Elements of Radio Telephony. By William C. Ballard, Jr., M. E. A reliable, authoritative discussion, in simple form, of the essential principles of Radio telephony and their application. The use of mathematics has been almost entirely avoided. Price, \$1.50.

Experimental Wireless Stations. By F. E. Edelman. This book assumes that the reader has some knowledge of fundamental electricity and mathematics and is a readily understandable text for beginners in the art of Radio communication who desire to start with the elements. Price, \$3.00.

The A B C of Vacuum Tubes in Radio Reception. By E. H. Lewis. An elementary and practical book on the theory and operation of vacuum tubes as detectors and amplifiers. Explains non-mathematically the fundamental principles upon which all vacuum tube circuits are based. Price, \$1.00.

The book department of the Radio Digest is prepared to send you any of the books on Radio published, whether listed in our Book Review or not. Let us know what book you want, send us your check and we will see that the book is mailed to you. Book Department, Radio Digest Illustrated, 123 W. Madison St., Chicago, Ill.

Books

GET secret of how to make practical radio receiving set for less than four dollars. Send one dollar for illustrated book by Lieutenant W. L. Shields, formerly aircraft radio officer in the Pacific Air Force. Write today to Lieutenant Shields, 423-424 Timken Bldg., San Diego, California.—Adv.

RADIO

APPARATUS

CROSLEY
Better—Costs Less

To the Dealer and General Public:—

CITIZEN RADIO IS NEW. Few people realize the manufacturers' problems in building production to take care of the hysterical demand of last winter. While the CROSLEY MANUFACTURING COMPANY—an old established manufacturing concern—had been engaged in the production of Radio Apparatus for a year prior to the big rush, it was hard pressed to take care of the demand for its Radio Products.

IN SPITE OF THIS FACT, CROSLEY Radio Apparatus has been recognized as the standard of value at moderate costs. And, with the aid of an efficient staff of engineers, certain additional refinements of detail have been effected.

CROSLEY RADIO APPARATUS and Radio Parts, with these refinements, are better now than ever. CROSLEY values are even more marked than heretofore, and are truly representative of the manufacturer, actuated by the highest ideals and a sincere desire to give the consumer the best for his money.

THE CROSLEY MANUFACTURING COMPANY not only makes complete sets from \$25.00 up, but all parts used in the assembling of receiving sets, excepting tubes, batteries and phones. A truly revolutionary feature in Radio Apparatus is combined in some of the new sets incorporating CROSLEY TUNED RADIO FREQUENCY AMPLIFICATION.

CROSLEY PRODUCTS are sold through jobbers and dealers everywhere. If your dealer does not handle them write us direct.

IT WILL PAY YOU
TO LOOK INTO THIS

WRITE for our new Illustrated Catalogue just off the press

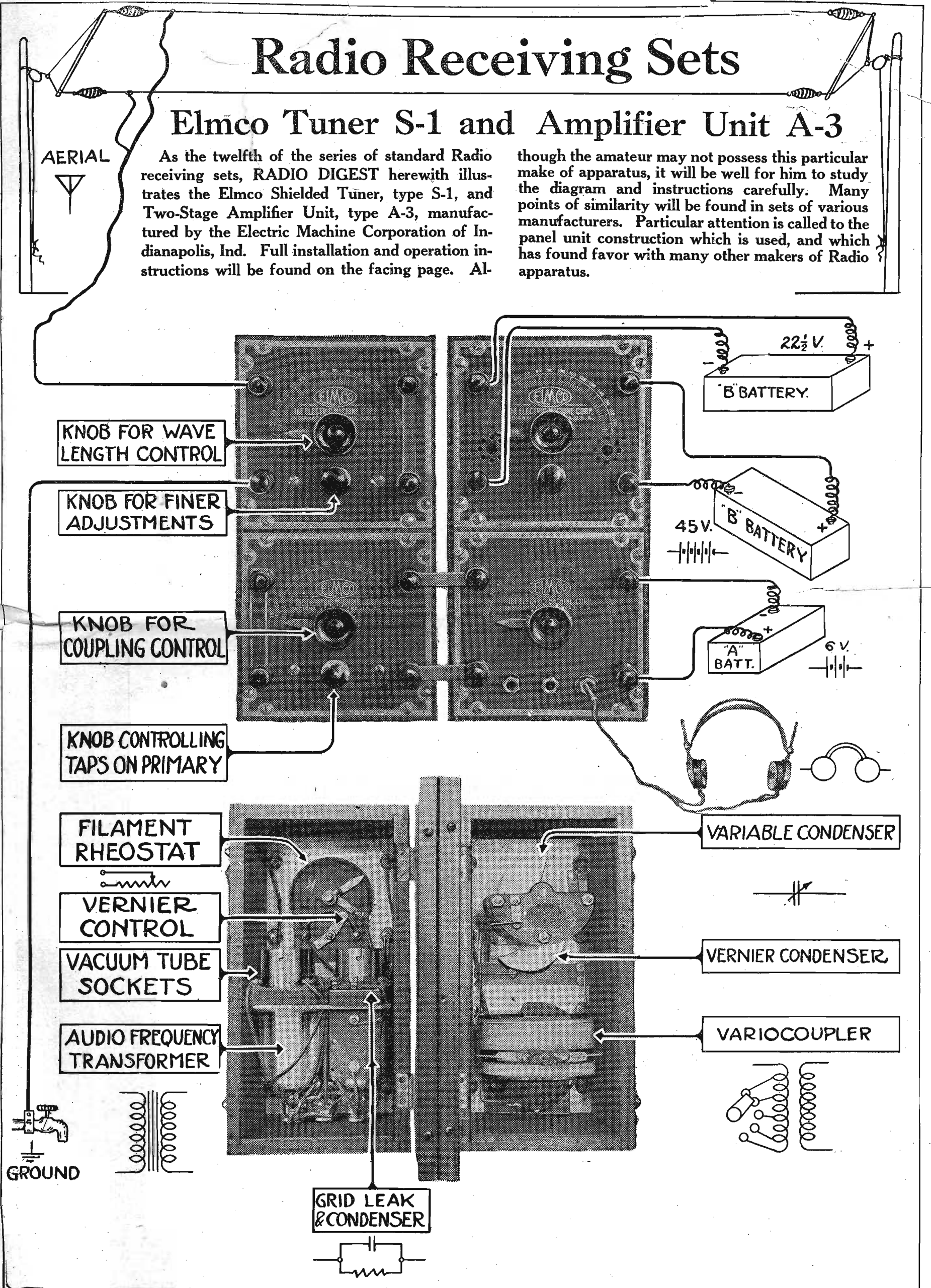
CROSLEY MANUFACTURING COMPANY
R. D. 1.4 CINCINNATI, OHIO

Radio Receiving Sets

Elmco Tuner S-1 and Amplifier Unit A-3

As the twelfth of the series of standard Radio receiving sets, RADIO DIGEST herewith illustrates the Elmco Shielded Tuner, type S-1, and Two-Stage Amplifier Unit, type A-3, manufactured by the Electric Machine Corporation of Indianapolis, Ind. Full installation and operation instructions will be found on the facing page. Al-

though the amateur may not possess this particular make of apparatus, it will be well for him to study the diagram and instructions carefully. Many points of similarity will be found in sets of various manufacturers. Particular attention is called to the panel unit construction which is used, and which has found favor with many other makers of Radio apparatus.



Radiophone Broadcasting Stations

Corrected Every Week.

CONTENTS AND HOW BEST TO USE

THE STATION schedules, given below, are listed alphabetically by call letters. Following the call is given the city and state, the wave length (PROVIDING a wave length other than 360 meters is used), the miles range of the station, the owner of the station, the schedule of operating hours, and the kind of time used.

The state, city and call list given following the station schedule list is merely an index. One wishing to find the calls of the stations in his vicinity, will find this index useful. All licensed broadcasting stations in operation are given in the index, while only those which have made special reports to RADIO DIGEST, are given in the station schedule list.

Station Schedules

AGI, Presidio of San Francisco, Cal. 50 mi. Signal Corps, U. S. A. Sun, 7-9 pm, instruction. Pacific.

CFA, Toronto, Canada, 400 only, 200 mi. Toronto Star, Daily ex Sun, 7-9 pm, baseball, stocks, concert. Tues, Fri, 8:30-9:30 pm, concert, address. Eastern.

CFBC, Vancouver, Canada, 440 only, 500 mi. Daily Province, Daily ex Sun, 8:30-9:30 pm, news, weather, concert. Pacific.

CFCF, Montreal, Can. 440 only, 200 mi. Marconi Co. Daily, 1-1:30 pm, concert. Mon, Thurs, 8-9 pm, concert. Eastern. Daylight Saving.

CHBC, Calgary, Canada, 410 also, 1,000 mi. W. W. Grant Radio Ltd. (Morning Alberta.) Daily, 8:45-10 pm, news, stock quotations, music. Mountain.

CHCB, Toronto, Canada, 440 only, 500 mi. Marconi Co. Tues, 8-10 pm, concert. Eastern.

CHCC, Calgary, Canada, 400 only, 200 mi. Western Radio Co. (Calgary Herald.) Daily ex Sun, 3:30-4:30 pm, music, news, baseball; 7:45-8:45, music, etc. Sun, 7:45-8:45 pm, church service. Mountain.

CHVC, Toronto, Canada, 410 only, 200 mi. Metropolitan Motors Co. Daily ex Sat and Sun, 6-5:30 pm, news, concert. Eastern.

CJCA, Edmonton, Canada, 450 only, 500 mi. Edmonton Journal, Daily ex Sun, every evening, music, bedtime story, news, weather, markets, etc. Sun, 7-10:30 pm, concert. Eastern.

CJCB, Toronto, Canada, 410 only, 200 mi. St. Eaton Co. Daily ex Sat and Sun, 4-4:30 pm, concert. Sat, 12-12:30 pm, concert. Eastern.

CJCC, Winnipeg, Canada, 410 only, 300 mi. Manitoba Free Press. Every other wk, beginning July 31, Mon, Wed, Fri, 10-10:30 pm, stocks, markets, weather; 12-12:30, concert. Tues, Thurs, 8:30-10 am, news; 1-2 pm, stocks, markets, weather; 7-8 pm, music. Sun, 8 am on, sacred concert. For all in weeks, Mon, Wed, Fri same as Tues, Thurs, Sat above, and Tues, Thurs, Sat same as Mon, Wed, Fri above. Sun, 9:15 am on, sacred concert. Central.

CJNC, Winnipeg, Canada, 420 only, 500 mi. Tribune Newspaper Company. Daily ex Sun, 12-2 pm, markets, news; 7-10:30, concert, baseball. Sat, 2-3 pm or 3-4, kiddies' hour. Sun, 3-4 pm or 4-5, sacred concert; 8-10:30, concert. Central.

D5, Denver, Colo. 340 only, 1,500 mi. Fitzsimmons General Hospital. Daily ex Sun, 8:15 pm, weather, news, concert. Thurs, 8:15-9:30 pm, special concert, speech. Mountain.

KDKA, Pittsburgh, Pa. 1,000 mi. Westinghouse Elec. Mfg. Co. Daily ex Sun, 10-10:15 am, 12:30-1 pm, 2-3:30, 4-4:30, music, news; 7:30, bedtime story; 7:45, news; 8:30-9:30, music. Sat, 3-4 pm, concert. Sun, 10:45 am, 3 pm and 7:30, church service. Eastern.

KDN, San Francisco, Cal. 485 also, 250 mi. Leo J. Meyberg Co. Daily ex Sun, 11-12 am, 1-2 pm, 4:30-5:30, concert; 7-7:15, weather; 8:30-9, concert. Sat, nothing after 5:30 pm. Sun, 10-11 am, sacred concert, Pacific.

KDPT, San Diego, Calif. 250 mi. Southern Elec. Co. Daily 7:30-9 pm, news, weather, concert, lecture. Pacific.

KLVL, Salt Lake City, U. 485 also, 300 mi. Salt Lake Telegram. Daily ex Sun, 7-8 pm, music, baseball, news, weather; 9-9:30 (occasionally). Sun, 2-3 pm, church service. Mountain.

KDYS, Great Falls, Mont. 200 mi. Tribune. Wed, 8-10 pm, bedtime story, concert. Sun, 4 pm, church service. Mountain.

KDZX, Honolulu, Hawaii. 750 mi. Star-Bulletin. Daily ex Sun, 12:15-1:15 pm, stocks, markets, business news; 6:30-7:30, concert, lecture. Sun, 11-12 am, church service; 4-6 pm, concert, lecture. Honolulu.

KDZE, Seattle, Wash. 300 mi. The Rhodes Co. Daily ex Sun, 3:30-4:15 pm. Mon, Wed, Fri, 7:15-8:15 pm, Pacific.

KDZH, Fresno, Calif. 50 mi. The Herald-Buford Co. Daily ex Sun, 4-5 pm, news, sports, music. Mon, Wed, Thurs, Sat, Sun, 7-8 pm, music. Tues, 8-9 pm, music. Fri, 8-8:30 pm, music. Sun, 10-11 am, sermon. Pacific.

KFA, Denver, Colo. 500 mi. Wm. D. Fyle. Mon, Wed, 8:15-9:30 pm, concert. Mountain.

KDZZ, Everett, Wash. 100 mi. Kinney Bros. & Sipprell. Daily ex Sun, 2:30-3:30 pm, 8-9:30, Pacific.

KFAC, Glendale, Cal. 485 also, 150 mi. Daily News. Mon, Wed, Fri, 3-3:15 pm, baseball, news, music. Tues, 8-9 pm, concert. Sat, 7-8 pm, dance. Pacific.

KFAD, Phoenix, Ariz. 485 also, 100 mi. Mon, Wed, Fri, 8-9:15 pm, concert, weather, stocks, markets. Sun, morning, church service. Mountain.

KFAE, Pullman, Wash. 200 mi. State College of Wash. Program irregular.

KFAF, Denver, Colo. 1,000 mi. Western Radio Corp. Daily, evenings, music, news, sermons, etc.

KFBF, Hanford, Calif. 100 mi. Calif. Radio Lab. Daily ex Sun, 3-4 pm. Sun, 5-6 pm, Pacific.

KFC, Seattle, Wash. 700 mi. Northern Radio & Electric Co. Daily, eight hours, miscellaneous. Pacific.

KFI, Los Angeles, Calif. 200 mi. Earle C. Anthony, Inc. Sun, 10:45-11:30 am, 4-5 pm, Pacific.

KFU, Gridley, Cal. 500 mi. Precision Shop. Mon, Thurs, Sun, 8-9 pm, concert. Sun, 3-4 pm, concert. Pacific.

KFZ, Spokane, Wash. 300 mi. Doerr Mitchell Elec. Co. Daily ex Sun, 7:30-9:30 pm, concert and voice. Pacific.

KGB, Tacoma, Wash. 200 mi. Wm. A. Mullins Elec. Co. (Tacoma Ledger.) Daily, 4-5 pm, 7:30-9:30, Pacific.

KGC, Hollywood, Cal. 300 mi. Elec. Lighting Supply Co. Tues, Thurs, Sat, 7:30-8 pm, concert. Pacific.

KGF, Pomona, Cal. 150 mi. Pomona Fixture & Wire Co. Thurs, 7:30-8:15 pm, news, markets, concert. Mountain.

