

Radio Digest

EVERY
WEEK

Illustrated

TEN
CENTS

TRADE-MARK

Vol. III

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CHICAGO, ILL., SATURDAY, DECEMBER 23, 1922

No. 11

SUES FOR MONOPOLY

CONGRESS SPEECH ON AIR FIRST TIME

MICROPHONES PICK UP HARDING'S MESSAGE

Experiment's Success Insure Broad-
casting of Future
Capitol Events

WASHINGTON.—For the first time in history a speech made in the halls of congress was broadcast, when President Harding, on December 8, read his message. It is probable that hundreds of thousands of Americans were able to hear the President through an effort made by "Jim" Preston, the superintendent of the Senate Press Galleries.

The speech made in the assembly room of the House was broadcast by NOF, naval air station in Washington, and which has a day radius of 200 miles and a night radius of approximately 1,500 miles.

Through the efforts of Mr. Preston, the following papers picked up the message and re-broadcasted it: Pittsburgh Post, Detroit News, Chicago Daily News, Indianapolis News, St. Louis Post-Dispatch, Kansas City Star, Los Angeles Times. The American Telephone & Telegraph Company picked up the message in New York and re-broadcasted it, as did also the Westinghouse Company at Newark, N. J.

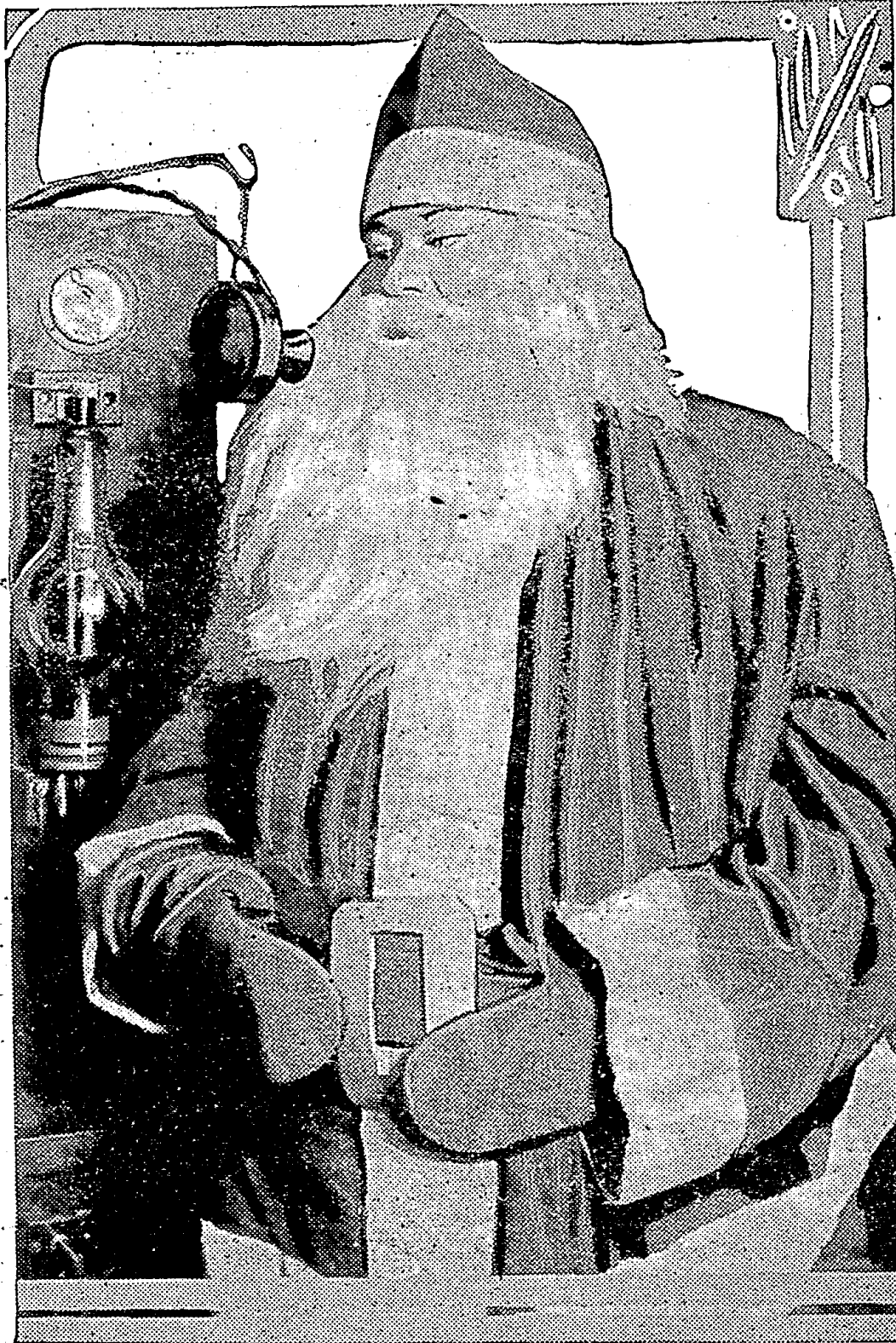
One of the interesting side-lights of the broadcasting work was the installation of a Radio receiving set in the White House for the benefit of Mrs. Harding, who listened to the President as though she were in her accustomed place in the house gallery.

The Success of this first experiment was so great that there is little doubt but what some kind of arrangement will be made for future broadcasting of important events at the Capitol.

Boy Scouts Build Set in Troop's Log Cabin

Columbus Youths Erect 160-foot Permanent Aerial

COLUMBUS, O.—A number of improvements have been made recently to the log cabin of Columbus Boy Scout Troop No. 26 near Flint, north of this city, but the one affording the members the greatest pleasure is the installation of a Radio receiving set. A 160-foot aerial has been erected and is to be left at the cabin permanently.



Santa Claus keeps right up-to-date with every new invention. The Radiophone broadcasting stations have helped him immensely in talking to the hundreds of thousands of children who could listen in to his various messages. This is a Radio Christmas, indeed © INT.

R. C. A. STARTS LEGAL FIGHT FOR CONTROL

Corporation in Court Action
Against Grebe and
Bunnell

Seeks Sole Tube Rights

Seventeen National Manufacturers
Hit Hard if Case Is Won
by R. C. A.

(Special to RADIO DIGEST)

NEW YORK—Monopolistic and imperialistic tendencies, according to rumors in Radio circles here, has manifested itself again among the Radio manufacturers in the suit just filed in the Southern District Court of New York by the Radio Corporation of America against A. H. Grebe and Company and the J. H. Bunnell Company, as joint defendants, alleging the infringement of five patents concerning the vacuum tube and its use in Radio apparatus. In this new court action the R. C. A., it is said, is attempting to extend its monopoly in a grab for the whole Radio industry.

If this new court action is successful the R. C. A. together with its subsidiaries will be in control of the many vacuum tube circuits. The action, according to reports, has not been unexpected by the legitimate manufacturers since the recent popularity of Radio and the growing market for apparatus became evident in the industry. The two manufacturers made defendants in the suit are well known and reputable and have been picked in a test case, it is said, because of their prominence.

The complaint, filed as two suits, alleges the infringement of five patents concerning the vacuum tube and its use in Radio apparatus.

Affects Whole Industry

Because of the extensive use of the vacuum tube, the suits against the Grebe and Bunnell companies jeopardize practically

(Continued on page 2)

First Radio Debate Held by Boston "U" on Bonus

BOSTON, MASS.—What was perhaps the first broadcast debate in the history of Radio was held Wednesday night, December 7, by Boston University students on the subject, "Resolved that President Harding was justified in vetoing the Bonus Bill." The debaters had it out in the salon of the Shepard broadcasting station, WNAC. A receiving set and two large amplifiers were installed in the large hall of the College of Secretarial Science, connected with Boston University, where the general public was admitted free of charge.

GRADS HEAR LEADERS OF OHIO "U" CAMPUS

Radio Carries Speeches In "State Day" Celebration

LONDON, O.—Ohio State University graduates, gathered in London and in all parts of the state, recently listened in on an address given by President William O. Thompson, of Ohio State, Coach Jack Wilce of the State football team and other campus leaders during the celebration of Ohio State Day on December 8.

RADIO BEARS NEWS OF BLAST KILLING 1

LIMA, O.—William Cramer, 53, of Columbus Grove, near here, died in a local hospital this week from pneumonia, contracted following burns sustained when a gasoline torch exploded in the hands of his son, Joseph, aged 31, who was terribly burned. Repairs were being made to a Radio outfit at the time of the accident.

NEW 750-MILE SET IN HOME FOR INSANE

WASHINGTON.—A new Radio receiving set has been installed recently at the government hospital for the insane at Anacostia, D. C., by the Department of the Interior. The set has a receiving range of about 750 miles and enables the inmates to receive concerts every evening from many different stations.

SUES FOR MONOPOLY

(Continued from Page 1)

the entire Radio industry. Included in this sphere are many hundred larger or smaller manufacturers who may be forced to stop the wheels in their factories! No more would independent companies be allowed the free right to manufacture vacuum tube Radio equipment. The complete monopoly of the R. C. of A., if adjudicated, could easily stop all this. There need be no competition!