KGG, Portland, Ore. 500 mi. Hallock & Watson Radio Service. Daily ex Sun, 4:30-6 and 7-7:30 pm, baseball scores, markets, news. Sat, 9-10 pm, instruction. Sun, 4-30-6 pm, Pacific.

KGN, Portland, Ore. 500 mi. Northwestern Radio Mfg. Co. Daily, 12-1 pm, concert, lecture; 2:30-3:30, miscellaneous. Mon, Fri, Sun, 9-10 pm, health bulletin, concert. Tues, 7-7:30 pm, miscellaneous; 8-9, concert. Wed, Thurs, Fri, Sat, 7-7:30 pm, miscellaneous. Pacific.

KGO, Altadena, Calif. 300 mi. Altadena Radio Lab. Daily, 7-12 pm, 8-7, Pacific.

KGW, Portland, Ore. 200 mi. Ship Owners Radio Service Inc. (Daily Oregonian.) Daily, 3:30-4:30 pm, news etc. Mon, 7:30-8:30 pm, concert. Wed, 8-10 pm, concert. Fri, 8-9 pm, concert. Sun, 7-8 pm, church service. Pacific.

KGU, Honolulu, Hawaii. 485 also, 150 mi. The Honolulu Advertiser. Daily, 7:30-9 pm, Tues, Thurs, Sat, special program. 150th meridian. (Three hours later than Pacific.)

KGY, Lacey, Wash. 100 mi. St. Martins College. Tues, Fri, Sun, 8:30-9:30 pm, concert, news, Pacific.

KHD, Colorado Springs, Colo. 200; 485 meters only, 100 mi. Aldrich Marble & Granite Co. Daily except Sun, 8:15 am, weather, forestry bulletins, etc. Mountain.

KHI, Los Angeles, Calif. 50 mi. C. R. Kieruff & Co. (Los Angeles Times.) Daily ex Sat and Sun, 1-1:45 pm, 7:15-8, concert, lecture, news, Pacific.

KIC, Los Angeles, Calif. 100 mi. Standard Radio Co. Barker Bros. Daily ex Sun, 1-2 pm, 5-6, Pacific. 10-11 am, Wed, 9-10 am, 11:30-12 noon, Mon, Tues, 10-11 am, Wed, 9-10 am, 11:30-12 noon, Pacific.

KIJ, Sunnyvale, Cal. 200 mi. The Radio Shop. Tues, 8:15-9 pm, concert. Fri, 7:30-8:15 pm, concert. Pacific.

KJR, Seattle, Wash. 200 mi. Northwest Radio Service Mfg. Co. Daily ex Sun, 8-9 pm, miscellaneous. Pacific.

KJS, Los Angeles, Calif. 100 mi. Bible Inst. of Los Angeles. Tues, Wed, 12-12:30 pm, sacred music, lecture. Sun, 11:30-12:30 pm, sacred music, sermon. Pacific.

KLB, Pasadena, Cal. 300 mi. J. J. Dunn Co. Mon and Fri, 7:30-8:15 pm, concert. Sun, 3-4 pm and 8-9, concert. Pacific.

KLN, Monterey, Cal. 150 mi. Nogle Electric Works. Daily, 12-1 pm, weather, markets, news; 7-8 pm, concert. Pacific.

KLP, Los Altos, Cal. 1,500 mi. Colin B. Kennedy Co. Mon, 7:30-8:30 pm, industrial news, concert. Thurs, 8:30-9 pm, concert. Sun, 4-5 pm, concert. Pacific.

KLS, Oakland, Cal. 150 mi. Warner Bros. Daily, 12-1 pm, concert. Sat, 7:30-8:15 pm, concert. Pacific.

KLZ, Denver, Colo. 485 also, 1,000 mi. Reynolds Radio Co. Daily ex Sun, 7:30 pm on, news, markets, bedtime story, concert. Sun, 8-9 pm, church service. Mountain.

KMC, Redley, Calif. 100 mi. Lindsay-Weatherill & Co. Mon, Wed, Fri, 8:30-9 pm, concert. Pacific.

KMO, Tacoma, Wash. 200 mi. Tacoma Times (Love Electric Co.) Daily ex Sun, 11-1 pm, 6-7, 9:15-10, concert, news, lecture. Pacific.

KNI, Roswell, N. M. 300 mi. Roswell Public Service Co. Daily ex Sun, 7-9 pm, weather, financial, markets, news. Sun, 7-9 pm, church service. Mountain.

KNN, Los Angeles, Calif. 100 mi. Bullock's. Standard Radio Co. Tues, Thurs, Fri, 10-11 am, Pacific.

KNT, Aberdeen, Wash. 400 mi. Grays Harbor Radio Co. Daily, 5-5:30 pm, 7:30-8:15, news, concert. Pacific.

KOA, Denver, Colo. 485 only, 100 mi. W. H. Smith (Y. M. C. A.). Daily, 9:55-10:25 pm, time, weather reports. (Teletype only.) Mountain.

KOG, Los Angeles, Calif. 300 mi. Western Radio Elec. Co. (Evening Herald.) Daily, 12:15-12:30 pm, concert; 5-6 pm, news. Tues, Wed, Fri, 8:15-9 pm, concert. Pacific.

KON, Los Angeles, Calif. 200 mi. Holzwarner Inc. Daily ex Sun, 4-5 pm and 8:15-9, concert, news. Sun, 10-11 am, 4-5 pm and 8:15-9, church service. Pacific.

KOP, Hood River, Ore. 100 mi. Blue Diamond Elec. Co. Daily ex Sun, 7-7:30 pm, news. Mon, Wed, Fri, 8:30-9:15 pm, concert. Pacific.

KQV, Pittsburgh, Pa. 100 mi. Doubleday-Hill Elec. Co. Daily ex Sat and Sun, 12-12:30 pm, 2:30-3 pm, Mon, Wed, Fri, 10-11 pm, Sat, 12-12:30 pm. Sun, 4-5 pm, Eastern, daylight saving.

KQW, San Jose, Cal. 200 mi. Chas. D. Herold. Daily, 1-1:30 pm, Wed, 8:15-9 pm, concert. Pacific.

KQY, Portland, Ore. 100 mi. Stubb Elec. Co. Daily, 1-2 pm, 6-7, miscellaneous. Pacific.

KRE, Berkeley, Cal. 100 mi. Maxwell Elec. Co. Sun, 1-12 pm, 6-7 pm, concert, Pacific.

KSD, St. Louis, Mo. 1,000 mi. St. Louis Post-Dispatch. Daily ex Sun, 4 pm, markets, news, concert; 7:45 pm, concert, lecture. Central.

KSL, San Francisco, Cal. 50 mi. The Emporium. Daily ex Sun, 10-11 am, concert, news; 2-3 pm, concert, educational talk. Sun, 2-3 pm, concert and educational talk. Pacific.

KSS, Long Beach, Calif. 25 mi. Prast & Dean Radio Research Lab. Daily ex Sun, 3:30-4:30 pm, news, concert. Pacific.

KTW, Seattle, Wash. 200 mi. First Presbyterian Church. Daily, 11-1 pm, 7:30-10, church service. Pacific.

KUO, San Francisco, Cal. 50 mi. San Francisco Examiner. Daily ex Sun, 3-3:30 pm, 5:30-6:45, news, etc. Sun, 5-6 pm, news, etc. Pacific.

KUY, El Monte, Calif. 500 mi. Coast Radio Co. Daily ex Sun, 4-4:45 pm, lecture, concert. Mon, 8-9 pm, lecture, concert. Thurs, 8-9 pm, concert. Pacific.

KVG, Sacramento, Cal. 1,000 mi. E. C. Hohreht (Sacramento Bee). Daily ex Sun, 5:30-6:30 pm, concert, news, markets, weather. Wed and Sat, 8-9, concert. Sun, 5-7 pm, concert. Pacific.

KWG, Stockton, Cal. 1,500 mi. Portable Wireless Telephone Co. Daily ex Sun, 4-5 pm, news, concert, markets. Tues, Wed, Fri, 8-9 pm, concert. Sun, 2-3 pm, concert. Pacific.

KWH, Los Angeles, Calif. 300 mi. Examiner. Daily ex Sat, 12:30 pm, music, news, crop reports. Daily, 5:30-6:30 pm, music, news. Sunday, 2-3 pm, sacred concert. Pacific.

KVJ, Portland, Ore. 700 mi. W. P. Hawley, Jr. Tues, Thurs, 9-10 pm, concert. Sat, 8-9 pm, concert. Pacific.

KVJ, Los Angeles, Cal. 1,000 mi. Leo J. Meyberg Co. (Hamburgers). Daily ex Sun, 4-5 pm, concert, markets, weather, news. Mon, Thurs, Sat, 8-9 pm, same program. Pacific.

KVC, Chicago, Ill. 485 also, 800 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 9:35 am-1:20 pm, market quotations every half hr; 2:15, news, markets; 3, baseball; 4:15 and 6:30, news, final markets and stocks; 7:30, baseball, bedtime story; 7:45, feature; 8-9, concert; 9, news. Sun, 3:30 pm, church service. Central, daylight saving.

KZC, Seattle, Wash. 50 mi. Public Market & Dept. Store Co. Daily ex Sun, 6:45-7:15 pm, prices of food-stuffs. Pacific.

KZM, Oakland, Cal. 200 mi. Preston D. Allen. Daily ex Sun, 7:15-7:30 pm, news. Tues, 7:30-8:15 pm, concert. Pacific.

KZN, Salt Lake City, U. 100 mi. Deseret News. Daily ex Sun, 3-4 pm, weather, markets, music; 8-9, news, concert. Mountain.

KZY, Oakland, Cal. 1,500 mi. Atlantic Pacific Radio Supplies Co. Daily ex Sun, 3:30-4:30 pm, concert; 6:45-7 pm, news. Wed, 7:30-8:15 pm, concert. Sat, 8:15-9 pm, concert. Daily ex Sun, 11-12:15 pm, church service; 3-4 pm, concert. Pacific.

WAAG, Shreveport, La. 50 mi. Bordaureux Co. Daily ex Sun, 7:30-9 pm, baseball, concert. Central.

WAAJ, Boston, Mass. 50 mi. Eastern Radio Inst. Mon, Wed, Fri, 9-10 pm, concert. Eastern.

WAAK, Milwaukee, Wis. 485 also, 300 mi. Gimbel Bros. Daily ex Sun, 10 am, markets, weather; 11, markets; 12:10 pm, markets; 1:25, closing markets; 2, and every hr. after, concert, text; 7, weather; 7:15, baseball; 7:30, concert. Central.

WAAO, Charleston, W. Va. 40 mi. Radio Service Co. Daily ex Sun, 6:45-7:45 pm, music, news, weather, baseball. Eastern.

WAAQ, Emporia, Kan. 600 mi. New England Motor Sales Co. Daily ex Sun, 9:30 am-5:30 pm, every half hr. Eastern, daylight saving.

WAAT, Jersey City, N. J. 70 mi. Jersey Review. Wed, 7-8 pm, concert, lecture. Sun, 7-8, church service, concert. Eastern.

WAAV, Athens, O. 500 mi. Athens Radio Co. Daily, 7-9 pm, miscellaneous. Central.

WAAW, Youngstown, O. 300 mi. Yohrling Rayner Music Co. Tues, Thurs, Sat, 5:45 pm, baseball, news; 7:30, music; 8-9, address, music. Eastern.

WAAZ, Emporia, Kan. 250 mi. Hollister-Miller Motor Co. Daily ex Sun, 9:45-1:15 pm, market quotations every half hr; 7-8 pm, concert, weather. Sun, church service, 2 pm. Central.

WBAA, W. Lafayette, Ind. 100 mi. Purdue University. Fri, 8:15-8:30 pm, educational lecture. Other features irregular. Central.

WBAB, Spruce, N. Y. 150 mi. Andrew J. Potter. Daily ex Sun, 7-8 pm, concert, baseball, weather, news, bedtime story. Sun, 6:30-7:30 pm, church service, etc. Eastern.

WBAD, Minneapolis, Minn. 100 mi. Journal. Mon, Fri, Sat, 9:30 am, markets; 7:50 pm, concert. Central.

WBAG, Bridgeport, Pa. 485 also, 300 mi. Diamond State Fibre Co. Daily ex Sun, 10:45-11:15 am, weather, markets. Eastern.

WBAJ, Toledo, O. 450 also, 500 mi. Marshall-Gerken Co. Tues, Thurs, Sat, 6-7:30 pm, news, bedtime story. 8:00 pm, concert. Eastern.

WBAM, New Orleans, La. 100 mi. I. B. Benayson. Daily ex Sun, 10-11 pm, real estate bulletins, lecture, concert. Central.

WBAN, Paterson, N. J. 100 mi. Wireless Phone Corp. Daily ex Sun, 10:30 am, on the hour to 9:30 pm, concert, baseball. Eastern. 200 mi. Central.

WBAP, Fort Worth, Tex. 485 also, 100 mi. Star Telegram. Daily ex Sun, 8:45-9 am, opening markets; 11-11:30, weather, markets; 1:30-2 pm, closing markets; 3:45-4, news, road conditions; 5:15-5:30, police; 6:30-6:45, baseball, police news; 9:30-10, music. Sun, 11-12:15 pm, church service; 2-2:30 pm, sermonette; 3:30-4 pm, concert. 6:45-7, baseball. Central.

WBAQ, South Bend, Ind. 100 mi. Myron L. Harmon. Daily, 5:30-6 pm, news, concert; 8 pm, concert, news, police reports. Sun, 3:30 pm, church service. Central.

WBAV, Columbus, O. 200 mi. Erner & Hopkins Co. Daily ex Sun, 3:30-7:30 pm, Central.

WBB, Wilkes-Barre, Pa. 200 mi. John H. Stenger, Jr. Three nights of week, no regular.

WBAZ, Richmond, Va. 300 mi. Times-Dispatch. Daily, 7-9 pm, news, concert, markets, etc. Eastern.

WBL, Anthony, Kan. 300 mi. T. & H. Radio Co. Daily ex Sun, 8:50 am, 9:50, 10:50 and 1:15 pm. Kansas city grain markets; 1:15, roads, local markets. 4-8, 9-10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

WBAL, Baltimore, Md. 485 also, 200 mi. W. Va. University. Daily ex Sun, 7-7:30 pm, news

WJT, Erie, Penna. 1,000 mi. Elec. Equipment Co. Daily ex Sun, 7:30 pm, baseball, markets, weather, police reports. Mon, Wed, Fri, 1:30, bedtime stories; 8:15, concert, lecture. Sun, 7:45 pm, church service. Eastern, daylight saving.

WJZ, Newark, N. J. 1,500 mi. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 15 minutes hourly from 9 am to 6 pm, 12-13:30 pm, 7-10:15 pm. Miscellaneous program of highly varied nature. Sun, 3-10:15 pm, misc. Eastern, daylight saving.

WKC, Baltimore, Md. 500 mi. Jos. M. Zamolski Co. Tues, Thurs, Sat, 7:30-9:30 pm. Eastern, daylight saving.

WKV, Oklahoma City, Okla. 485 also. 500 mi. Oklahoma Radio Shop. (Daily Oklahoma.) Daily, 12 m, weather; 7-7:30 pm, baseball, specials; 8:30-9:30, concert; 9, weather, news. Sun, 3:30-4:30 pm, concert. Central.