Licenses of the Armstrong regenerative circuit patent, of which there are seventeen, are not exempted by the suits. Regardless of their purchased rights, they could make no Armstrong regenerative sets, unless the R. C. of A. generously saw fit to allow this to happen.

De Forest patents 841,387 and 879,532 are involved by the first of the two suits instituted. The former protects the audion or triode tube as a so-called audion amplifier, and the latter is protection of the grid structure of the triode tube. The first suit is undoubtedly the most important because of the leeway for monopoly which would be afforded the R. C. of A., should it win.

Bait Trap in Former Case?

When the same two patents were litigated before their validity was not carried to the highest court. It is said that the reason for this was that in the former case, the Marconi Company of America, predecessor of the Radio Corporation, wished to open the way for manufacturing and popularizing Radio apparatus. The R. C. of A., according to Charles Gilbert, president of the De Forest Radio Telephone and Telegraph Company, does not hold the two patents upon which the suit is built, but is merely licensed for their use.

The history of the troublesome patents is as picturesque as the method in which it is rumored the R. C. of A. is attempting to monopolize them. Dr. Lee De Forest licensed the American Telephone and Telegraph Company for the use of the patents, with the understanding that the A. T. and T. Company would not directly cross license the Marconi Company of America. The latter company at that time held the Fleming two-electrode valve patent which deadlocked De Forest from the use of the product of his own brain. It must be remembered that the R. C. of A. is the offspring of the old, late Marconi Company.

It is understood that, living within the terms of the contract, the A. T. and T. Company cross licensed another large electrical organization which, in conjunction with the Fleming patent rights inherited by the R. C. of A., was enabled to manufacture triode tubes with perfect propriety, as far as legal rights are concerned.

The death by expiration of the Fleming patent a little over a month ago has now enabled Dr. Lee De Forest to make and sell his own invention, a right hitherto denied by the patent monopoly framed about him.

The complaint filed by the R. C. of A. does not disclose this interesting bit of history.

Armstrong Licensees Band Together

The seventeen holders of Armstrong regenerative circuit licenses have banded together and formed a fighting corporation, it is said, for the purpose of supporting the Grebe company in defense of the R. C. of A. monopoly suits. Should the suits prove successful for the R. C. of A., the seventeen licensees will not be able to manufacture regenerative sets under their licenses, which, at the time the Westinghouse Electric and Manufacturing Company bought the Armstrong patents, were then considered bona fide. In fact the latter company bought the regenerative patents subject to the licenses and contracts outstanding.

All of the seventeen Armstrong licensees are reputed to be reliable, business-like concerns with no thought of deliberate infringement in their organization. This group is represented by the firm of attorneys, Pennie, Davis, Marvin and Edmonds, with William H. Davis and Willis H. Taylor, Jr., of this firm as counsel.

The R. C. of A. has retained the firm of Sheffield and Betts, with L. F. H. Betts as counsel.

Second Suit Less Important

Three patents are involved by the second suit against the same defendants as in the first suit. The three patents alleged to be infringed are Langmuir patent 1,282,439, relating to the use of a grid condenser and leak in shunt; Lowenstein patent 1,231,764, regarding the use of a negative grid bias, and Mathes patent 1,426,754, involving the use of a resistance for placing a bias upon the grid of a triode tube.

Many other concerns have also been sued incidentally by the R. C. of A. These together with the alleged infringements are: John Firth & Co., De Forest and Langmuir patents; Radio Stores Corp., Langmuir patent; Sleeper Radio Co., Langmuir patent.

According to reports, it is said that the R. C. of A. will not stop here but plans suits along similar lines against every possible manufacturer. Even though such manufacturers do not supply the vacuum tubes for the apparatus they make, a victory for the R. C. of A. will mean that they cannot legally manufacture.

On this account it is thought that all other Radio manufacturers may band together to defend any action brought against them so as not to allow the killing of private enterprise in the new industry.

Effect on Public

Every Radiophan should be deeply concerned in the complaint filed, inasmuch as the future manufacturer to profit and be supported by the fan's money will be the paramount question to be decided. Victory by the R. C. of A. will mean, it is rumored, an entire and complete monopoly, and the resultant scale of prices usually paid for monopolized goods. Barometric observation of opinions from typical fans seems to indicate to which side their support and sympathies are tendered. From the start the fight is one of a large corporation against a group of smaller organizations.

The effect on the future of Radio broadcasting is also to be considered. A tie-up of patents at this time may be very harmful to the popular diversion of listening in. Monopolization of broadcasting stations is one goal being eyed by one of several large electrical concerns. Success of the great corporations in their monopoly efforts are believed by many to be merely for control of the indirect advertising and direct publicity available, as well as the profits which will, it is believed, be accrued in the future by broadcasting stations.

Seminary Entertains on WNAC

BOSTON, MASS.—An entire evening's entertainment to Radiophans was given recently by the glee and mandolin clubs of Lasell Seminary of Auburndale, Mass., from WNAC, Shepard Stores station. There were about forty girls who participated in the program, which included Christmas carols, other holiday songs and many popular selections. This is the first time in the history of this seminary, which for fifty years has been one of the most exclusive finishing schools in the east, that it has ever given a Radio concert, and one of the few occasions on which the musical organizations have been permitted to give a concert outside of the seminary domains.

Chicago May Pass Radio License Law

Would Impose \$3 Fee for Inspection of Receiving Outfit; \$5 for Transmitter

CHICAGO.—The city council has under consideration a proposed Radio ordinance, and a study of the contemplated regulations is being made now by a subcommittee of the council committee on gas, oil and electric light.

The proposed measure stipulates an inspection fee of \$3 for antenna of receiving outfits and a fee of \$5 for the antenna of transmitting apparatus. Specifications as to the kind of equipment and methods of installation are outlined, chiefly for the guidance of the inspectors.

The ordinance has stirred up Radio interests, some of which are opposed to any legislation, declaring that such regulatory measures would stifle the infant industry. Others of the Radiophan public approve the inspection of antennae, but object to the size of the fee on the ground that an inspection of apparatus can be made in a very few minutes, and that a fee of 50 cents would be sufficient.

To Stop Fire Hazard?

The fact that the ordinance does not contemplate inspection of indoor antenna is said to indicate that the measure is not an effort to tax the people on the use of the air. As explained by George E. Carlson, commissioner of gas and electricity, the regulations are for the sole purpose of guarding against fire hazards.

The precautions necessary to guard against fire hazards, in the opinion of Radio authorities, should be taken by every person using an out-of-door antenna. One common-sense precaution is for the fans to make certain that their antenna wires do not cross power or telephone wires, or that the breaking of either the power wire or a wire of the antenna will not throw the wires across each other.

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Looking Ahead

Reflex Receiving Hook-Ups. You've heard a lot about amplifying at Radio frequency, detecting on a crystal detector, and then amplifying at audio frequency, all one tube? The Radiophan tide is going in that direction now, so Harry J. Marx, next issue will tell a lot about reflex circuits and how to set them up.

Lone Star State Has One Famous Station in WBAP which will be pictured and described in the next number of the Digest. Get the December 30th issue of the paper and learn more of this far reaching Texan plant.

Radio Frequency Amplification, Part II, by Laurence C. F. Horle will appear in the December 30th issue. Mr. Horle KNOWS Radio frequency amplification, and in the second part of his interesting article, will tell his experimental results in testing the efficiencies of various makes of R. F. Transformers, and many helpful kinks in the use of this great aid in bringing in distant stations.

Reinartz Circuit in Photo Diagram, is one of the features soon to appear. So many fans have found this "old-timer's" circuit of value that the popular Digest method of showing such a set will be used in the near future.

Broadcasting Station Directory. No explanation needed. An original service instituted by the Digest which is the only reliable means of finding the who, where, when of every plant in the U. S., Canada, Hawaii, Porto Rico, and Cuba. The "Station-City" index appears in full next week. Get your copy early.

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These safety measures are advocated for fans living outside of the city limits, and especially for those who will be affected by whatever ordinance is passed.

England Hears Ohio Set

COLUMBUS, O.—Robert Higgy, one of the best Radio operators of this city, has just learned that his signals recently were picked up in Honolulu, H. I., Manchester and London, England. He also was heard at a point 20 miles south of the Alaskan border.

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NEW WAVE LENGTH STANDARDIZATION

NOTE FREQUENCY WITH THAT OF TUNING FORK

Standards Bureau's Method Includes Use of Cathode-Ray Tube as Basis for Test

WASHINGTON.—The Bureau of Standards has developed a very precise method of standardization of Radio wave lengths and frequencies, the fundamental basis of Radio measurements in this country. By the process used, the frequency of Radio waves is compared with that of an audible musical note.

A tuning fork is mounted in such a way that it may be made to control the frequency of an oscillatory circuit. The frequency of another oscillatory circuit operating at much higher frequencies is then compared with it by means of a cathode-ray oscillograph.

This latter instrument consists of the cathode-ray tube, a special kind of vacuum tube in which the narrow stream of electrons is subjected to the action of electric fields applied by the two alternating-current generators. When neither generator is operating, the electrons, impinging on the active screen at the end of the tube, cause a single luminous spot. If one generator is connected, the spot is deflected back and forth along a single line, horizontal or vertical as the case may be, with such rapidity that it appears as a solid line.