WLK, Indianapolis, Ind. 300 mi. F. F. Hamilton. (Indianapolis News.) Daily ex Sun, 11-11:30 am, music, weather; 12-12:30 pm, music; 2-2:30, music; 3-3:30, music; 5, baseball; 10, weather. Tues, Thurs, Sun, 8:30-10 pm, Special, Sun, 2-4 pm, church services; 10, weather. Central.

WLW, Cincinnati, O. 2,000 mi. Crosby Mfg. Co. Daily ex Sun, 1 pm, market, lecture; 1:30, weather; 2:30, N. Y. stocks; 2-3, music. Central.

WMA, Anderson, Ind. 25 mi. Arrow Radio Lab. Mon, Wed, Fri, 7:30-8:30 pm, concert, news, etc. Central.

WMC, Youngstown, O. 500 mi. Columbia Radio Co. Mon, Wed, Fri, Sat, 8:30-9:45 pm, concert, address etc. Eastern.

WMI, Cincinnati, O. 485 also. 1,000 mi. Precision Equipment Co. Daily ex Sun, 11 am and 4 pm, weather, markets. Mon, Wed, Sat, 8:15-10, concert, lecture, vaudeville, news. Central.

WMO, Washington, D. C. 100 mi. Doubleday-Hill Elec. Co. Daily, 4:30-5:30 pm, concert, baseball. Thurs, 8-9 pm, concert. Eastern.

WNJ, Albany, N. Y. 80 mi. Shotton Radio Mfg. Co. Mon, Wed, Sat, 8-9:30 pm, music, entertainment. Eastern, daylight saving.

WOC, Davenport, Ia. 485 also. 150 mi. Palmer School of Chiropractic. Daily ex Sun, 12-12:15 pm, markets, weather, concert; 3:30-4, lecture; 5:45-6 and 7-8, concert. Sat, 8-8:15, business review. Sun, 9-10 am and 5:30-6 pm, sacred concert. Central.

WOF, Akron, O. 50 mi. Buckeye Radio Service Co. Mon, Wed, Fri, 7-8:15 pm, concert, news, lecture. Sun, 10-12 am, church service. Eastern.

WOH, Indianapolis, Ind. 1,000 mi. Hatfield Elec. Co. (Indianapolis Star.) Daily ex Sun, 10-11 am, music; 10:15, financial, markets; 1-2 pm, music; 1:20, markets; 4-5 pm, music; 4:15, police notes; 4:50, baseball. Mon, Wed, Sat, 8:30-10 pm, concert. Central.

WOI, Ames, Ia. 300 mi. Iowa State College. Daily, 8:30 am, 12:40 pm, weather. Central.

WOK, Pine Bluff, Ark. 1,000 mi. Arkansas Light and Power Co. Daily, 7:30 pm, baseball, markets, weather, news. Tues, Fri, 8-9:30 pm, concert. Sun, 11 am and 7-45 pm, church service. Central.

WOQ, Kansas City, Mo. 485 also. 300 mi. Western Radio Co. Daily ex Sun, every half hour 9:30-11:15 pm, markets; 11:30 am, 2 pm, 7:30, markets, weather, road conditions; 7-45, concert, vaudeville. Sun, 7 pm, church service. Central.

WOR, Newark, N. J. 150 mi. L. Bamberger & Co. Daily ex Sun, 20 minutes on half hour from 10:30 am to 6:30 pm, miscellaneous. Eastern, daylight saving.

WOZ, Richmond, Ind. 485 only. 300 mi. Richmond Paladium. Daily ex Sun, 12-12:15 pm, markets; 4-5, concert, news, markets; 6:30 pm, concert, news, weather, lecture. Central.

WPA, Fort Worth, Tex. 485 also. 500 mi. Fort Worth Record. Daily ex Sun, 11:30 am, 2:30-3 pm, 6-6:15, 7:15-7:30, 8-9:30, Sun, 8-30, 9:30, Central.

WPE, Kansas City, Mo. 300 mi. Central Radio Co. Mon, Fri, Sun, 7:45 pm, concert. Sun, 8:15 pm, ser-

monette. Daily, afternoon, baseball scores. Central.

WPI, Philadelphia, Pa. 30 mi. St. Joseph's College. Daily ex Sun, 2:30 pm, 8:30, sports, news. Sun, 10:45-12 noon, 7:45-8:30 pm, church service. Eastern.

WPM, Washington, D. C. 200 mi. Eastern J. Williams, Inc. (Washington Daily News.) Daily ex Sun, 12:30 pm, news. Mon, 8 pm, concert. Eastern.

WPO, Memphis, Tenn. 200 mi. United Equipment Co. (News-Scimitar.) Daily, 7-9 pm, concert, news. Central.

WRK, Hamilton, O. 1,000 mi. Doron Bros. Elec. Co. Mon, Wed, Sat, 8:30-10:30 pm, concert, news. Fri, 7:30-9:30, concert. Sun, 10:45 am and 7:30 pm, church service. Central.

WRL, Schenectady, N. Y. 800 mi. Union College. Sun, 7:30 pm, sacred concert, speeches, etc. Irregular miscellaneous weekday program. Eastern.

WRM, Urbana, Ill. 410 also. 200 mi. Univ. of Ill. Thurs, 8:30-8:55 pm, 9:05 on, news, concert, lecture. Special concerts irregular. Central.

WRP, Camden, N. J. 200 mi. Federal Inst. of Radio Teleg. Daily ex Sat, and Sun, 10-10:45 pm, instruction. Eastern, daylight saving.

WRR, Dallas, Tex. 485 also. 200 mi. City of Dallas. Daily ex Sun, 12-12:30 pm, weather; 3-3:30, baseball, markets, news; 7-7:15, police news; 8:30-9, music. Sun, 11 am, church service; 7-8 pm, police news, church service. Central.

WRW, Tarrytown, N. Y. 1,500 mi. Tarrytown Radio Research Lab. Tues, Thurs, Sat, 10:05 pm, Sun, 10:30 am, 2 pm, 10:05, Eastern, daylight saving.

WSB, Atlanta, Ga. 485 also. 1,000 mi. Atlanta Journal. Daily ex Sun, 12-1 pm, concert for industrial employees; 2:30, weather, markets; 4-4:30, theater concert; 4:30, markets; 5-6, baseball, markets, music, bedtime stories; 7-8, concert, etc.; 10:45-11:15, music. Sun, 11 am, 5 pm, church service. Central.

WSN, Norfolk, Va. 300 mi. Shipowners Radio Service Inc. Mon, Wed, Sat, 8:15-9:30 pm, concert. Eastern.

WSX, Erie, Pa. 75 mi. Erie Radio Co. Tues, Thurs, Sat, 10-10:55 pm, news, concert, lecture. Sun, 12:15-1:30 pm, sermon. Eastern, daylight saving.

WSY, Birmingham, Ala. 150 mi. Alabama Power Co. Daily ex Sun, 8:30 pm, markets, stocks; 8, concert. Sun, 8 pm, chapel. Central.

WTG, Manhattan, Kan. 485 only. 75 mi. Kan. State Agri. College. Daily ex Sun, 9:55 am, weather (code). Central.

WTK, Paris, Tex. 300 mi. Paris Radio Elec. Co. Daily ex Sun, 10 am to 5 pm, 7-11 pm, miscellaneous. Sun, 11 am to 8 pm. Central.

WTP, Bay City, Mich. 75 mi. Ra-Do Corp. Daily ex Sun, 1-2 pm, 6:30-7:30, 10-11, concert, baseball, markets. Sun, 1-2 pm, 6:30-7:30, 9-10, Eastern.

WTI, Dearborn, Mich. 300 mi. Ford Motor Co. Wed, 8-11 pm, Eastern.

WWJ, Detroit, Mich. 485 also. 1,000 mi. Detroit News. Daily ex Sun, 9:30-10:30 am, hints to housewives, concert, weather; 10:55, time signals; 12:05-12:45 pm, concert; 3:30-4:15, markets, weather; 5-6, news, baseball. Week of July 14, and every other week, 7-8:30 pm, concert, lecture, fill in weeks, 8:30-10 pm, concert, lecture. Sun, July 9, wk etc., 9:30 am-2:30 pm, church services and special; 4-6 pm, special. Sun, fill in wk, 2-4 pm, special; 6-10, church services and special. Eastern.

WWX, Washington, D. C. 1,160 only. 600 mi. Post Office Dept. Daily ex Sun, 10 am, weather; 10:30, markets; 5 pm, 7:30, 8, markets; 9:50, weather. Eastern.

WWZ, New York, N. Y. 200 mi. John Wanamaker. Daily ex Sun, 1:40-2 pm, 2:40-3, 3:40-4, 4:40-5, 10:30-12 midnight, concert. Eastern.

WYW, Washington, D. C. 100 mi. Nat'l Radio Inst. Daily, 6:30-7:30 pm, instruction. Eastern.

SARU, Louisville, Ky. 200 only. Darrell A. Downard. Mon, Wed, 8 pm, police news, concert. Central.

State, City, Call

Alabama:
Birmingham, WIAG, WSY
Mobile, WEAP
Montgomery, WGH

Arizona:
Phoenix, KDYW, KFAD
Tucson, KDZA

Arkansas:
Fort Smith, WCAC
Little Rock, WCAV,
WEAX, WSV
Pine Bluff, WOK

California:
Altadena, KGO
Bakersfield, KDZB, KYI
Berkeley, KQI, KRFE
El Monte, KUY
Eureka, KNI
Fresno, KDZH, KMJ
Glendale, KFAC
Gridley, KFU
Hanford, KFBD
Hollywood, KFAR, KGC
Long Beach, KSS
Los Altos, KLP
Los Angeles, KDZD,
KDZP, KDZP, KFI,
KHJ, KJC, KJS, KNN,
KNR, KNV, KNX, KOG,
KON, KQL, KUS, KWH,
KXS, KYJ, KZI
Modesto, KOQ, KXD
Oakland, KLN
Oakland, KLS, KLX, KZM,
KZY

Pasadena, KDYR, KLB
Pomona, KGF
Reedley, KMC
Redwood City, KDYN
Sacramento, KVQ
San Diego, KDPT, KDYM,
KDYO, KFBC, KYF
San Francisco, AGI, KDN,
KDZG, KDZW, KDZZ,
KPO, KSL, KUO
San Jose, KFAQ, KQW,
KSC
San Luis Obispo, KFBE
Santa Ana, KFAW
Stockton, KJQ, KWG
Sunnyvale, KJJ
Venice, KFAV

Colorado:
Boulder, KFAJ
Colorado Springs, KHD
Denver, DD5, KDYY,
KDZU, KLZ, KOA

Connecticut:
Greenwich, WAAQ
Hartford, WDAK
New Haven, WCJ, WGAH

Delaware:
Wilmington, WHAV

District of Columbia:
Washington, WDM,
WEAS, WEAQ, WIL,
WIAY, WJH, WМУ,
WPN, WWX, 3YN

Florida:
Jacksonville, WCAN,
WDAL
Miami, WFAW, WYAZ
Pensacola, WGAN
Tampa, WDAE, WEAT,
WHAW

Georgia:
Atlanta, WAAS, WDAW,
WSB, 4CD
College Park, WDAJ
Fort Smith, WGAF
Savannah, WGAU, WHAO

Idaho:
Boise City, KFAU
Lewiston, KFBA
Moscow, KFAN

Illinois:
Chicago, KYW, WAAF,
WBU, WDAP, WGAS,
WGU
Decatur, WBAO, WCAP,
WHAP
Peoria, WBAE, WFAP,
WJAN
Quincy, WCAW, WCAZ
Rockford, WIAB, WJAM
Springfield, WDAC
Tuscola, WDJ
Urbana, WRM

Indiana:
Anderson, WMA
Fort Wayne, WFAS
Huntington, WHAY
Indianapolis, WLK, WOH
Marion, WIAQ
Richmond, WQZ
South Bend, WBAQ, WGAZ
Terre Haute, WEAC
West Lafayette, WBAA

Iowa:
Ames, WOI
Burlington, WIAS
Cedar Rapids, WJAX,
WKAA
Centerville, WDAX
Davenport, WHAL, WOC
Des Moines, WGF
Fort Dodge, WEAB
Iowa City, WHAA
Le Mars, WIAU
Newton, WIAH
Shenandoah, WGAJ
Sioux City, WEAU, WHAE
Venton, WIAE
Waterloo, WEAZ, WHAC

Kansas:
Anthony, WBL
Atwood, WEAD
Eldorado, WAH
Emporia, WAAZ

State, City, Call

Independence, WFAY
Lindsborg, WAD
Manhattan, WTG
Salina, WEAD
Wichita, WAAP, WEAH,
WEY, WHAN

Kentucky:
Louisville, WHAS, 9ARU
Paducah, WIAR

Louisiana:
New Orleans, WAAB,
WAAC, WBAM, WCAQ,
WGV, WIAF, WWL
Shreveport, WAAG,
WDAN, WGAQ

Maine:
Auburn, WMB
Portland, WJAL
Sanford, WFAR

Maryland:
Baltimore, WCAO, WEAT,
WKC

Massachusetts:
Boston, WAAJ, WFAU
Holyoke, WHAX
Medford Hillside, WGI
New Bedford, WDAU
Springfield, WEZ, WIAP
Worcester, WCN, WDA,
WDAI

Michigan:
Bay City, WTP
Dearborn, WWI
Detroit, KOF, WCX, WWJ
East Lansing, WHW
Flint, WEA
Lansing, WHAL
Saginaw, WIAW

Minnesota:
Duluth, WJAP
Hutchinson, WFAN
Minneapolis, WAAL,
WBAD, WBAH, WCAS,
WCE, WLB
Redfield, WCAL
St. Cloud, WFAM
St. Paul, WAAH

Mississippi:
Corinth, WHAU

Missouri:
Brentwood, WFAK
Cameron, WFAQ
Columbia, WAAN
Jefferson City, WOS
Joplin, WHAH, WJAC
Kansas City, WDAF,
WHB, WQZ, WPE
St. Joseph, WBEK
St. Louis, KSD, WAAE,
WCK, WEB, WEW
Springfield, WIAI
Tarkio, WIAT

Montana:
Butte, KFAP, KFBB
Great Falls, KDYS
Havre, KFBB

Nebraska:
Lincoln, WCAJ, WFAV,
WGAT, WIAX, WJAB,
WKAC
Norfolk, WJAG
Omaha, WAAW, WIAK,
WOU, WOY
Rushville, WEAU

Nevada:
Reno, KDZK, KFAS, KUJ

New Hampshire:
Berlin, WEAQ
New Jersey:
Atlantic City, WHAR
Camden, WEP
Deal Beach, 2XJ
Jersey City, WAAT
Moorestown, WBAF
Newark, WAAM, WBS,
WJX, WJZ, WOR, 2XAI
N. Plainfield, WEAM
Ocean City, WIAD
Paterson, WBAN

New Mexico:
Roswell, KNJ
State College, KOB

New York:
Albany, WNJ
Binghamton, WFAZ,
WIAV
Brooklyn, WGAC
Buffalo, WGR, WWT
Canton, WCAD
Ithaca, WEAI
Newburgh, WCAB
New York, KDOW, WBAY,
WDAM, WDT, WVP,
WWZ
Poughkeepsie, WFAF
Rochester, WHAM, WHQ
Ridgewood, WHN
Schenectady, WGY, WRL
Syracuse, WBAB, WDAI,
WFAB
Tarrytown, WRW
Troy, WHAZ
Utica, WSL
Waterford, WFAQ

North Carolina:
Asheville, WFAJ
Charlotte, WBT

North Dakota:
Fargo, WDAY

Ohio:
Akron, WOE
Athens, WAAV
Canton, WWB
Cincinnati, WAAD,
WHAG, WIZ, WLW,
WMH
Cleveland, KDPM, WHK
Columbus, WBAV, WEAQ
Dayton, WA1, WFO,
WJAJ
Defiance, WCAQ
Fairfield, WL-2
Granville, WJD

State, City, Call

Hamilton, WBAU, WRK
Lebanon, WPG
Marietta, WBAW
Norwood, WIAL
Portsmouth, WDAB
Stockdale, WJAK
Toledo, WBAJ, WHU,
WJK
Wooster, WGAU
Youngstown, WAAY, WMC
Zanesville, WPL

Oklahoma:
Muskogee, WDAY
Oklahoma City, WKY,
5XT
Tulsa, WGAF
Yale, WHAT

Oregon:
Eugene, KDZJ, KFAT
Hood River, KQF
Klamath Falls, KDYU
Portland, KDYQ, KFAB,
KGG, KGN, KGW, KQY,
KYG

Pennsylvania:
Allentown, WIAN
Bridgeport, WBAG
Brownsville, WDAQ
Clearfield, WPI
Erie, WJT, WSW
Harrisburg, WBAK
Lancaster, WGAL
McKeesport, WIK
Philadelphia, WCAU,
WDAR, WFI, WGAW,
WGL, WIP, WOO
Pittsburgh, KDKA, KQV,
WAAZ, WCAE, WHAF
Villanova, WCAM
Wilkes-Barre, WBAX

Rhode Island:
Eastwood, WEAG
East Providence, WKAD
Pawtucket, IOJ, IXAD
Providence, WEAN, WJAR

South Carolina:
Charleston, WFAZ
Orangeburg, WGAM

South Dakota:
Rapid City, WCAT
Sioux Falls, WFAT

Tennessee:
Memphis, WKN, WPO
Nashville, WDA
Texas:
Amarillo, WDAG
Austin, WCM
Dallas, WDAO, WFAA,
WRR
El Paso, WDAH
Fort Worth, WBAP, WPA
Galveston, WHAB, WIAC
Houston, WCAK, WEAV,
WEV, WFAL, WGAB,
Paris, WTK
Port Arthur, WCAH
San Antonio, WCAR,
WJAE
Waco, WJAD
Wichita Falls, WKAF

Utah:
Ogden, KDZL
Salt Lake City, WT

Vermont:
Burlington, W...

Virginia:
Norfolk, WSN
Richmond, WBAZ

Washington:
Aberdeen, KNT
Bellingham, KDZR
Centralia, KDZM
Everett, KDZZ
Lacey, KGY
Pullman, KFAE
Seattle, KDZE, KDZT,
KFC, KHQ, KJR, KTW,
KZC
Spokane, KFZ, KOE
Tacoma, KFEG, KBG,
KMO
Wenatche, KDZI, KZV
Yakima, KFV, KQT

West Virginia:
Bluefield, WHAJ
Charleston, WAAO
Clarksburg, WHAK
Huntington, WHAR
Morgantown, WHD

Wisconsin:
Madison, WGAY, WHA
Milwaukee, WAAK,
WCAV, WHAD, WIAO
Neenah, WIAJ
Superior, WFAC
Waupaca, WIAA

Hawaii:
Honolulu, KDYX, KGU

Porto Rico:
Ensenada, WGAD

Canada:
Calgary, CHBC, CHCQ,
CFAC
Edmonton, CJCA
Fort Frances, CFPC
Halifax, CFCE
Hamilton, CKOC
London, CJGC
Montreal, CFCF, CHYC,
CJBC, CKAC
Ottawa, CHXC
Regina, CKCK
St. John, CJCI
Toronto, CFCA, CHCB,
CHCZ, CHVC, CJCD,
CJCN, CJSC, CKCE
Vancouver, CFBC, CFYC,
CHCA, CJCE, CKCD
Winnipeg, CHCF, CJCG,
CJNC, CKZC

FAMOUS ENGINEERS SPEAK AT CONGRESS

BOSTON CODIST RETAINS WORLD'S SPEED TITLE

Crowds Attend Pageant of Progress Feature to See and Hear Ether Notables

CHICAGO.—Opening Sunday, August 6 with a code speed marathon and closing Tuesday, August 8, with a message from Senatore Guglielmo Marconi, the first annual Radio Congress was held here at the Pageant of Progress Exposition. Many thousands of interested fans, novices, manufacturers and dealers attended the sessions of the congress to hear and see the many ether notables who delivered speeches.

On Monday T. R. McElroy of Boston, holder of the present world's record for Radio code speed of 56 1/2 words per minute, defended his title by winning the congress marathon. His speed was 52 1/2 words per minute. The award received by Mr. McElroy was a solid gold diamond medal, donated by George E. Carlson, Commissioner of Gas and Electricity of the City of Chicago. The three next contestants and their speeds were: B. C. Seutter, New York, 52 words; M. Swartz, Chicago, 48 words; B. D. Brankey, Chicago, 46 words.

Monday's Program

The Monday program of the congress was opened by Major J. O. Mauborgne, signal officer of the 6th Army Corps Area, and president of the congress. Speakers and their subjects at the Monday session were:

John Mills, research engineer of the Western Electric Co., "The Human Voice and Its Electrical Transmission." Mr. Mills' paper was appropriately illustrated by moving oscillographs projected on a screen.

Samuel M. Kintner, general Radio engineer in research department of the Westinghouse Electric & Mfg. Co., "The Technique of Broadcasting."

Dr. Louis Cohen, consulting engineer for Signal Corps, U. S. Army, "Wired Wireless and Its Application to Broadcasting on Power Lines."

Dr. J. H. Dellinger, physicist in charge of Radio Laboratory of Bureau of Standards, "Interference Problems in Radio Telephony."

Benjamin F. Miessner, Radio research engineer and acoustic expert, "Design of Vacuum Tube Amplification Systems."

R. E. Heising, research engineer of the Western Electric Co., "How Speech Is Carried."

Tuesday's Program

The program for the closing day, Tuesday, was:

R. H. G. Mathews, central division manager of the American Radio Relay League, "Amateur Radio."
Lt. Col. L. R. Krumm, superintendent of Radio operations of the Westinghouse Electric & Mfg. Co., "Broadcasting Operations, Present and Future."
Dr. Chas. P. Steinmetz, chief consulting engineer of the General Electric Co., "The Problem of Radio Power Transmission."
F. W. Dunmore, Radio laboratory of Bureau of Standards, "A Relay Recorder for Remote Control by Radio."
George H. Clark, publicity engineer for the Radio Corporation of America, "Radio Telegraphy," a paper written by Senatore Guglielmo Marconi, who, unable to be present, authorized its reading by Mr. Clark. Mr. Clark also gave an illustrated talk on the Radio Corporation station, "Radio Central," at Port Jefferson, Long Island.

CONDENSED By Dielectric

Senator Marconi may have lost a good eye, but he retains his wisdom teeth. When this wizard of Radio tells us we are the lead-in, his set is working right. After looking us over and getting a hunch or two from Dr. Langmuir's new Radiotrons the Senator went away on his boat to juggle with the short waves. Considering what he has done for the science he well deserves the little medal given him.

Something new in South America. Added to Brazilian nuts that country now is developing "fans." Installing a big Radio system down there has started the growth of fans and the youngsters of Brazil are assembling sets with high frequency.

Mars never sent a spark after all. New stunts in Radio have been coming along so fast we thought maybe someone had started a signal several hundred years ago from that planet. Nothing to it. Some fellows think it is nearly time to transmit code messages requesting reservations in the next world. Not so fast, my friends you don't know where those messages would be picked up.

About the time we get all our stuff together on the latest type of receiving set, Armstrong, or someone else gets a new hunch and we fade out. Here's the super-regenerative set capable of amplifying the signal strength 100,000 times. You will just about commence one of these when the super-super will be along. For speedy changes Radio has all the sciences beaten.

Dealers in Radio books say the craze is dying out. Some of them think it is the novelty of listening in via Radio to the same things we have heard from our phonograph, which caused the craze and is now wearing off. Well, broadcast pro-

grams are quite different—most of them. Besides, buying new records and winding the phonograph are eliminated with Radio-telephony. I'm sure no code fan will agree with the book sellers.

The next time you are seated in the lobby of a big hotel, or busy putting away a good meal, and you hear yourself paged, don't show your ignorance by looking for the boy. It's the announcer at the desk using his amplifier.

I expect to hear of loud-speakers being used at the beach resorts giving the

bathers the latest baseball returns. Perhaps dance music broadcast at night will make the beaches favorite cool retreats for this pastime.

Did any of you read Dr. Steinmetz' statements disproving the theory of ether waves? I tried to follow him through it all but somehow couldn't get his signals clear. Einstein, with his relativity, made me dizzy. Scrapping the idea of ether waves will mean tuning in all over again.

Watch this space for the latest Radio gossip.

Radio Digest Illustrated

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Patent Infringement

In the Rush to Make Outfits, Patents Are Overlooked
A RECENT investigation shows that at least thirty-seven Radio apparatus manufacturers are infringing upon each other's patents. More than one thousand other manufacturers are infringing upon patents of older Radio concerns. Apparently everyone has been too busy to go to the law, but when the day of reckoning comes there will be trouble. It is obvious that only a small portion of those who are putting Radio apparatus on the market have either technical skill or the protection of exclusive patents.

Vacation as Radio Operators

Receive Pay While Taking the Summer Vacation
A GREAT many young Radio enthusiasts have discovered this summer that through their knowledge of the transmitting key they have been able during these vacation months to travel as commercial operators aboard ship.

This makes one of the most practical vacations possible, combining as it does the pleasure and broadening influence of travel with the opportunity of earning a fair salary. The drawback in most cases is, of course, the dearth of ships requiring Radio operators. However, the persistent seem somehow to find eventually the berths they are looking for. It would seem an excellent idea for a number of amateurs who are uncertain how they will spend their next summer's vacation to get into practice during the winter for a valuable experience. Even if they do not land aboard valuable berths, it is useful and likely to be

Demand for Apparatus Unabated

The Coming Months Will See Another Boom in Trade
A STATEMENT issued by the president of a large concern is that their manufactured Radio goods has increased 50 per cent during the last four weeks. The report shows that dealers throughout the country are now buying for the late August and early September demand which is expected to eclipse last spring's rush on the Radio shops.

The feverish growth the industry had during last winter and spring has given much valuable publicity to the business. The simmering down of the demand, however, has been caused by the summer heat and has brought many a manufacturer to his senses. The reliable builder of apparatus is now getting a better angle of the market. He is catching up with orders and stocking up for the fall business.

There is no question as to what the results will be when fall comes. The indoor sport of the American public will again be the Radiophone and no one knows at this time just what the outcome will be as to the amount of business that will be done this winter.

Future of Broadcasting

Stations Trying to Find Most Popular Program
THE FUTURE of Radiophone broadcasting might be viewed from a dozen angles. A dozen or more of prophecies might be obtained from as many people, but perhaps the only possible deductions which can be made thus far are those based on what has occurred and what progress has been made during the first six months of popular Radio.

Already the broadcasting stations have tried out a range of subjects from prize fight ringside returns to lectures on social hygiene and from jazz to grand opera. Religious sermons and sacred music are being sent out on Sundays and kiddies' bedtime stories several evenings each week.

In the ambitious attempt to feel out the public desire, the broadcasters have discovered what newspaper managers discovered long ago—that the mental and intellectual appetite of the American family has a wide range of interests, and in order that the new means of disseminating what the American public wants to know daily, it is essential only to realize that the change is one of manner—not of matter.

The Radiophone receiver in the home, if desired, can be on duty all of the time. Its messages come in spoken words, pleasing and easy to understand. In this one feature, state and national government departments have an agency whereby the home, the office, the farm and the workshop may be reached directly and at opportune times.

All in all we have in the Radiophone a new and valuable means of communication—in the main a way to get the news matter in a direction of flow from organized sources into the dwellings of men.

Ye Ed Asks 'imself

Question.—Why is a fixed condenser required across the telephone receiver in a receiving circuit?

Answer.—A fixed condenser is necessary across a telephone receiver so as to provide a path of low impedance for the high frequency Radio current which would otherwise make the operation of the head telephone sets sluggish.

Question.—What was the original inventor of multiplex carrier current telegraphy?

Answer.—At one time it was universally believed that Major General Squier of the Signal Corps was the inventor of carrier current telegraphy or telephony which permitted the sending of four messages or telephone conversations at the same time on a single wire. Major General Squier is at the present time contesting his patent which he claims infringed by the American Telephone & Telegraph Company, and it will be up to the United States Appellate Court to decide this question.

Question.—Do you consider a patent based on a silicon core in a telephone receiver as a new invention?

Answer.—Silicon core has never been used as a core in receiver coils. It has been universally used as a core in almost every other type of coil. The patent would seem justified as the application is new, although principle, old.

Question.—Have tests been made with an exposed wire antenna which will entirely overcome static interference?

Answer.—A. H. Taylor has carried on a large number of tests using a long single wire antenna and a long underground antenna wire tuned together in a coupled circuit. These tests were carried on in connection with transmission experiments between this country and Europe and under severe conditions all static interference was entirely eliminated.

Question.—Is it considered a dangerous proposition to use a receiving set during a thunderstorm?

Answer.—Provided the set is equipped for outside and inside lightning arresters the use of a Radio receiving set is no more dangerous than the use of an ordinary telephone during a local thunderstorm. The inductive effect of a lightning bolt striking a set so equipped is, however, a very uncertain factor, and is, therefore, considered a dangerous liability.

Question.—There is considerable difference of opinion as to whether or not all disturbances encountered in Radio reception during the summer months are due to static disturbances. What are some of the steps which can be taken to cut down the amount of disturbances that are present in a set during humid weather?

Answer.—The use of a vacuum type arrester, as stated above, will carry off much of the electrostatic charge which accumulates on an aerial antenna. Copper shields between the vacuum tubes will materially decrease leakage noises brought about by the oscillations of one tube leaking into the other adjacent tube. Mounting the vacuum tubes so that they are free from vibration and also guying with ropes the aerial wire of antenna will decrease these noises. In addition the set should be entirely shielded inside of the cabinet on all sides, all shields being connected to the ground.

Question.—Why was the Poulsen arc abandoned in the use of Radio telegraphy?

Answer.—The carbon arc due to the destruction of the carbon in operation at white heat brings about uneven crater electrodes, and because this uneven burning of the carbon brought about sputtering in the circuit, and the higher efficiency of the present vacuum tube generator, this arc was finally abandoned.

Question.—Why has Radio frequency amplification been delayed?

Answer.—Because it has been hard to design Radio frequency transformers with a wide range of wave length and still with satisfactory efficiency.

Question.—What is the principal distinction in design of honeycomb coils?

Answer.—Honeycomb coils wound on self contained tubes have the wiring so arranged that a minimum amount of capacity is not only present between the turns but also between the layers. This is accomplished by winding the turns in a honeycomb construction. In other words, the lap of the turns across the section of the layers are in diamond shape form. This construction has been found very satisfactory and has been patented in combination with a satisfactory mounting for installing such coils readily in position on the face of the panel. Dr. Lee De Forest is the inventor of this method of winding coils.