Spot Oscillates, Forms Rectangle.

If both generators are applied simultaneously, the spot oscillates both horizontally and vertically and appears, in general, as a blurred luminous rectangle. If, however, the frequencies of the two generators bear a simple ratio, such as four to one, the spot traverses and retraverses a definite simple path, forming a figure by which the frequency ratio may be recognized. It has been found possible to compare frequency ratios as high as twenty-one to one.

The Bureau is at present engaged in the standardization of a high precision standard wavemeter by this means. A tuning fork of known frequency, approximately 1,000 cycles per second, is used as the basis of the standardization. A low-frequency generator is tuned to successive multiples of this frequency by means of the cathode-ray oscillograph and corresponding settings of the wavemeter are obtained. A third generator is similarly tuned to multiples of these frequencies and thus by successive stages the standardization is extended to include frequencies as high as 5,000 kilocycles (60 meters). It is intended that this wavemeter be used at the bureau as the basis for the standardization of commercial wavemeters.

Extend Use of Phones in German Shipping

Code and Speech Weather Reports Sent Vessels

WASHINGTON.—An extension of the use of Radiophone broadcasting to the coastwise shipping service, which has been under consideration in Germany for some time, has been applied to German shipping through the station at Norddeich about 75 miles north of Bremen. The station is equipped with both Radio telegraph and telephone transmitters. Two weather reports are broadcast daily on a 600-meter wave length.

Each report is broadcast first by Radio telegraph and at the conclusion of the transmission the attention of navigators is called to the fact that the report is repeated immediately by Radiophone. The idea is that in the case of small vessels, such as steam trawlers, the delivery of the spoken notices will obviate the necessity for a code operator.

ENGLAND GETS MOST OF OCTOBER EXPORTS

WASHINGTON.—Domestic exports of Radio apparatus during the month of October totaled \$207,535 and weighed 114,309 pounds, according to the Department of Commerce. The value of these Radio shipments was as follows: England, \$70,391; Quebec and Ontario, \$35,728; Argentine, \$32,092; Brazil, \$27,072, and Japan, \$11,299, the balance going to 20 other countries.

HANGED INVENTOR IS "SUICIDE BY RADIO"

NEW YORK.—The death of Alfred Iverson, 45-year-old inventor, recently went into the coroner's records as "suicide by Radio." Discouraged because he was unable to finance his Radio inventions, Iverson hanged himself on an indoor aerial. Iverson had been listening in the WJZ, at Newark, and the appliances he had devised are claimed to have given excellent results.

RADIO JOINS RANK OF FIRE FIGHTERS

FOREST PLANTS TO SAVE TIMBER FROM FLAMES

C. M. Allen, Forestry Telephone Engineer, Predicts Extensive Usage in Future—Test Station Used

ROSEBURY, ORE.—That Radio is to play an important part in the prevention of fire in the national forests of the country is the belief of C. M. Allen, telephone engineer for the United States forestry service. There is a close relation between static and humidity, Radio engineers believe, and Mr. Allen says that if this relation can be determined so that it will become possible to determine the atmospheric conditions and predict these conditions in advance, many thousands of dollars will be saved annually in the prevention of disastrous forest fires.

Use Test Station

A station which is conducting experiments along this line has already been installed at the Wind River experiment station, Mr. Allen states. This station is located near the Cascade locks on the Columbia river and is one of the most complete and sensitive receiving sets in the country. It was built and installed by some of the leading Radio engineers of the Pacific coast and in tests has proven extremely sensitive.

By the use of this station the forest service will endeavor to determine the relation between static, lightning and humidity. Special instruments, operating throughout the full 24 hours, will detect the intensity of the static of the "grinder" type, and it is believed that by checking this with the humidity reports from the various sections of the country a direct relationship can be worked out.

Detects Distant Lightning Strength

The apparatus is so delicate that the intensity and direction of a lightning flash 1,000 miles away can be determined. These instruments will show whether a storm is approaching or moving away, will give the storm's approximate location, and the forest service will be able to spread advance warning to the localities threatened. Later, Mr. Allen expects, this will be worked in connection with a transmission system, which will spread the warning to all sections which may be affected by the storm. By this advance information the supervisors may be in a position to offset the fires as they start.

Will Warn of Fire Danger

Another important usage will be to detect and ascertain humidity conditions. As the relative humidity becomes lower the moisture in the forests is taken into the air and the forests become exceedingly dry and a fire will flash and run in an unexpected manner. Advance information as to humidity conditions would enable the supervisors and officials concerned in fire prevention to be prepared for trouble and by this means great sums of money would be saved.

The use of Radio in connection with the national forest work is just beginning, Mr. Allen says. It is impossible to tell what the future will bring forth, but in light of the development of the past no one can tell what the airphone will do for the fire fighters.

HIGH COURT MAY GET AMATEUR RIGHTS SUIT

Relay League Ready to Carry Case Before Supreme Bench

HARTFORD, CONN.—According to Kenneth B. Warner, secretary of the American Radio Relay League, his organization is prepared to carry a test case involving the rights of amateur transmitting stations to the Supreme Court of the United States. This statement was made by Mr. Warner on his return from Dwight, Ill., where an action involving the principle has been started.

MA'S SEWING MACHINE IN USE



Miss Mabel Goodman, girl Radiophan of New York City, has found a new use for mother's sewing machine, as this picture testifies. Miss Goodman built the receiving set and cage-type aerial herself and erected it. Results, she declares, are very satisfactory © K. & H.

CHRIS MATHEWSON TALKS

Broadcasts on Health After Battle with Tuberculosis

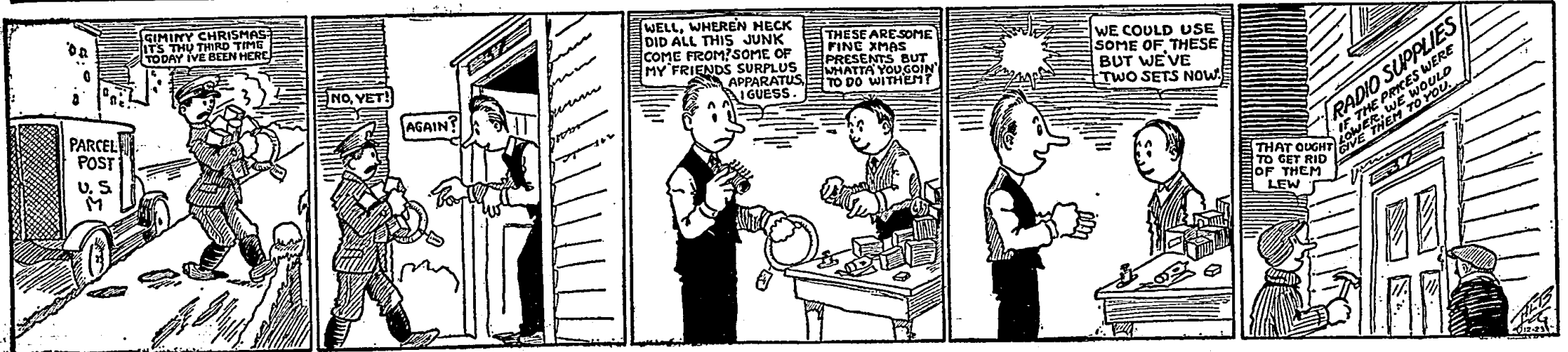
NEWARK, N. J.—Christy (Big Six) Mathewson, who ranks today as the greatest of all ball players, broadcasted "Your Health and Its Care" from Station WOR, L. Bamberger & Company, here recently. He has just returned from Saranac, New

York, where he fought the greatest battle of his life against tuberculosis, but now feels that his battle is so nearly won that he is physically able to carry the battle into new regions in order to help others who are suffering from this disease. "Big Six" is more concerned right now in the question of preservation of health than the average person, for having tasted of the bitterness of his pulmonary illness, he shows by his general attitude the great happiness which comes with the return of his health.

THE ANTENNA BROTHERS

Spir L. and Lew P.

A Tip for December 26th



"1,000,000 SUPER SETS IN 5 YEARS"

RADIO ENGINEER MAKES PREDICTION

O. C. Roose Sees Need for Universal Code Language as Science Advances

BOSTON, MASS.—O. C. Roose, fellow of the I. R. E., predicts that within five years there will be at least 1,000,000 Radio receiving sets in the United States of sufficient sensitiveness to receive code or speech from Europe, Latin-America, or the Orient. The wave lengths used will be about the same as have recently been tried successfully between Java and Holland.

He and other authorities predict that the one to 50-kilowatt stations will be able to span thousands instead of hundreds of miles, because super-regeneration in cascade will by then make practically all receiving distances equal. Then the only question the amateur transmitter will have to face will be signals over high mountains or plateaus at short or medium meter wave lengths.

Then will come, he says, the need for a universal code language, understandable by all nations alike. This new code language will have to be modern, simple, flexible and have a central "academy" to decide all questions as the coining of new words, spelling, etc. Already Esperanto exists, and for which there is being conducted an active propaganda. It is sometimes used, mainly in an experimental way by Radiophans. Then there is "Ido," an improved Esperanto, and "Idiom Neutral." The latter is said to have several good points, but not many adherents.