Question.—In international telegraph signaling what is the object of the three-letter signals beginning with Q?

Answer.—The introduction of these signals by means of the letter Q has simply a purpose of abbreviation for reducing unnecessary conversation between the telegraph stations. In other words, it is a code applying to questions and statements which have the same definition in any language which may be used.

Question.—What is meant by the use of the word "Omnigraph" in connection with telegraph transmission?

Answer.—An omnigraph is a device operated mechanically for the purpose of sending code. This device provides a very efficient means for code practice.

W. N. Furthman.

RADIO INDI-GEST

Coal Strikers, Beware!

A Spokane paper says when some fans try to operate a loud speaker with their sets, they hear a noise like a ton of coal being dropped down a chute in a cellar. To some of us that would be a mighty interesting noise.

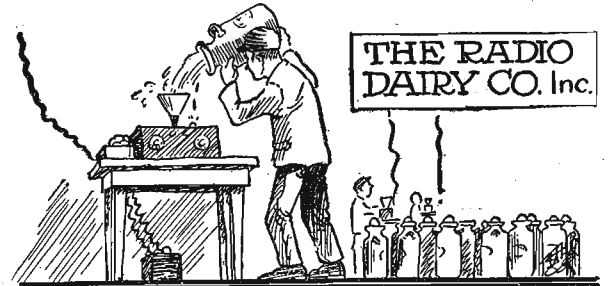
And Chain Him to the Ground

Warden: "Who are you and what are you charged with?"

Prisoner: "My name's Spark, I'm an electrician and I'm charged with battery."

Warden: "Jailer, put this man in a dry cell."

Mercy, We Hope He Can't Radio Hootch



Excerpt from the State Journal, Springfield, Illinois, comes right out and tells the world (seriously) that H. E. Richardson, 15-year-old-wonder-of-wonders residing in the city Mr. Kodak made famous, that this marvel has perfected a system of disintegrating milk, thence squirting it into the ethereal milky way in the form of Radio bovine juice wavelets, thence the second, converts the atomized and Radioized chalk-and-water back into milk. But to get the right idea about this soul-anguishing, resplendent, scintillating device, we must quote to you the clipping from Kodaktown:

"Doubt and ridicule met young Richardson's first announcement that he could transport milk by Radio. But the boy repeated his assertion, and in the presence of seven witnesses, performed the experiment for the second time.

"At first, Richardson says he succeeded in receiving a quantity of milk by Radio from Brooklyn, 260 miles away!

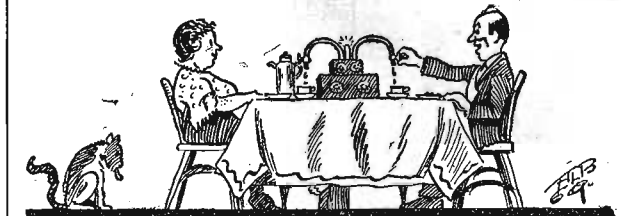
"All who saw Richardson perform this wonder say there is no trick to it. In their presence he actually sent a quantity of milk twenty feet by Radio."

AND NOW, let us hear how our prodigy explains it:

"The milk is passed through a vacuum and the spark going through the vacuum unites the atoms of the milk with the electrons and is carried out in the form of an electric current. This applies to the sending of the milk.

"The milk is received in the form of an ordinary message and in place of the phones I use a condenser. When the condenser is filled to capacity it discharges. Atoms discharge easier than the electrons, and therefore the atoms discharge and form the milk."

Now not that we want to be sarcastic or anything old maidish like that but we hereby promise Mr. Richardson and the State Journal top place in our own hand-painted foyer of fame when we find that we have been making light of such a wonderful invention. Just think of its enormous possibilities, ye home-brewing brethren!



Or Geraldine's Cracked High C's?

One Radio fan listening in on Independence Day heard only static, and has inquired of Mr. Q. & A. whether they were broadcasting fireworks!

Hint—Put Birdseed on Your Aerial

Dear Indi.—As I was looking over my Radio Digest I noticed in Vol. 1 No. 7 a cartoon of a Radio station owned and operated by the well known "Willie Jones." The artist informed the world that the aforesaid "Willie" had a difficult time keeping the birds off his antenna. Will you oblige me by writing "Willie" to tell him he should worry for all the birds he has perching there he surely must get music on his antenna.

Or the "Shriek" in Arabia

"Choke off Caruso, Gertie, and let's hear what the wild waves are saying."

The golden tenor's record ends in a sobbing whir. Gertie adjusts her hair with one hand, and with the other languidly twirls a button and a couple of dew-drops. Up aloft an aerial vibrates and through the phonograph horn comes a voice:

"This is RED, of the Moscow Daily Murder, broadcasting the noon report from the morgue. Seventeen—"

"Aw, gee, Gert! Get something cheerful! Try that fellow in Hong Kong. He's got the swellest lisp. His wave length is 431.5."

Radio Telephony for Amateurs and Beginners

Part XI—Amplifiers

By Peter J. M. Clute

To Explain—

The following article by Peter J. M. Clute is a continuation of his series. The last article will be:

XII. Useful Information.

WE HAVE previously considered in more or less detail simple receiving sets of the crystal detector type, the vacuum tube detector type and the regenerative type. These receiving units were complete in themselves and required nothing more to prepare them for the reception of the broadcasted programs. However, most Radio enthusiasts are not satisfied with simply "listening in," but they are interested in getting the signals as loudly as possible. Up to this point, we have considered how to make signals audible and the present discussion will be concerned with showing how to increase the strength and tone of these signals.

In order to get louder signals, once they have been detected, it is necessary to "amplify" them. This is accomplished by using an "amplifier," a device which increases the feeble oscillations hundreds and even thousands of times. This is desirable in order to make the weak signals sufficiently loud to be distinctly understood. In some cases, the signal strength is augmented to such a degree that it will operate a loud-speaking device.

General Type of Amplifiers

There are two general types of amplifiers, namely, the Radio-frequency ampli-

impressed upon them currents having frequencies well within the audible range. In the case of audio-frequency amplification, the amplifying is accomplished after

The method known as Radio-frequency amplification is used for increasing the distance over which receiving equipment will operate satisfactorily. In order to

in the detector tube, it is again amplified at audio-frequency to obtain volume of sound. Radio-frequency amplification is advantageous because Radio frequencies are inaudible to the ear and, hence amplifying is produced without unpleasant noises or disturbances.

Transformer Coupling Method

Figure 4 shows the transformer coupling method as applied to one stage of Radio-frequency amplification. A special form of transformer, termed the "Radio-frequency amplifying transformer," is used in this connection, designed especially for the shorter wave-lengths. The transformers used must be designed for the particular wave-length on which signals are to be received. As shown in the diagram, the primary of the amplifying transformer is connected in the plate circuit of the preceding amplifier tube and the secondary is connected to the grid of the next tube.

A single-stage Radio-frequency amplifier and vacuum tube detector with regenerative "tuned-plate" hook-up is shown in Figure 5. Figure 6 shows the typical connections for a detector tube and two stages of Radio-frequency transformer coupled amplification. In actual hook-ups the filament and plate batteries are used for the detector and amplifier tubes, but in Figures 5 and 6 separate batteries are shown in order to simplify the diagrams.

The amplifier of the audio-frequency type is employed when loud signals are desired and it introduces loudness and clarity, as well as depth to the tones. The problem is to provide a means of coupling the output of one tube to the input of the next, to obtain as much amplification as possible and at the same time to preserve the original quality of the incoming signal without distortion. Coupling between the detector and amplifier tubes can be accomplished by using vari-

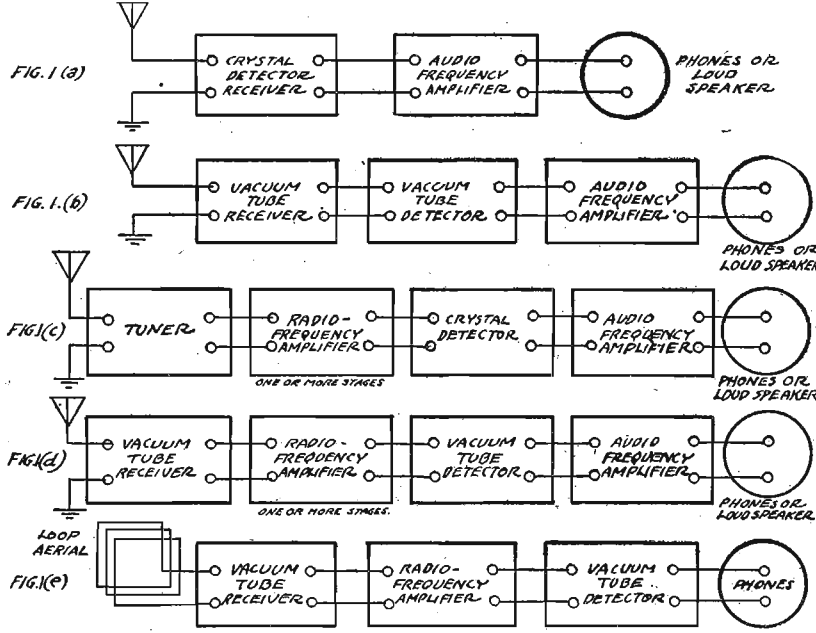


FIG. 1 METHODS OF CONNECTING AMPLIFIERS IN CIRCUIT.

the signal energy has passed through the detector unit and has been rectified so as to produce audio-frequency currents, while with the Radio-frequency amplification the signals are amplified before they are impressed upon the detector. The chief advantage of Radio-frequency

receive signals over very long distances with a loop aerial, it is necessary to employ Radio-frequency amplification. Figure 2 shows Radio-frequency amplification used with a loop antenna. The loop permits reception with a reduction of static and interference, inasmuch as it is

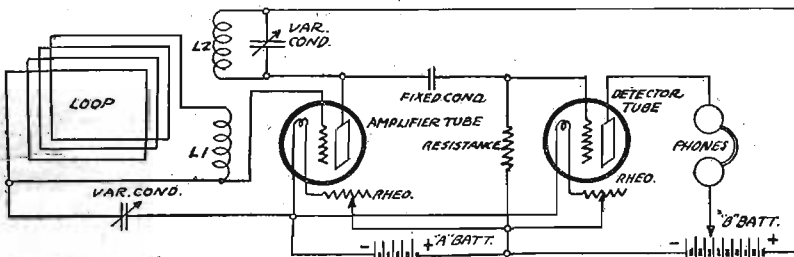


FIG. 2 RADIO FREQUENCY AMPLIFIER USED WITH LOOP ANTENNA

fier and the audio-frequency amplifier. The difference between these two classes is that Radio-frequency amplification consists of building up the intercepted Radio energy before impressing it on the detector, which in turn makes this energy capable of actuating a telephone or other device. Audio-frequency amplification, on the other hand, is used to build up the audible frequency current coming from the detector. Inasmuch as many types of detectors just begin to function when the

amplification lies in the fact that it amplifies only the wave and not the numerous little irregularities existing in most receiving and amplifying apparatus.

Both Radio-frequency and audio-frequency amplifiers make use of that property or characteristic of the three-electrode vacuum tube which causes it to act as an amplifier of high-frequency alternating current. When a slight change is made in the voltage impressed upon the grid, the plate current increases in much

larger proportions. The vacuum tube detector functions as a relay in which the amount of current flowing through it from a local battery is controlled by the feeble impulses of the signals received. It has been shown in the preceding discussion that a regenerative effect or self-amplification may be secured with only a single tube. In the regenerative hook-ups, instead of applying the potential of the plate circuit to the grid of another tube, it is fed back into the grid circuit of the same tube so as to increase the potential on the grid. This characteristic of the vacuum tube is employed in the amplifying circuits, where the plate circuit of one tube is connected to the grid circuit of the next tube. By the use of one or more additional tubes the incoming signals can be greatly increased in volume. Each tube has a certain value of potential impressed upon its grid and input circuit, and because of this relay action the voltage is amplified and passed on to the next tube or to the phones.

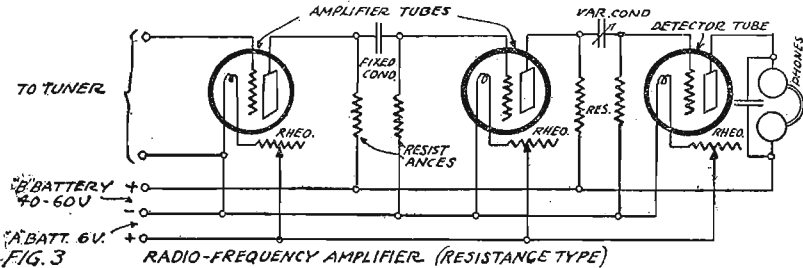


FIG. 3 RADIO-FREQUENCY AMPLIFIER (RESISTANCE TYPE)

strength of the intercepted waves has reached a critical point, it is quite evident that extremely weak signals will not be detected, and no amount of audio-frequency amplification will help, since there is nothing to amplify. On the other hand, even with very weak signals, it is possible to pass them through one or more steps or stages of Radio-frequency amplification to be built up before being rectified by the detector. Then, if it is desired, the detector output can be impressed

upon several stages of audio-frequency amplification, so as to obtain maximum audibility.

Audio-Frequency Amplifying

The majority of amplifying equipments in use at present are of the audio-frequency type, so called because they have

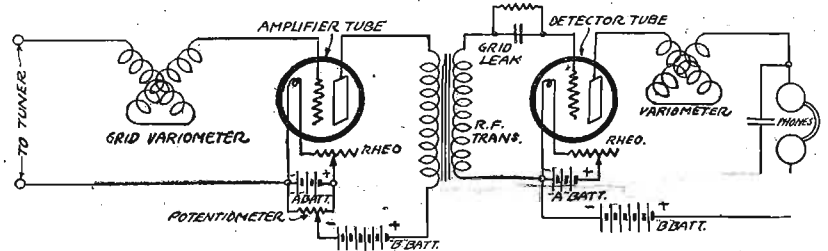


FIG. 5 ONE STEP RADIO FREQUENCY AMPLIFIER WITH REGENERATIVE "TUNED PLATE" HOOK UP.

ous combinations of resistances, reactances, condensers or transformers.

Figure 7 shows a method of coupling from a detector to an amplifier tube through resistances and a condenser. This resistance coupling gives the least audio-frequency amplification but preserves the best quality of reproduction.

Typical One Stage Amplifier

The typical connections for a detector tube and one stage audio-frequency trans-

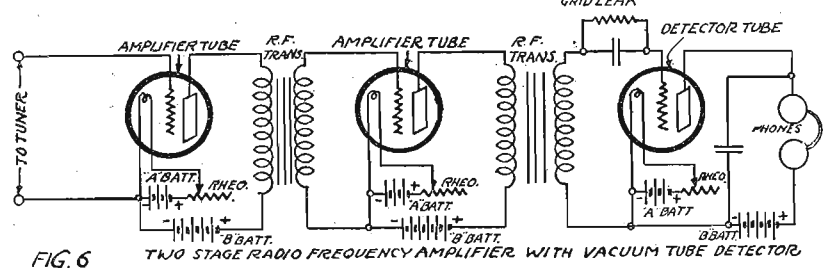


FIG. 6 TWO STAGE RADIO FREQUENCY AMPLIFIER WITH VACUUM TUBE DETECTOR

Radio Frequency Amplifiers

Amplifiers of the Radio frequency type are used in one, two or three stages. The simplest type of Radio-frequency amplifier is shown in the diagram in Figure 3. This diagram shows a method of coupling from an amplifier to a detector tube by means of resistances and a condenser. Instead of the usual amplifying transformers, the amplified energy is transferred from one circuit to the other by means of the resistance coupling. The resistance in the plate circuit should be at least equal to the internal plate resistance of the tube, while the resistance inserted in the grid circuit should be one megohm or more. Because of its simplicity, this circuit is to be preferred.

The circuit shown in Figure 3 may be changed from a resistance-coupling type to a reactance-coupling type, by replacing the plate and grid resistances by choke coils having impedances at audio-frequencies equal to the resistances replaced. Greater amplification is obtained by coupling with reactances than with resistances inasmuch as the necessary drop in potential across them is obtainable with much less energy loss.

If the grid leak and condenser is omitted for some of the vacuum tubes of a multi-stage amplifier, the incoming Radio-frequency waves are amplified before rectification. After being rectified

former-coupled amplification are given in Figure 8. The primary of the transformer is connected to the plate circuit of the detector tube while the secondary is connected to the grid of the amplifier tube. The range of frequencies of signals passing through the windings of the audio-frequency amplifying transformer is small compared with the frequency range of the signals flowing through the Radio-frequency amplifying transformers. Although Radio-frequency amplifying transformers must be designed for the particular frequency at which they are to be

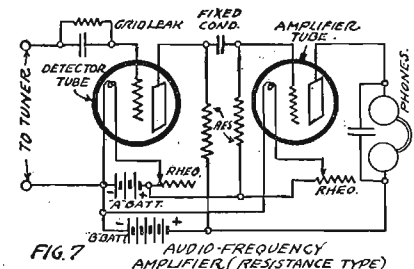


FIG. 7 AUDIO-FREQUENCY AMPLIFIER (RESISTANCE TYPE)

used, the regular audio-frequency amplifying may be used since it covers the whole range of audio-frequencies.

The action of the audio-frequency amplifier is quite simple. The incoming

(Continued on page 12)

How to Make a Pancake Variometer

Popular Tuning Device Made of Odds and Ends

Very few amateurs have undertaken the delicate and laborious task of making their own variometers, but here is a simple and efficient instrument that any fan can make in a very short time with a few odds and ends that are usually found around his workshop.

WORKSHOP KINKS? EARN A DOLLAR—

THERE are many little kinks worked out at home that would aid your fellow Radio worker if he only 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 securing 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.

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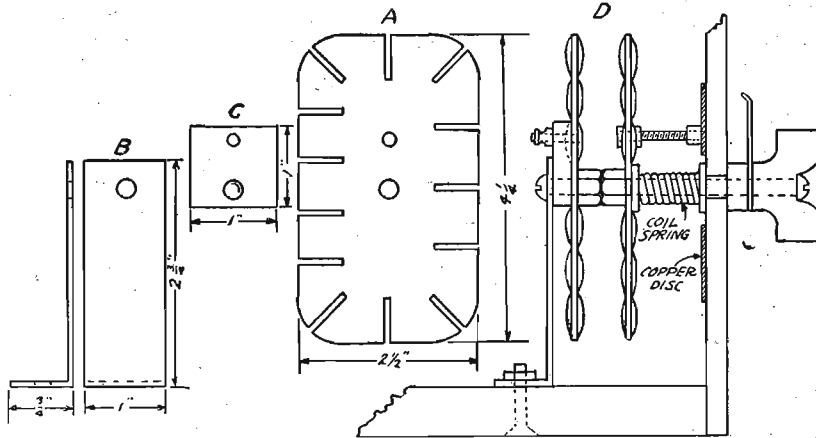
List of materials needed:

- 1 Switch lever and knob with pointer
- 1/4 lb. No. 22 D.C.C. wire
- 1 Strip of brass 1 x 3 1/2 inches.
- 1 Piece Copper sheet 3 x 3 inches
- 1 Strip of brass 1 x 3 1/2 inches
- 4 Small Flat Head Machine Screws and nuts with washers
- 1 Small Spiral Spring, 2 Washers
- 2 Hexagon Nuts to fit Machine Screws

Pancake Coils

Two winding forms of the size and shape shown at A are first cut from a piece of hard red cardboard about 1/8 inch thick and an uneven number of slots are cut in each, about 13 or 15 at most. They are next wound with 30 or more turns of No. 22 D.C.C. wire, care be taken that an equal amount is wound on each form. Punch holes in the exact centers suffi-

FLAT COILS SPIDERWEB WOUND



ciently large to take an ordinary binding post screw.

Coil Mountings

The brass strip B can be procured from any printing shop for a few cents. Bend it at one end to an angle slightly greater than 90 degrees so that when screwed to your base board, the coil contact will be pressed against a like contact on opposite coil and thereby connect the two in series without necessitating a pigtail connection. Holes are drilled at top about 1/8 inch from end and at bottom in center of bent part.

Cut a piece of formica to dimensions shown at C and drill holes 3/8 inch apart. This is to be used as a spacer between the brass strip and the coil.

The rotor coil is mounted on the switch lever screw with 2 washers and coil spring placed between panel and coil. After the outside nut is tightened so that the coil is tight on the screw, file the screw down to the nut so that it will present a smooth surface.

A copper disc should be cut from the copper sheet with as large a radius as

possible. The center of this disc should be cut out so as to allow it to be passed over the switch lever screw and coil springs and fastened to the panel with small screws. No part of it should touch the mounting upon which the rotor coil is fastened.

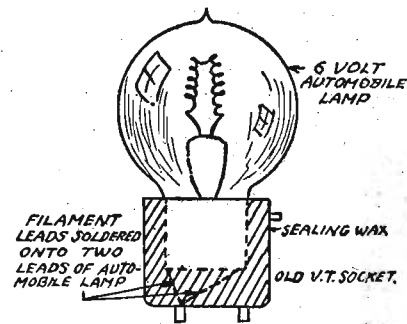
Assembling

The various parts may now be assembled as shown at D. An end of the wire on stationary coil is fastened to center screw and the other end is fastened to a binding post passed through the top hole on the formica spacer and coil. The rotor coil is connected in like manner to its corresponding screws. In connecting up the variometer to your set, the binding post on the stationary coil is used as one terminal and one of the screws securing the copper disc to the panel is used as the other. Be sure that the turns of each coil run in same direction.

This variometer can be converted into a variocoupler by slightly separating the coil contacts so that they will not touch and using variable condensers in addition for tuning in.—Harry C. Williams, Man-nington, Ky.

Automobile Lamp Saves Costly Vacuum Tubes

The accompanying illustration shows a small piece of apparatus in my laboratory I could not get along without. I use it for testing new circuits. It is convenient to use and it will save the one who uses it some hard earned money. When you have the new circuit all hooked up, just slip the tube out of its socket and put



this one in its place. If the lamp burns you will know the battery leads are correct, if the battery leads are crossed a burned out filament will be the result, but as it is only a six-volt automobile lamp it is considerable cheaper and easier to replace than a vacuum tube.—Gilman Snyder, Jackson, Cal.

A Light Touch on Galena

Did you ever notice that the lighter the contact spring is placed against your galena crystal the louder and better you receive the signals? To get the best out of your crystal detector obtain No. 36 gauge German silver or copper wire and construct the contact spring out of this material. German silver is the best because it will not oxidize and a bright clean surface can always be depended upon.—George Hanley, San Francisco, Cal.

TIERS

(Continued from page 11)

signal passes through the tuning elements of the receiver to the detector tube and then to the first amplifier tube, which functions as a valve controlled by the intensity of the incoming waves. The valv-

point the adjustment of the circuits becomes difficult for satisfactory work and additional stages tend to over-amplify noises developed in the tube itself. When it is desired to receive louder signals or to do long distance work, Radio-frequency amplification may be used, followed by a detector and two stages of audio-frequency

amplification. Figure 10 shows a hook-up of this character. In this hook-up separate batteries are shown to simplify the diagram, whereas in practice the "A" and "B" batteries are used for all tubes.

Amplification With Crystal Set
Amplification may be used with any re- ceiving set even of the simplest type. A crystal detector may be employed with a Radio-frequency amplifier. After the wave strength has been built up in the

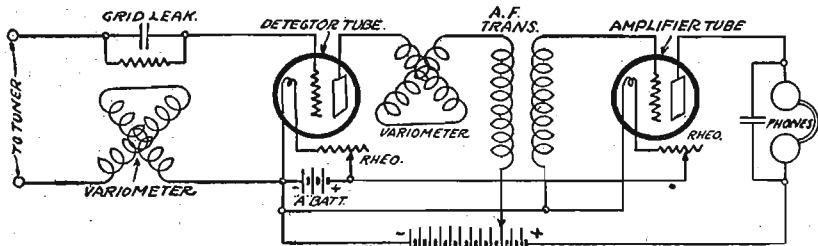


FIG. 8 ONE-STAGE AUDIO-FREQUENCY AMPLIFIER.

lar action of tube increases in proportion to the incoming energy and draws current from the plate battery which passes through the telephone receivers or loud-speaking device. Every change in antenna current causes an increased plate battery current variation, thereby giving a much louder signal.

Two Stages of Amplification

Where two stages of audio-frequency amplification are used, as shown in Figure 9, the energy from the first stage is used to control the valvular action of the second amplifier tube. Each stage of amplification increases the signal audibility about ten times. In connecting up such a circuit it is important that the various parts be so arranged that the wiring will be as short and as direct as possible. This is especially desirable where two or three stages of amplification are being used inasmuch as back coupling from the output to the input of the amplifier will cause it to "howl" or oscillate. Even a little back coupling will produce enough

regeneration to bring the vacuum tubes near the oscillating point.

It is impractical to use more than two or three stages of audio-frequency amplification for the reason that beyond that

amplifier tubes, it is rectified by the crystal detector. This rectified current can then be amplified by means of audio-frequency amplifiers. Signals may be brought in and amplified sufficiently to

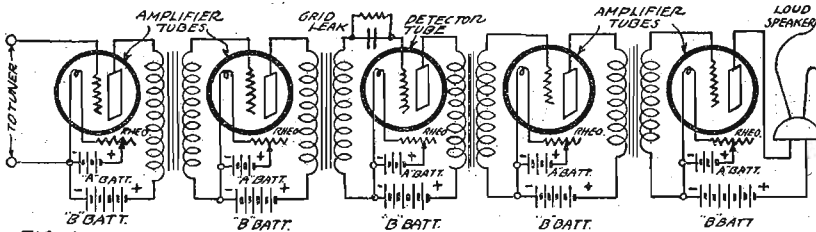


FIG. 10 HOOK-UP WITH RADIO-FREQUENCY AND AUDIO FREQUENCY AMPLIFICATION

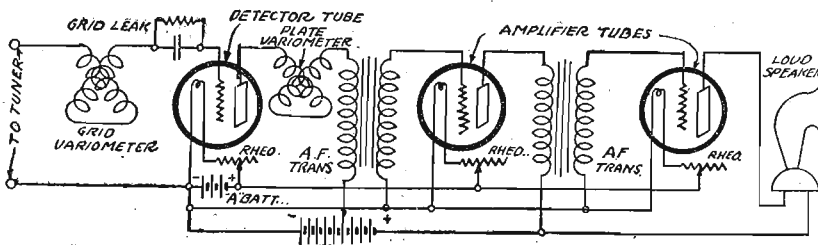


FIG. 9 TWO STAGE AUDIO-FREQUENCY AMPLIFIER.

regeneration to bring the vacuum tubes near the oscillating point.

It is impractical to use more than two or three stages of audio-frequency amplification for the reason that beyond that

amplification, 22 1/2-volt units of "B" battery may be connected in series and connections made in such a manner that full voltage may be used on the amplifier tubes, while a variable part of the same battery is used for the detector tube. Filament rheostats should be so regulated that a minimum value of current consistent with loud, clear signals flows through them. Increasing the currents through the vacuum tube filaments not only shortens the life of the tube but also hinders good signal reproduction.

Much of the present success of Radio broadcasting depends on the amplifying apparatus now in use. The amplifier has served to increase the range of all transmitters to a remarkable extent. The transmitter is not any the more powerful or efficient than it was formerly, but the receiver, because of the regenerative hook-up and the amplifier arrangement, can be made to respond to much more weakened waves.

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Simple Instructions for the Beginner

By Harry J. Marx

Radio Frequency Hook-Ups

Numerous question department letters have come in, asking whether steps of Radio frequency using a plug and jack system of control can be added to a receiving set in a manner similar to that utilized in audio frequency amplification. In addition, numerous questions have been asked about the new Myer's vacuum tubes which but recently have been introduced on the market.

In this article Mr. Marx furnishes two hook-ups, both of which use a jack system for controlling both the Radio and audio frequency amplification. In addition the second hook-up is designed for Myer's tubes, and coils, with a description of its operation and details of the parts required.—EDITOR.

SOME TIME ago the writer was in receipt of a letter requesting him to check over a hook-up diagram that had two steps of Radio frequency amplification, detector and two steps of audio frequency amplification, with a plug and jack system of control for both Radio and audio stages. Unfortunately there were considerable changes necessary to make the hook-up practical. There have been numerous inquiries, however, for a hook-up of this type, so after considerable changes it is presented as shown, using a regeneration with three honeycomb coils.

The second hook-up was designed for use with a variocoupler, variometers, and the new Myer's tubes and coils. Although only recently introduced on the market, they have been popularly received and the newly developed Radio and audio frequency choke coils, help make up some extremely interesting and simple circuits.

Honeycomb Coil Circuit

It will be noticed that the plug "P" in the circuit is connected to two binding posts marked "T" and "S." This is to indicate that the "T" binding post, which is grid side of the detector unit, should be connected to the "tip" of the plug—while the "S" binding post, which is the filament side, should be connected to the "sleeve" of the plug. If this is done the sleeve of the plug, when inserted in jack "A," makes a connection through the body of the jack to the negative side of the "A" battery. The tip of the plug makes a contact with the spring of the jack, connecting it to the one side of the secondary coil. In doing this the connection to the grid of the first Radio frequency amplifying tube is broken. Therefore, when the plug is inserted in jack "A" the two stages of Radio frequency amplification are disconnected.

One caution is suggested here. The cords from the binding post "T" and "S" to the plug "P" should be as short as possible, else the self-induction created in the wires will produce noisy and poor reception.