Latin has been reported by the scientists as too difficult for an international auxiliary language. Both Ido and Esperanto are suitable, but need careful trial.

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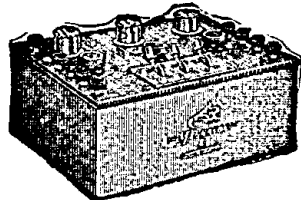
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RECEIVING RECORDS? SEND 'EM IN—

DURING the past week seventeen new records were established in the Receiving Records Contest. Owing to the length of the rules, they are not repeated at this time, but may be found by referring to page 4 of last week's issue. The new records are:

- CFAC—1275, A. W. Smallfield, Kansas City, Mo.
- CFCN—1275, A. W. Smallfield, Kansas City, Mo.
- KDYS—1650, W. S. Rembert, New Orleans, La.
- KFAY—1550, C. N. Schwab, Grinnell, Ia.
- KFDB—1500, A. W. Smallfield, Kansas City, Mo.
- KFI—1475, C. N. Schwab, Grinnell, Ia.
- KGG—1500, C. N. Schwab, Grinnell, Ia.
- WDAO—1500, M. J. Columbe, Plattsburg, N. Y.
- WEAF—1125, W. Loomis, Jr., Blencoe, Ia.
- WHAB—1550, G. W. Perkins, Thomson, N. Y.
- WHAZ—1125, W. Loomis, Jr., Blencoe, Ia.
- WIP—1000, R. V. Hammer, Creston, Ia.
- WKAQ—2400, R. V. Hammer, Creston, Ia.
- WLAD—1275, M. J. Columbe, Plattsburg, N. Y.
- WNAC—1200, R. V. Hammer, Creston, Ia.
- WNAT—1000, R. V. Hammer, Creston, Ia.
- WWL—1275, G. W. Perkins, Thomson, N. Y.

SANTY GETS TOT'S LETTER BY RADIO

Kiddies Use Up-to-Date Method of "Putting Old St. Nick Wise"

MEDFORD HILLSIDE, MASS.—Santa Claus is an up-to-date "old gent" and the Radio is one of his latest methods of getting news from the kiddies and their ideas on what they would like to have him bring them in his big pack and sleigh to them. Station WGI has been appointed by long distances and at such a fast pace with his swift reindeer, team, he has found it necessary to get new methods of learning the desires of his little friends. So the Station WGI is receiving their requests by mail from all over New England.

Three times a week letters received by WGI are broadcast to Santa Claus, who picks them up wherever he is at that time. The letters are broadcast Sunday afternoons at 5:20; Wednesday evening at 6:45 and Friday evening at 6 o'clock, Eastern time. While Santa cannot acknowledge each letter personally, aside from the gifts he brings, he is acknowledging them through the Radio by a special signal.

A blind 10-year-old girl is taking part in Station KPH's concerts. She is proficient on the saxophone, piano and violin.

Spirola REAL CABINET LOUD SPEAKER

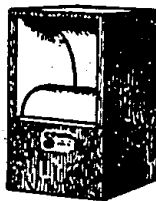
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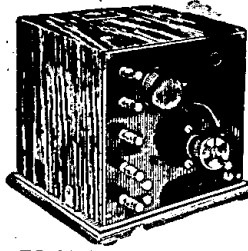
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SEEING men in haste, do not seek to overtake them" wrote Kang Hsi. The wise Radioist deliberates—then buys a Grebe Receiver. A. H. GREBE & CO., Inc. Richmond Hill, N. Y. Doctor Hu. Illustration of a man with a beard and a hat, looking thoughtful, with a Grebe Receiver logo in the background.

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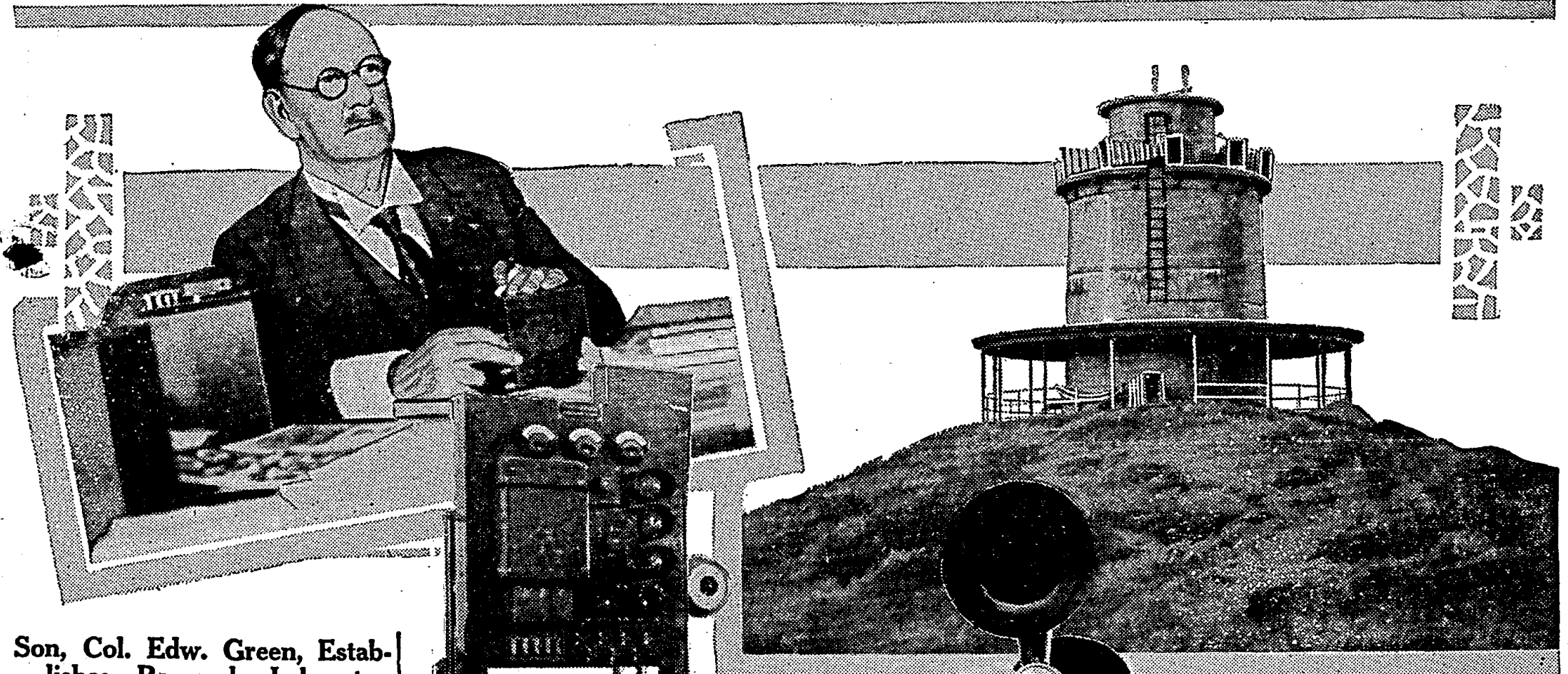
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HETTY GREEN MILLIONS TO RADIO



Son, Col. Edw. Green, Establishes Research Lab at Buzzards Bay Estate

Is Philanthropic Venture

Idea to Help Needy Inventors—Annual Prizes to Be Awarded for Best Ideas

By F. N. Hollingsworth

When Mrs. Hetty Green, the richest woman in the world of her time, died some years ago and left a fortune of \$100,000,000, half of which went to her only son, Col. Edward H. R. Green, she little dreamed of the purpose to which this great fortune would ultimately be put. If she were alive today she would be amazed, for in her heyday, the Radiophone was little thought of, and even Radio telegraphy was in its infancy.

Col. Green was a successful railroad and business man when he inherited this vast fortune, and had accumulated a good sized competency of his own. So he is eminently practical, but withal a streak of romance and boyishness and much of the enthusiasm of youth still with him, although today he is so crippled that he cannot get around actively like most of the young men he is trying to help.

Col. Green a Radiophan

Col. Green is a Radiophan, one of the most enthusiastic of the many thousands who dot the continent with their little receiving sets and transmitting stations. On his big estate of 253 acres here, known as "Round Hills," about eight miles out from New Bedford and right on the shore of Buzzards Bay, he has a big home that he now uses throughout the year, and which he has converted into the largest amateur Radio laboratory, receiving and transmitting plant in the world. Here he has one powerful broadcasting station and is building another; a loud speaker tower which sends music for miles over the country and out to sea; and one of the finest Radio laboratories to be found anywhere, with a large paid staff of engineers and Radio workers and trained mechanics. Here he keeps open house for the amateur Radiophan and others interested in such experiments, welcoming them and offering them free use of the great facilities offered by the plant and the great quantities of apparatus to be found here.

Not for Profit; to Aid Inventors.

A big crew of workmen under the direction of skilled Radio engineers is busy erecting on the Round Hills estate a new set of broadcasting, receiving and experimental stations that will be the most extensive amateur experimental plant in the world. And none of it is for personal profit. Whatever discoveries that may be made here will be given over to the discoverers, if they choose to benefit; otherwise to the great and fast growing Radio public. With one man at least, the inventor is likely to get a square deal.