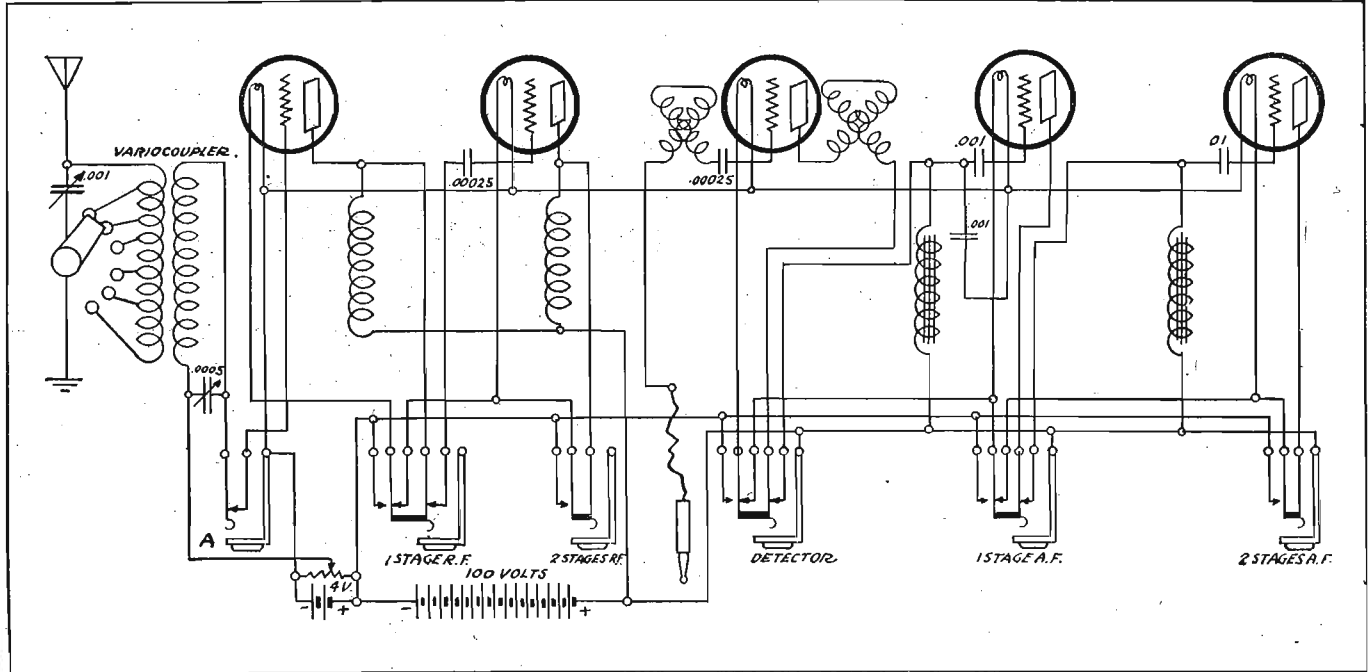
When the plug is inserted in jack "B," the grid leak and condenser is connected to the one side of the secondary coil of the first R.F. transformers while the filament negative of the detective filament is connected to the other side of the secondary. In addition the grid of the second vacuum tube is disconnected and the filament of the first amplifier tube is lighted.

When the plug is inserted in jack "C" the connections are made to the secondary

in jacks "D," "E," or "F." With these jacks the regular plug with connection to the head receivers or loud speaker is used.

standard type of tube and socket can be used for the detector stage. The Myer's Audion, (vacuum tube) oscillates uniformly from 2 to 300 volts on the plate and four volts in the filament circuit. It has no tube noises and consumes only 0.8 amperes. No rheostat is necessary—thus

the lead from the grid of the first tube. When the jack is inserted in the first R.F. stage, the grid of the detector tube is connected in the plate circuit of the first amplifier tube, at the same time lighting the filament. Likewise when the second stage of R.F. is used, both fila-



It will be found that this hook-up permits nine variations as follows:

- 1—Detector only.
- 2—Detector and one step R.F.
- 3—Detector and two steps R.F.
- 4—Detector and one step A.F.
- 5—Detector and two steps A.F.

eliminating the cost and saving the space of five filament rheostats. The tubes are rugged and small in size, measuring only 3 3/8 inches in length. The amplifying coils are wound to balance the internal resistance of the tubes, giving maximum amplification with minimum distortion.

ments are lighted and the detector grid is connected to the plate circuit of the second amplifier tube.

As in the case of the first hook-up another jack with the telephone receivers or a loud speaker is used for the detector and audio frequency stages.

The potentiometer as before gives accurate control of the grid potential. It will be noticed that this hookup has no more controls than the usual regenerative variocoupler and variometer circuit. The same combination of parts is possible as before.

The cost of the parts required for this set, including batteries, antenna, tubes, one pair receivers but no loud speaker, using only high class apparatus, will be about \$175.00 unassembled. This set however will give exceptionally good results for both local and long distance reception. If desired a loop aerial can be used. Use of loop aerial only requires taking out the variocoupler and primary condenser and substituting the loop in place of the secondary coil. This will improve the directional selectivity and will help in tuning out strong local stations. Of course with the loop aerial, it will be necessary to take advantage of both stages of Radio frequency amplification.

Since no rheostats are used, care must be taken to see that a 6-volt "A" battery is not substituted by mistake, in place of the 4-volt as the Myer's tubes are made for only 4 volts in the filament circuit. Voltmeter control would be advisable across the "A" battery. An ammeter in the filament circuit will give the current consumption.

PARTS REQUIRED FOR HONEYCOMB COIL CIRCUIT

- Antenna and ground connections
- Triple honeycomb coil mounting with necessary coils
- Two 43-plate (.001 Mfd.) variable condensers
- Four amplifying vacuum tubes
- One detector vacuum tube
- Five tube sockets
- Five filament rheostats
- Two Radio frequency transformers
- Two audio frequency choke coils
- Two 1 megohm grid leaks
- Two .01 Mfd. grid condensers
- One grid leak and condenser
- One 400-ohm potentiometer
- Two 6-volt "A" battery
- Two 45-volt "B" battery
- One 22 1/2-volt "B" battery
- Three filament-control jacks
- Two 3-spring jacks
- One 2-spring jack
- Two telephone plugs.

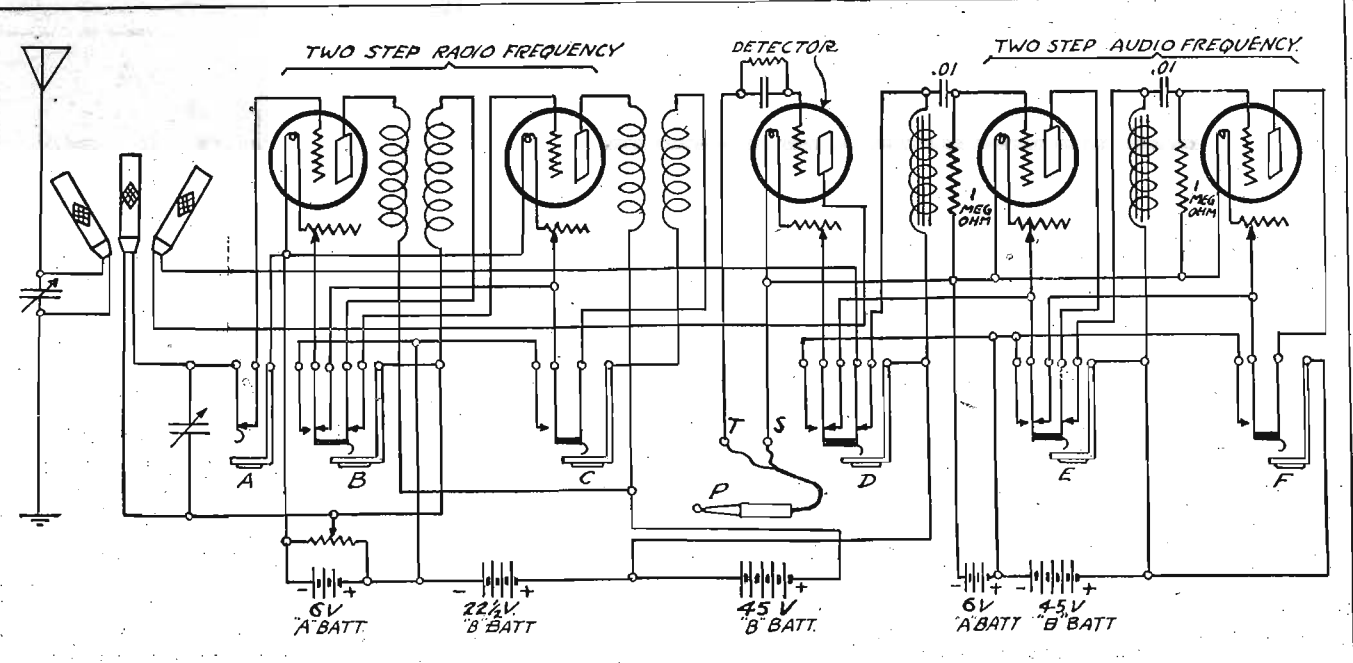
PARTS REQUIRED FOR VARIOCOUPLER AND VARIOMETERS CIRCUIT

- Antenna and ground connections
- One variocoupler with tapped switch and dial
- Two variometers with dials
- One 43-plate (.001 Mfd.) variable condenser
- One 23-plate (.0005 Mfd.) variable condenser
- Five vacuum tubes
- Two Radio frequency choke coils
- Two audio frequency choke coils
- Nine tube and coil bases
- Two .00025 Mfd. fixed condensers
- Two .001 Mfd. fixed condensers
- One .01 Mfd. fixed condenser
- One 400-ohm potentiometer
- One 4-volt 80-ampere "A" battery
- One 100-volt "B" battery or equivalent
- Three filament-control jacks
- Two three-spring jacks
- One two-spring jack
- Two telephone plugs

- 6—Detector and one step R.F. and one step A.F.
- 7—Detector and one step R.F. and two steps A.F.
- 8—Detector and two steps R.F. and one step A.F.
- 9—Detector and two steps R.F. and two steps A.F.

The same bases are used for tube and coils. When the tube base is mounted on the front of the panel, the coil base can be mounted in line on the back of the panel and the necessary wiring will be reduced to a minimum length required. This construction permits very compact construction, instead of the usual cumbersome cabinets.

The telephone plug used for connecting



of the second R.F. transformer and the filaments of both the first and second R.F. amplifier tubes are automatically lighted. The potentiometer is used to control the grid potential of the grids of both the first and second amplifier tubes. The plug "P" is not used for insertion

the regular connections with jacks as has been illustrated in previous issues.

Variocoupler and Variometer Circuit

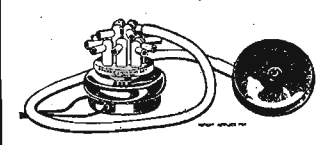
The Myer's tubes are not sold for use as detector, until November 7, 1922. After this date they can be used for both detector and amplifier. Until that date the

Radio frequency stages is only used through the "tip" connection—the "sleeve" side is left open. This plug then connects the grid lead of the detector tube from the one side of the variometer to the secondary of the variocoupler when in jack "A," at the same time disconnecting

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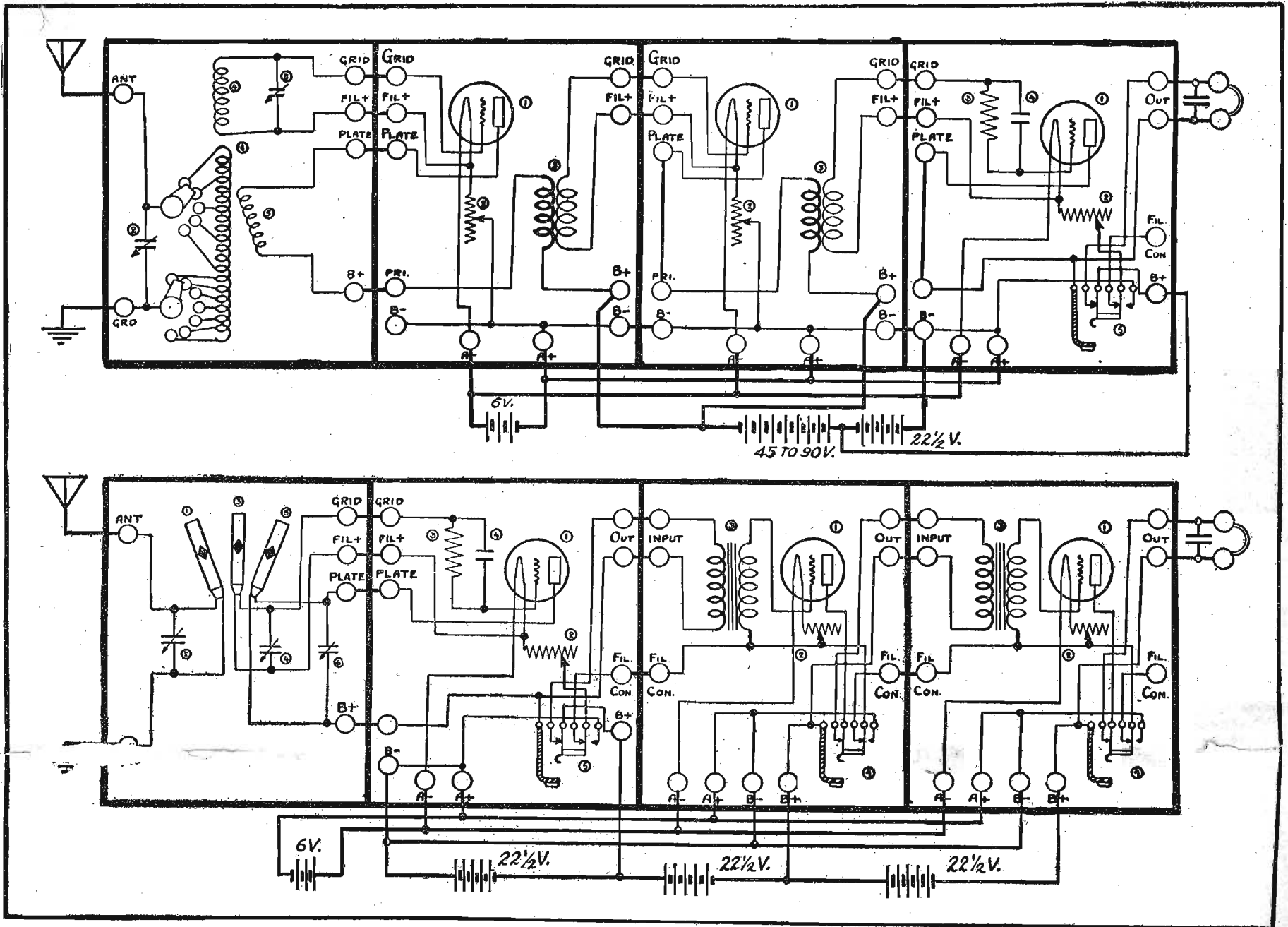
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Panel Units for Your Receiving Sets

By Harry J. Marx



Beginning with the July 18 issue, Volume I, No. 13, RADIO DIGEST has described a series of panel units for receiving sets. These have appeared each week on page 14. The advantages of the panel unit system may be seen from the two circuits shown above which utilize panel units described previously. The method of connection to one another and to external batteries is clearly marked.

The top diagram shows the fixed coupling tuning panel (described July 22) in circuit with two Radio frequency amplifier panels (described July 29) and one vacuum tube detector panel (described July 22). The four units when so assembled give two stages of Radio frequency amplification and one detector, a combination which, together with the short wave fixed coupling

panel, makes for fine long distance broadcast reception, or other low wave length work.

The bottom diagram illustrates the honeycomb coil tuning panel (described July 22) in circuit with the vacuum tube detector panel (described July 22) and two audio frequency amplifier panels (described July 29). Much versatility is obtained by this combination. The combination of honeycomb coils can be changed to give the tuning unit any wave length range desired. Not only can this be done but jacks are provided so that the honeycomb coil tuning panel and detector alone can be used, or one or two stages of audio frequency amplification can be added as desired.