Col. Green believes that the future advancement of Radio lies much in the hands of the enthusiastic amateur who will spend days and nights working over some little problem, testing and experimenting for the sheer love of the thing, without thought of ultimate profit. Some of these amateurs may have brilliant ideas but, through lack of means, may be unable to

The upper left photo shows Col. Edw. H. R. Green doing Radio experimental work in his study at Round Hills, Buzzards Bay. At the right is shown the immense loud speaker tower atop a high hill. The amplified sounds from the four large horns have been heard four and one-half miles distant. Down below is pictured a corner in the private laboratory of Col. Green. The call of the 100-watt transmitter is WMAF. The speech amplifier is the high panel on the left.

carry out these. He intends to aid such enthusiasts by putting their theories into effect, no matter what the cost.

Free School for Amateurs.

Everything is expected to be in readiness by next June, by which time the schools and colleges will be closed and those students who are interested in Radio can give their summer vacations to experiment. He will establish a free school for amateurs, at which a picked staff of instructors and experts will give lectures and teach the advanced part of the science. Other professors will be given a chance to test out for themselves without cost any theories or ideas they have developed. All the while expert experimental work will be going on, and any Radiophan will have an opportunity to witness or participate in a part, at least, of these experiments and tests.

Annual Prize of \$5,000 for Idea.

As a part of his plan, Col. Green will offer a prize of \$5,000 in cash and will put up a gold cup, both to be awarded to the amateur who is judged as having furnished the idea that has advanced Radio the farthest during the preceding year. To the amateur with the second best idea will go \$2,000 in cash and a silver cup. The cash prize will be given outright, but the cups must each be won twice to become the winner's final property.

A second plan will be to send out a call to amateurs offering the free use of the tremendously efficient and powerful plant in the furtherance of amateur work and for amateur experimental purposes. Thus an amateur may bring his set to Col. Green and try it out at any one of the powerful stations that are being constructed.

To Aid Professors Without Funds.

The third plan is for the college professor, who, handicapped perhaps by a meager salary, though brilliant and prolific in ideas, is unable to carry on any experimental work outside of his classroom. In the spring Col. Green will send out a call to professors to visit Round Hills if they desire. Those who, after having been given a hearing, are found to have feasible ideas, will be placed on Col. Green's payroll and maintained on the place during the summer or for as long a time as they need to conduct their experiments.

They may either build their own sets from material furnished by Col. Green, or have the sets built by his engineers under their own direction and according to their

own specifications. They may then hook-up their sets on some one of the powerful antennae at the plant and "go to it."

Loud Speaking Tower Unique.

His loud speaking tower device is most unique, and is the development of Col. Green's own idea. It looks like an old fashioned Atlantic Coast lighthouse, on the gallery of which are mounted four large wooden horns. Connection is had with the studio, nearby, where the amplifying apparatus is located. This reproduces music and speech with such intensity that it is directed through the horns for a distance of four and one-half miles, clearly and with excellent modulation. Fishing boats and yachting parties far out in the bay have heard the sound and wondered where it could be coming from.

The four great steel masts to be used for the antennae of the new broadcasting station and the four wooden ones now in use, can be seen for miles along the road before the visitor reaches Round Hills, which covers a large frontage on the bay and extends inland. A fine macadamized road has been built from the estate to join with the main highway into Dartmouth and New Bedford; an artificial pond has been constructed on the property, and is filled with ducks; and a beautiful entrance gateway is also being built.

Sun Parlor Now Laboratory.

Col. Green has turned his big sun parlor into a private Radio laboratory, filled with all kinds of apparatus. It might be the Radiophan's dream of Heaven, with its multitude of receiving sets, loud speakers, amplifiers and transmitting sets, scattered about. Just outside the house is a pair of 146-foot steel towers which will be used for the antenna of the new 500-watt station now under construction about a quarter of a mile away. This will carry a B license. Transmitting tests are now conducted on a 100-watt station, WMAF, carrying an A license.

"It is pure selfishness on my part," said Col. Green, in speaking of his plans and experiments. "I am interested in the thing for the pleasure it gives me. I believe, however, that the pleasure afforded by the Radiophone should be accessible to every man—not only to the rich, who can have the best of apparatus, but to the poor man who must obtain his outfit at a low price or not at all.

Hopes to Develop "Radio Ford."

"My aim is to hasten the advent of the 'Radiophone Ford'—a low-priced receiving set to cost not more than \$25 at the

most, which will be really reliable, sensitive and simple in operation. When the majority of people are contented, wars and strikes will be unknown. The way to keep them contented is to keep them entertained in their own homes. The Radiophone does that better than any other agency I know of. If I can hasten the day when every home will be equipped with a Radio receiver, I shall be content myself.

"Our experimental station call is 1XV. That will take care of nine different transmitting stations. Our broadcast call is WMAF. This carries the 50, the 100 and 500-watt stations. We are having three different stations all built for experimental purposes only. We have eighteen orders out now for types of loop aeriels that have any difference between them. What we are after is the practical loop aerial, and we will test them all to see which is the best.

"At present we have four steel masts, each 146 feet high, erected to carry antennae. Then we have eight wooden masts, 125 feet high, and there are three 12-foot loop aeriels.

Hear Own Broadcasts for Test.

"The Round Hills station is out for quality. At various places on Cape Cod and in other sections, receiving sets have been distributed and others will be distributed to receive the Round Hills broadcast. Then through the telephone the broadcast reception will be returned to Round Hills House and listened to here. Thus we will be able to judge of the quality of the broadcasts and not be obliged to depend upon varying reports from others. One of these receiving sets has been installed at the Cuttyhunk life-saving station and another at Broadway and 42nd street, New York City.

Find Tides Change Wave Length

"We have found that the tides affect the wave length. Once at the house here I got a terrible reception of our broadcast and called up the broadcast building to see if they were still on the same wave length. Finding they were, I instructed them to investigate and finally they found that the tide had dropped four feet since the broadcasting had begun and this had changed the wave length.

"We are having a band room prepared, with a different type of transmitter from that used for soft music or the human voice. The latter will not go through it, but a brass band, with a bass drum, which ordinarily sounds badly in broadcasts, will go out beautifully. We will have a special microphone for each station; one type for voice; another for the organ and another still for band music. Whatever we do will either be for quality or experiment. To anyone who listens in on our broadcast on 400 meters, the result will either be excellent or rotten.

To Publish Not Hide Results.

"Once a year the station will publish articles giving full details of all that has been discovered during the previous year, and this will all be available to the public, for general use.

"We are not going to do the way the big telephone, electric and other companies do," said the Colonel—"buy up new ideas and patents and quietly shelve them because they are such radical improvements that hundreds of thousands of dollars' worth of apparatus and material already made up would have to be scrapped. We are going to give the boys a square deal

(Continued on page 9)

EXPLAINS ONE TUBE "FLIVVER" RECEIVER

SET FOR DISPLAY SHOWS PARTS ASSEMBLED

Chicago Store Makes Detail Layout of DIGEST'S "Scoop" Receiver—Tuning Methods Told

(See Photo Diagram, Page 7)
 CHICAGO.—The Washington Radio Shop of this city has assembled one of the most efficient Flewelling single tube receivers since the initial announcement of the circuit in the October 21st number of the RADIO DIGEST. The photo diagram, page 7 of this issue, is made from the set on exhibit at their store. It clearly shows each individual part used and its relative position and function. The purpose of this article and diagram is to bring out and illustrate in a non-technical manner the essentials and construction of this new Flewelling single tube circuit for Radiophone reception.

Detector Unit

Instead of the vertical panel as previously described by RADIO DIGEST, this set is mounted on a long, narrow panel. The double honeycomb coil mounting is located on the left side. The dial of the variable condenser for the adjustment of the wave length of the grid circuit is located at approximately the center of the panel. Since it is anticipated that only short aeriels will be utilized, the antenna series condenser has been omitted, thus reducing the cost somewhat.

The rheostat control has been placed in the lower right corner (front view), while immediately above it seven holes are drilled for observation of tube lighting. Five binding posts are fastened to the right side of the panel. The uppermost of these is for the antenna or ground connection, depending on which is used since both are unnecessary. The second post is for one phone terminal, and the third is for the other phone terminal, and in addition, is connected to the positive side of the approximately one hundred-volt B or plate battery.

If the audio amplifier is used, the phones are removed and the second and third terminals are strapped across to the input terminals of the amplifier unit as shown in the illustration. The negative terminal of the plate battery and the positive terminal of the A battery are both connected to the fourth binding post from the top. The last or bottom binding post is for the negative terminal of the filament storage battery.

Leak and Condenser Bank

It will be noted that the leak and condenser bank are mounted in the rear of the panel. Looking at the rear view, the leak indicated between the socket and the variable condenser is the one usually located in the grid circuit. This is the leak that requires the most careful adjustment. The resistance of this leak should be very high. In fact, several experimenters with this circuit have been able to eliminate it entirely.

The other leak and condenser bank are shown on the right side of the rear view. This leak is not as critical in adjustment as the grid leak. The condenser bank leak simply requires a few heavy black pencil lines, sufficient to keep the resistance down to at least .5 megohm, to be drawn between two terminals.

Amplifier Unit

The amplifier presents but little variation from standard construction. The dial is for filament control. The two binding posts on the left are the input terminals and are connected to the phone posts of the first unit, as explained before. The two posts on the right side of the panel are for the phone connections. Four binding posts on the base of the panel are for

the A and B battery connections. From left to right, the first one is for the positive terminal of the A battery, the second one, the negative terminal of the A battery, the third one, the negative terminal of the plate battery, and the fourth one, the positive terminal of the plate or B battery. It should be noticed that a separate B battery of one hundred volts is indicated for this unit. If another stage of amplification were added, this same amplifier plate battery could be used, but the detector circuit battery should not be utilized for the amplifying plate circuits.

In looking over both the front and rear views, it will be noted that the variable leak resistance used across the primary of the first audio frequency transformer, as mentioned in the December 2nd and 8th issues of RADIO DIGEST, is not indicated. The use of a separate piece of apparatus has been eliminated and the grid leak effect is accomplished by the addition of slight pencil marks between the two input binding posts on the face of the amplifier panel.

Tuning Operations

In tuning, it will be found that the coupling between coils and the setting of the variable condenser is not as critical as the proper adjustment of the high resistance grid leak. The low resistance leak connected to the condenser bank is first adjusted to a very low resistance value. The coupling of the honeycomb coils is set at about a 45 degree angle. The variable condenser dial can then be rotated for reception which can be temporarily adjusted to about the phone wave lengths. The grid leak should then be adjusted for the elimination of nearly all whistle and noise, after which the coil coupling, the rheostat and condenser dial can be readjusted. Attention should be paid to the fact that the general tendency is to add too many pencil marks across the grid leak, thus reducing the resistance to too low a value. Because of the requirement of a high resistance it's impractical to mount this circuit on a wooden panel, as the actual resistance through the wood is apt to be much too low for efficient operation. When the amplifier is used, the resistance between the two input terminals is first adjusted for best results after which the grid leak must be readjusted.

In working with this circuit the experimenter must realize that two amplifying tubes are required as soft detector tubes have not been found to give as satisfactory reception.

Gothamites Borrow Chi's Music for Society "Hop"

NEW YORK.—Mr. and Mrs. Charles William Taussig gave a dance at their home, 190 Riverside drive, recently, borrowing their music from Chicago by Radio. Mr. Taussig, who is a Radiophan and an author, said today that the experiment of giving a dance in New York to Chicago music was successful.

"The music came, not spasmodically, as is frequently the case in long distance reception with low-power stations, but was continuously loud more than two hours," said the Radio dance host.

Mr. Taussig is experimenting with apparatus to receive music from Europe loud enough for dancing and other entertainment.

Book Reviews

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

Radio Receivers for Beginners. By Snodgrass and Camp. Answers the universal question, "How can I receive Radio?" Price, \$1.00.

Radio First Aid. Illustrated with working drawings and complete data as to the necessary equipment and cost of constructing from the simplest to the most modern Radio outfits at home. Price, \$1.

How to Retail Radio. A new book telling of tested plans and methods and policies for the dealer in Radio. Financing, location, store equipment and arrangement. Price, \$2.00.

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

Radio Experimenter's Hand Book. By M. B. Sleeper. This book will help in the selection and the construction of simple apparatus for transmission and reception of Radio telegraph and telephone signals. Price, \$1.00.

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.

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

Radio Reception. By Harry J. Marx, Technical Editor Radio Digest, Illustrated, and Adrian Van Muffling. A simple treatise on Radio reception. Beginning with

the elementary principles of electricity, it carries the reader on into the essentials of Radio telephony. The most successful methods of Radio reception are explained and special reference given to practical tuning. 230 pages, with 130 illustrations. Price, \$2.00.

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 not accepted. Send money order or check. Book Department, Radio Digest Illustrated, Postage stamps in payments for books 123 W. Madison St., Chicago, Ill.

Persons who can tune in on the government station NOF at Washington, have an opportunity to learn all there is to know about their government and its departments. The United States department of labor has started broadcasting information about itself, three nights a week, and it is expected other bureaus will follow its example.



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No other manufacturer offers such a high quality battery at such a low price. Save 50 per cent on your next battery and get better and longer service—buy a World Storage Radio Battery. Write today.

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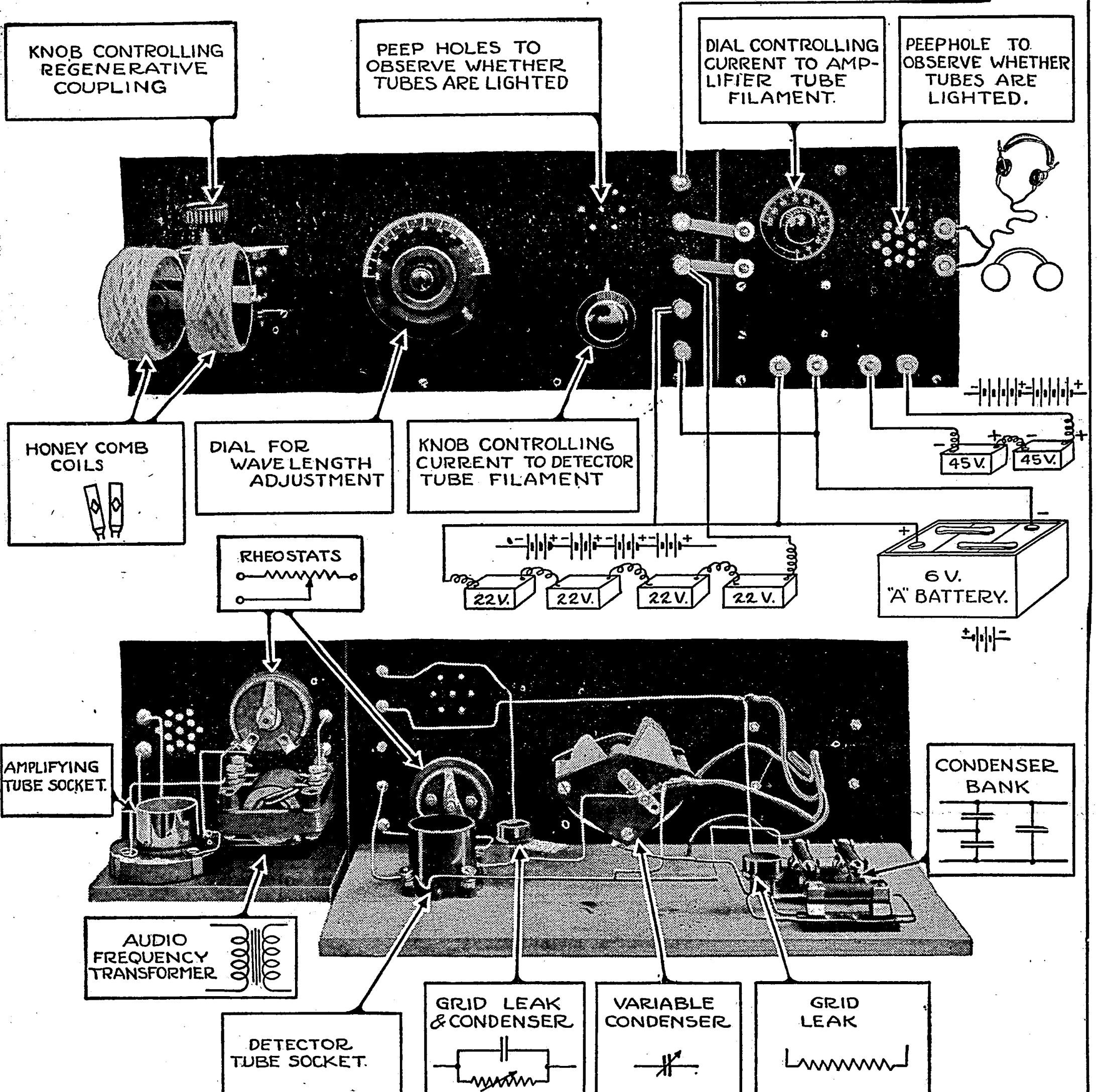
A Good Single Tube 'Super'

Popular Flewelling Set Made by Chicagoan

The accompanying photo diagram illustrates the Flewelling single tube receiving circuit as assembled by the Washington Radio Shop of Chicago. Its successful performance has won for it this page and the description to be found on the facing page. The usual front and rear views of the set are shown, as has been the custom with all the standard receiving sets. Due to the patent situation, this set cannot

be purchased assembled completely, but there are no restrictions against the amateur building it himself. As shown in the diagram, one stage of audio frequency amplification has been added in the form of a small amplifier unit, consisting merely of a socket and tube, filament rheostat and transformer. The various parts are indicated clearly and the instructions on page six supplement the diagram.

ANTENNA



Radiophone Broadcasting Stations

Corrected Every Week—Part II

(NOTE.—The second part of the schedule list appears below. The first appeared last week and the last part, together with the city-station index will appear next week.)