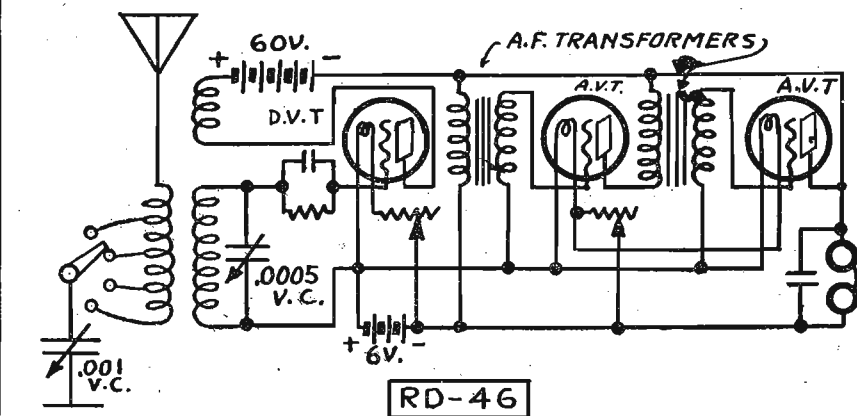
Both circuits described are of the feed-back or regenerative type.

RECEIVING RECORDS

(Continued from page 6)

- WDAP-165—E. B. Wagles, Geneseo, Ill.
- WDAS-1,035—W. G. Isemonger, Midlothian, Ill.
- WDAU-1,800—A. L. Lewis, Stanberry, Mo.
- WDAW-625—E. B. Wagle, Geneseo, Ill.
- WDT-1,150—R. Hastings, Atchinson, Kan.
- WDY-1,250—H. L. Peterson, Charles City, Ia.
- WEAC-510—M. Owen, Starsville, Ga.
- WEAD-915—M. Gazda, Chicago, Ill.
- WEAH-300—T. R. Gentry, Dallas, Tex.
- WEAO-2,500—Dobson & Tucker, Oakland, Cal.
- WEAR-160—H. Kunkel, Jr., Jersey City, N. J.
- WEAU-900—J. R. Hale, Houston, Tex.
- WEAZ-220—J. and B. Radio Co., Avoca, Ia.
- WEH-500—J. K. Stafford, Decatur, Ill.
- WEI-2,000—Wm. Hayes, E. Liverpool, O.
- WEV-320—E. S. Bee, Brookhaven, Miss.
- WEY-925—W. G. Mann, London, Ont., Canada.
- WFAA-600—J. and B. Radio Co., Avoca, Ia.
- WFAD-240—J. and B. Radio Co., Avoca, Ia.
- WFAT-150—J. Vaux, Swea City, Ia.
- WFI-300—L. Fletcher, Baldwinville, Mass.
- WFO-600—C. F. Lovely, South Amboy, N. J.
- WGAN-765—R. Latta, Clinton, Wis.
- WGAQ-935—C. D. Mason, Cleveland, O.
- WGAY-970—N. Theobald, Attleboro, Mass.
- WGF-1,000—E. K. Kitts, Bluefield, W. Va.
- WGH-660—H. S. Rahiser, Pittsburgh, Pa.
- WGI-1,000—H. Walrath, Cedar Rapids, Ia.
- WGL-1,250—T. E. Jones, Beggs, Okla.
- WGM-675—W. G. Mann, London, Ont., Canada.
- WGR-500—J. H. Schneider, Winneconne, Wis.
- WHA-915—A. Lacouture, Marlboro, Mass.
- WHAM-225—H. S. Rahiser, Pittsburgh, Pa.

HOOK-UP R.D.-46



This hook-up gives a slightly different form of detector and two stage audio-frequency circuit. The usual variocoupler is used with a tickler coil rotating in the primary tube at the opposite end from the secondary rotor. Accurate control of the secondary circuit is obtained though the .0005 variable condenser is shunted across the secondary coil of the vario-

coupler. One rheostat is provided for the detector tube. Both amplifier tubes are controlled by another rheostat. A 60-volt "B" battery is used on all three of the plate circuits. No potentiometer is required. Since a tickler coil is used the circuit of course is regenerative. Five controls in addition to the two rheostats permit very close tuning adjustments.

- WHAS-550—K. Peterson, Laona, Wis.
- WHB-900—E. K. Kitts, Bluefield, W. Va.
- WHD-750—R. Luther, Jefferson, Ia.
- WHK-465—D. R. Bartsch, Galena, Ill.
- WHQ-725—H. Walrath, Cedar Rapids, Ia.
- WGY-3,100—J. J. Beales, Jr., San Anselmo, Cal.
- WIK-260—F. F. Sims, Petersburg, Va.
- WIL-670—J. K. Stafford, Decatur, Ill.

- WJH-1,000—R. O. Wise, Villisca, Ia.
- WJK-275—H. L. Evans, Folsom, W. Va.
- WJX-1,000—H. L. Peterson, Charles City, Ia.
- WJZ-3,000—J. J. Beales, Jr., San Anselmo, Cal.
- WKC-900—R. Luther, Jefferson, Ia.
- WKN-930—A. F. Burns, Marcellus, N. Y.
- WKY-1,250—R. Zorger, Akron, O.

- WLB-1,500—C. H. Vale, Providence, R. I.
- WLK-830—N. Theobald, Attleboro, Mass.
- WLW-500—Wm. Holland, Brookline, Mass.
- WMH-730—A. Lacouture, Marlboro, Mass.
- WOC-475—D. Ploesser, Canton, O.
- WOE-460—E. B. Wagle, Geneseo, Ill.
- WOH-1,050—F. S. Cates, Jacksonville, Fla.
- WOI-500—A. E. Strong, Flagler, Colo.
- WOK-700—F. D. Weeks, Milwaukee, Wis.
- WOO-285—D. Ploesser, Canton, O.
- WOQ-1,100—G. W. Perkins, Thomson, N. Y.
- WOR-1,100—J. Hammond, Minneapolis, Minn.
- WOS-460—E. Dahlgren, Rice Lake, Wis.
- WOU-830—H. S. Rahiser, Pittsburgh, Pa.
- WOZ-340—D. R. Bartsch, Galena, Ill.
- WPA-465—R. P. Shelton, Memphis, Tenn.
- WPE-600—M. K. Kiracofe, Huntington, Ind.
- WPL-690—R. Luther, Jefferson, Ia.
- WPO-750—Wm. J. Lee, Jacksonville, Fla.
- WRK-600—R. O. Wise, Villisca, Ia.
- WRL-310—W. E. Thomas, Altoona, Pa.
- WRH-1,000—Lee Augustus, Ypsilanti, Mich.
- WRW-1,250—K. E. Gabbert, Clay Center, Kan.
- WSB-1,300—F. A. Rose, Two Harbors, Minn.
- WSX-250—A. E. Taylor, Coldwater, Mich.
- WSY-655—D. R. Bartsch, Galena, Ill.
- WWI-1,200—F. S. Cates, Jacksonville, Fla.
- WWJ-2,200—F. W. Hill, Cristobal, C. Z.
- WWL-507—Mrs. A. C. Wright, Kewanna, Ind.
- WWU-320—H. B. Plowman, Fairmont, W. Va.
- WWZ-315—H. S. Rahiser, Pittsburgh, Pa.
- 2XAT-950—L. W. Dow, Port Byron, Ill.
- 2XB-210—L. M. Hainer, Bolton Landing, N. Y.
- 2XI-350—H. S. Rahiser, Pittsburgh, Pa.
- 2XJ-1,900—C. G. Munns, Holsington, Kan.
- 3XW-780—F. J. Hinds, Berwyn, Ill.
- 4CD-880—E. Dahlgren, Rice Lake, Wis.
- 9YA-270—E. Dahlgren, Rice Lake, Wis.

Questions and Answers

Hook-Ups

(458) CJV

In the last DIGEST'S on hand, No. 4 and 5 from May 6 and 13th respectively, I missed an explanation or description of the hook-ups on the corresponding data sheets.

As a beginner in the extremely interesting Radio work, would feel much obliged if you could furnish the missing information and also if you would be so kind as to furnish them in future issues.

Upon close comparisons with other Radio publications I found the descriptions and diagrams from your own hand, together with those of Mr. Miessner, the most appealing ones to my wants and consider myself lucky to have met your publication.

A—If you will see Issues 9 and 10, June 10 and 17, also issue 12, July 1, you will have good information on these hook-ups. We try to cover as much ground as possible—but there is a limit to the space we have available, even if we do use the smallest type readable.

Simple Tube Set

(460) CHR

I have been a reader of RADIO DIGEST and have noticed the questions and answers. I am taking advantage of your question and answer department and am asking you to send me a hook-up in the self addressed envelope for the following:

1. Variocoupler, Variometer, Vacuum tube, socket, rheostat, potentiometer, "A" battery, "B" battery and phones.

2. Is it necessary to have two variometers and is the condenser necessary?

3. What kind of ground wire is best and what kind of lead-in wire should I use?

4. What distance can I get with this outfit?

A—1. See page 13, issue 12, July 1.
2. Not necessarily. Phone condenser will help.

3. Seven strands No. 22 bare copper is good. No. 4 copper wire (bare is O. K.) must be used for lightning ground.

4. About 50 to 100 miles.
R. F. and Tubes

(461) HB

I am about to build a Radio frequency amplifier and would like to know which of the three enclosed diagrams is the most efficient and which is the most practical for a three step Radio frequency amplifier. Which is the best for one step R. F. amplifier to cover from 175 to 1700 meters? Are A. P. amplifier tubes better for Radio frequency amplification than Radio-tron U. V. 201?

A—Not very good. See page 13, issue 12, July 1. Both types of tubes are satisfactory.

Winding Variometers

(432) RD

Would you please answer the following questions for me? I am building my own set. I am enclosing an addressed and stamped envelope for reply as I want to receive the answer by mail.

How many turns of wire should be put in the coils of the stators and rotor of the plate and grid variometers? What size wire should be used for each?

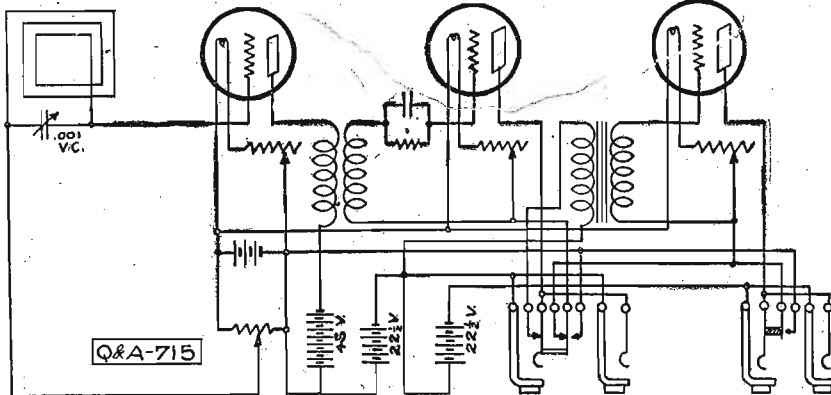
A—See RADIO DIGEST Nos. 9 and 10, June 10 and 17, page 13, for winding data. Use No. 24 gauge wire, about 30 turns in each.

Radio Frequency

(715) RHF

As a reader of your very interesting paper from the beginning, I am going to

denser across the terminals of so want a hook-up or diagram showing layout for one stage of Radio frequency amplification, vacuum tube detector.



avail myself of the privilege of asking for a wiring diagram or hook-up I am trying to construct.

I am using a loop of 6 turns of No. 19 wire on a frame 4 1/2 feet square for receiving, and have a 43-plate variable con-

denser across the terminals of so want a hook-up or diagram showing layout for one stage of Radio frequency amplification, vacuum tube detector. I want to use jacks and plugs so arranged that either one or two sets of head phones can be plugged in. My head phones are wound to 2,200 ohms resistance.

special to construct the best quality you soon by re. a stamped self-addressed envelope for the reply. This is to be used as a short wave set. I figure about 200 to 600 meter wave length range. I expect to use a Murad Radio frequency transformer and a Thordason audio frequency transformer.

A—Hook-up is shown (Q&A-715).

Super-Heterodyne Circuit

(423) FM

1. Will you please tell me a few of the good and also bad points of the Armstrong super-heterodyne receiving circuit?

2. Is it better for short waves than a regenerative?

3. Can honeycomb coils be used to change from short to long waves? Please give the hook-up with a short explanation of its working.

A—1. Sensitive and selective but somewhat difficult for the beginner to operate.

2. Yes, especially for long distance code reception.

3. See RADIO DIGEST issue No. 12, July 1.

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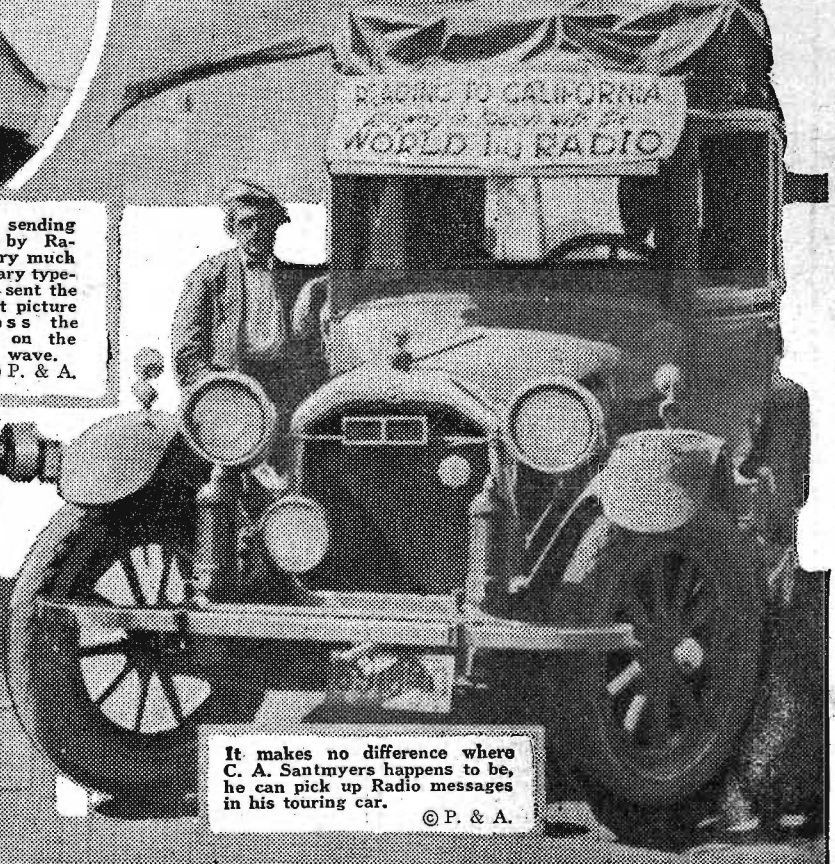
An especially assembled receiving set for milady's boudoir. Miss Anne Bronaugh listens in on the latest beauty talks while finishing her toilet for the street. © Fotograms



Machine for sending photographs by Radio. It is very much like the ordinary typewriter but it sent the first picture across the ocean on the ether wave. © P. & A.



Professor Korn of Italy at the sending apparatus for transmitting photographs by Radio. © P. & A.



It makes no difference where C. A. Santmyers happens to be, he can pick up Radio messages in his touring car. © P. & A.