WBAB, Syracuse, N. Y. 1,000 ml. Syracuse Radio Tel. Co. Mon, Wed, Sat, 7:30-9:30 pm, concert, agramms etc. Eastern.

WBAC, Moorestown, N. J. Fred M. Middleton. WBAG, Bridgeport, Pa. 485 also. 300 ml. Diamond S. Fibro Co. Daily, 11:45-12 m, markets, weather, Eastern.

WBAN, Minneapolis, Minn. 200 ml. The Dayton Co. Daily ex Sun, 1-1:30 pm, 3-3:30, 5-5:30, 9:30-10. 11-11:30 am, Wed, 8-10 pm, Central.

WBAJ, Toledo, O. 300 ml. Marshall-Gerken Co. Daily ex Sun, 12:05-2 pm, 6-7:30, news, music, reports, Tues, Thurs, Sat, 8-9 pm, concert, Eastern.

WBAN, Paterson, N. J. 200 ml. Wireless Phone Corporation. Daily ex Sun, 9:15-9:45 am, 10:30-11, 1-1:15 pm, 2:15-2:30, 4:30-5:30, music, Sat, morn, only, Eastern.

WBAO, Decatur, Ill. James Millikin Univ. WBAQ, Mishawaka, Ind. Lybrand Mfg. Co. WBAF, Fort Worth, Texas. 400 and 485 only. 1,500 ml. Ft. Worth Star Telegram. Daily ex Sun, 6:45-10 am, 11-11:30, 3-3:30 pm, 3:45-4, 5:15-5:30, 6:30-6:45, 9:30-10:30, news, reports, concert, Central.

WBAU, Hamilton, O. Republican Pub. Co. WBAV, Columbus, O. 500 ml. The Ernor Hopkins Co. Daily ex Sun, 12:30-1 pm, Mon, 7-9 pm, Central.

WBWA, Marietta, O. Marietta College. WBAX, Wilkes-Barre, Pa. 200 ml. John H. Stenger, Jr. Three nights of week, not regular.

WBAY, New York, N. Y. 400 only. 1,500 ml. A. T. & T. Co. Daily, 11-12 am, 4:30-5:30 pm, Thurs, 7:30 pm on Eastern daylight saving.

WBL, Anthony, Kans. 200 ml. T. & H. Radio Co. Mon, Wed, Fri, 10-11 pm, concert, lecture, Sat, 11-12 pm, concert, Sun, 10 am, 4-5 pm, church service, Central.

WBS, Newark, N. J. 100 ml. D. W. May Inc. Mon, Wed, Thurs, 7:30-8:30 pm, reports, music, Sun, 9-10:30 am, 1-3 pm, church service, Eastern.

WBT, Charlotte, N. C. 485 also. 500 ml. Southern Radio Corp. Daily ex Sun, 11 am, reports, 8 pm, music, Sun, 7:30 pm, church service, Eastern.

WBU, Chicago, Ill. City of Chicago.

WBZ, Springfield, Mass. 400 only. 500 ml. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 7:30 pm, children's hour; 7:45, markets, weather, lecture; 8-9, concert, Sun, 3 and 8, church service, Eastern.

WCB, Newburgh, N. Y. 150 ml. Newburgh Daily News. Daily ex Sun, 1 pm, 2, 3, 7, Mon, Fri, 10:30 pm, Eastern.

WCAC, Fort Smith, Ark. John Fink Jewelry Co. Tests only.

WCAD, Canton, N. Y. 200, 480 also. 300 ml. St. Lawrence Univ. No regular schedule, Eastern.

WCAE, Pittsburgh, Pa. Kaufman & Baer Co. WCAE, New Orleans, La. 200 ml. Clyde R. Randall. Daily ex Sun, 6:45-7 pm, news, time, Thurs, 8:30-10 pm, concert, Sun, 2-4 pm, music, Central.

WCAH, Columbus, O. 150 ml. Enteklin Elec. Co. Tues, Fri, 7-9 pm, music, Wed, Thurs, Sat, 7-8 pm, music, Sun, 10-12:30, church service, Central.

WCAI, San Antonio, Tex. Southern Equipment Co. WCAJ, Univ. Place, Neb. 485 also. 100 ml. Neb. Wesleyan Univ. Daily ex Sun, 12 am, weather, news, Wed, 9 pm, music, lecture, Central.

WCAK, Houston, Tex. 100 ml. Alfred P. Daniel. Daily ex Sun, 7-7:15 pm, music, Wed, 8-9:15, concert, Sun, 3-4:30 pm, concert, Central.

WCAL, Northfield, Minn. 500 ml. St. Olaf College. Thurs, 11 pm, music, Sun, 8:30 pm, music, concert, lecture, Central.

WCAM, Villanova, Pa. Villanova College.

WCAO, Baltimore, Md. 100 ml. Sanders & Stayman Co. Daily ex Sun, 12-12:20 pm, 5-5:20, Mon, Wed, 7:30-8:30 pm, Eastern.

WCAP, Kalamazoo, Mich. Kalamazoo College.

WCAP, Decatur, Ill. Central Radio Service.

WCAD, DeRanc, Ill. 200 ml. Tri-State Radio Mfg. Co. Daily, 11:30-12:30 pm, 3, baseball; 6-6:30, baseball, concert; 8, special program, Central.

WCAR, San Antonio, Tex. 200 ml. Alamo Radio Elec. Co. Mon, Thurs, Sat, 8:30-9:30 pm, concert, Sun, 11 am, church service, Central.

WCAS, Minneapolis, Minn. 200 ml. Wm. H. Dunwoody Industrial Inst. Mon, 8-8:45 pm, music, lectures, Central.

WCAT, Rapid City, S. D. 485 only. 300 ml. S. D. State School of Mines. Daily ex Sun, 9:30 am, 12:30 pm, 3 pm, weather, reports, Mountain.

WCAU, Philadelphia, Pa. Phila. Radiophone Co. WCAV, Little Rock, Ark. J. C. Dice Elec. Co. WCAW, Omaha, Neb. Woodmen of the World.

WCAW, Quincy, Ill. 200 ml. Quincy Elec. Supp. Co. (Quincy Herald.) Daily ex Sun, 8:45 am, markets; 11, markets; 1 pm, markets; 5, music, baseball, Tues, Wed, Thurs, Sat, 8:30-9:45 pm, concert, Sun, 6:30-7:30 pm, religious, Central.

WCAZ, Burlington, Vt. Univ. of Vt. WCAZ, Milwaukee, Wis. 485 also. 500 ml. Kesselman-O'Driscoll Music House. Daily ex Sun, 11 am, reports, Mon, Tues, Thurs, Fri, 8:30-9:30 pm, music, Sun, 7:30-8:30 pm, church services, Central.

WCAZ, Quincy, Ill. Whig-General.

WCE, Minneapolis, Minn. Findley Elec. Co. WCI, New Haven, Conn. 400 ml. A. C. Gilbert Co. Mon, Wed, Thurs, 7:30-8:30 pm, news, music, Eastern.

WCK, St. Louis, Mo. 485 also. 50 ml. Stix Baer & Fuller (Grand Leader). Mon, Wed, Fri, 6:45-8 pm, concert, lecture, bedtime story, Central.

WCM, Austin, Tex. Univ. of Tex. WCN, Worcester, Mass. 485 also. 100 ml. Clark Univ. Daily, 11:15 am, 5:15 pm, weather. Evening program irregular, Eastern.

WCX, Detroit, Mich. 400 and 485 only. 1,000 ml. The Detroit Free Press. Daily ex Sun, 10:35 am, WCX Woman's Club; 2 pm, news; 2:15, stock reports; 2:50, weather markets; 4:15, markets, music. Daily ex Sat, 8:30-10 pm, week starting Dec. 11 and alternate weeks thereafter, concert; 7-8:30 pm, week starting Dec. 18 and alternate weeks thereafter, concert, Sun, 2:30 pm, 4 pm, church services, Central.

WDAA, Nashville, Tenn. Ward Belmont School.

WDAC, Springfield, Ill. Illinois Watch Co. Time and weather, spark only.

WDAE, Tampa, Fla. 485 also. 500 ml. Tampa Daily Times. Wed, Fri, 8-10 pm, music, lecture, Eastern.

WDAF, Kansas City, Mo. 400 and 485 only. 500 ml. Kansas City Star. Daily ex Sun, 3-4 pm, reports, music; 6-7, educational, bedtime story, etc. Mon, Wed, Fri, 8-10 pm, concert, Sun, 3:30-5:30 pm, music, Central.

WDAB, Amarillo, Tex. J. Laurance Martin.

WDAC, El Paso, Texas. 485 also. 300 ml. Mine & Smelter Supply Co. Daily ex Sun, 10 am, news, reports, Tues, Thurs, Sat, 7:30-8:30 pm, music, Mountain.

WDAI, Syracuse, N. Y. 485 also. 200 ml. Hughes Radio Corp. Daily ex Sun, 12 m, reports, Wed, Sat, evening concert.

WDAJ, College Park, Ga. 485 also. 300 ml. A. & W. P. R. Co. Daily, 9-10 pm, concert, etc. Central.

WDAK, Hartford, Conn. 150 ml. Hartford Courant. Daily ex Sun, 2:30 pm, 3:30, 4:30, 5:30, music; 7:40, bedtime story; 8:15, concert, Eastern.

WDAL, Jacksonville, Fla. 485 also. 250 ml. Florida Times Union. Daily, 11 am, time, weather, 3-3:15, 4-4:15, 5-5:15, 8-9:30 music. 10:05-10:20 pm, reports, Eastern.

WDAN, Shreveport, La. Centenary College and Glenwood Radio Corp.

WDAO, Dallas, Tex. Automotive Elec. Co. WDAF, Chicago, Ill. 2,000 ml. Thorne Donnelly and J. Elliott Jenkins. Drake Hotel. Daily ex Sun, 9:45 am, 10:45, 11:45, 1:45 pm, music; 3:15, stock; 6, music, news, Tues, Thurs, 10-11 am, and Sat, 10-2 am, dance music, Sun, 8:30-10:30 pm, concert, Central.

WDAS, Brownsville, Pa. 200 ml. Hartman-Riker Elec. & Mach. Co. Daily ex Sun, 10:30-10:50 am, music; 12:50-1:10 pm, music, news, weather; 5:05-5:30 music, Tues, Thurs, Fri, 9:15-10 pm, concert, Sun, 5 pm, chapel, Eastern.

WDAW, Philadelphia, Pa. Lt. Bros. WDAS, Worcester, Mass. Samuel A. Walto. WDAU, New Bedford, Mass. 500 ml. A. H. Smith. Wed, Fri, 7:45-10 pm, music, Sun, 10:30-12 m, 5-6 pm, church services, Eastern.

WDAV, Muskogee, Okla. Daily Phoenix.

WDAX, Centerville, Iowa. 500 ml. First Nat'l Bank. Daily ex Sun, 11:30 am, reports, news, Mon, Thurs, 7:30-9 pm, concert.

WDAY, Fargo, N. D. 485 also. 300 ml. Daily ex Sun, 12:15-12:30 pm, 7:30-8:15, reports, news, music, Central.

WDBM, Washington, D. C. 50 ml. Church of the Covenant. Sun, 10:30 am, church service; 3 pm, lecture; 7:30, church service, Eastern.

WDT, New York, N. Y. Ship Owners Radio Service.

WDV, Omaha, Neb. 100 ml. John O. Yeiser, Jr. Daily 7-8 pm, Tues, Sat, 12-1 am, Fri, 10-10:45 pm, Sun, 2-4 pm, Music, Central.

WDY, Roselle Park, N. J. Radio Corp. of America.

WDZ, Tuscola, Ill. 70 ml. James L. Bush. Daily ex Sun, every half hr, 8:30 am-12:15, Chicago Board of Trade quotations, Tues, Fri, 7-8 pm, concert, entertainment, Central.

WEAA, Flint, Mich. Fallain & Lathrop.

WEAB, Fort Dodge, Ia. 600 ml. Standard Radio Equip. Co. Daily ex Sun, 9:40 am, 10:40, 11:40, 1:40 pm, 5:15, market reports; 6:30 pm, sports; 7:30-8:45 pm, music, Sun, 10:45 am, church service; 7:30-8:45 pm, music, Central.

WEAC, Terre Haute, Ind. 485 also. 75 ml. Baines Electric Service Co. Daily ex Sun, 10:15 am, weather, 12-1 pm, 5-6, music, Central.

WEAD, Atwood, Kan. 485 also. 150 ml. N. W. Kansas Radio Supply Co. Daily ex Sun, 11-11:30 am, markets music; 12 markets; 1:45 pm, markets; on half hour 3:15 to 5:45, news sports, Tues, Wed, Thurs, Sat, 7:30-9, concert, Sun, 11 am, church service; 3 pm, sacred music; 7:30, church service, Central.

WEAE, Blacksburg, Va. Polytechnic Inst.

WEAF, New York City, N. Y. 400 only. 1,500 ml. Am. Tel. & Telg. Co. Daily ex Sun, 4:30-5:30 pm, Mon, Wed, Thurs, Sat, 8-10 pm, concert, Eastern.

WEAG, Edgewood, R. I. Nichols-Hineline-Bassett Lab.

WEAH, Wichita, Kan. 485 also. 500 ml. Lander H. H. Co. Daily ex Sun, 9:40 am, 10:40, 11:40, 12:30 pm, 1:30, 3:15, reports, Wed, Sat, 8 pm, concert, Every third Sun 8 pm, concert, Central.

WEAI, Ithaca, N. Y. Cornell Univ.

WEAJ, Vermillion, S. D. 300 ml. Univ. of S. D. Mon, Wed, Fri, Sat, 7:30 pm, music, lectures, Central.

WEAK, Grove City, Pa. Grove City College.

WEAK, St. Joseph, Mo. 100 ml. Julius B. Abernethy. Thurs, 8-9:45 pm, concert, Central.

WEAM, North Plainfield, N. J. 75 ml. Borough of N. Plainfield. Daily, 7:30-8 pm, music, police news, etc. Eastern.

WEAN, Providence, R. I. 50 ml. The Shepard Co. Daily ex Sun, 8-5 pm, 6-8, music, bedtime stories, Mon, Wed, 8-10 pm, concert, Eastern.

WEAO, Columbus, Ohio. Ohio State Univ.

WEAP, Mobile, Ala. 485 also. 50 ml. Mobile Radio Co. Daily, 4-5 pm, 7-8:55, Central.

WEAR, Baltimore, Md. 485 also. 200 ml. News & American Pub. Co. Daily ex Sun, 2-2:30 pm, 6:30-7, weather, music, news, Thurs, Sat, 7:30-9:30 pm, Eastern.

WEAS, Washington, D. C. 200 ml. The Hecht Co. Daily ex Sun, 8-9 pm, Wed, Fri, 7-8 pm, Eastern.

WEAT, Tampa, Fla. John J. Fogarty.

WEAU, Sioux City, Ia. 50 ml. Davidson Bros. Co. Daily ex Sun, 9 am, 10, 11, 1 pm, reports, news, Mon, Wed, Fri, 8:30 pm, concert, Central.

WEAV, Rushville, Neb. 200 ml. Sheridan Elec. Service Co. Wed, Fri, Sun, 8-9 pm, concert, news, etc. Mountain.

WEAW, Anderson, Ind. Arrow Radio Lab.

WEAX, Little Rock, Ark. T. J. M. Daly.

WEAY, Houston, Tex. Will Horwitz, Jr.

WEBA, St. Louis, Mo. 800 ml. The Benwood Co., Inc. Daily ex Sun, 9-9:40 am, 12-12:45 pm, 3-4, Wed, 7-9 pm, Central.

WEH, Tulsa, Okla. (300 S. Main St., Eldorado, Kans.) Midland Refining Co.

WEV, Houston, Tex. 485 also. 500 ml. Hurbit-Stull Elec. Co. Daily ex Sun, 10 am, 5:30 pm, weather, roads, Tues, Thurs, 8 pm, concert, Central.

WEW, St. Louis, Mo. 485 also. 100 ml. St. Louis Univ. Daily ex Sun, 9 am, 10, 2 pm, reports, Central.

WEW, Wichita, Kan. 485 also. 500 ml. Cosradio Co. (Wichita Beacon.) Daily ex Sun, hourly, 8:45 am-12:40 pm, stock markets. Daily, 10:45 am and 4-5 pm, weather; 8-10 pm, sports, concert, lecture; 10:45 weather, Sun, 8:10 pm, church service, concert, Central.

WFAA, Dallas, Texas. 400 and 485 only. 250 ml. Dallas News and Dallas Journal. Daily, 10:15 am, reports; 12:30-1 pm, address; 6:45-7, bedtime story; 8-8:30, music, Tues, Thurs, Sat, 11-12 pm, music, Central.

WFAB, Syracuse, N. Y. 100 ml. C. F. Woese. No definite schedule.

WFAC, Superior, Wis. 400 ml. Superior Radio Co. Daily, 7-7:45 pm, news, Central.

WFAD, Salina, Kan. 250 ml. Watson Veldton Motor Supply Co. Daily ex Sun, 8:45 am, 9:45, 10:45, 11:45, 1:30 pm, reports, Tues, Thurs, Fri, 8 pm, concert, Sun, 11 am, church service; 8 pm, concert, Central.

WFAP, Poughkeepsie, N. Y. 200 ml. H. C. Spratley Radio Co. Daily ex Sun, 10-10:30 am, 11:30-11:45, 1:30-2 pm, 4-4:15, Tues, Thurs, Sat, 8:15 pm, feature program, Eastern.

WFAG, Waterford, N. Y. 340 only. 300 ml. Radio Engineering Lab. Wed, Sat, 7:45-10 pm, concert, Sun, 2-4 pm, church service, Eastern.

WFAH, Port Arthur, Tex. Elec. Supply Co.

WFAI, Asheville, N. C. Hi-Grade Wireless Instrument Co.

WFAM, St. Cloud, Minn. 485 also. 100 ml. Granite City Elec. Co. Daily ex Sun, 3:30-4:00 pm, markets; 7:30, entertainment, Central.

WFAN, Hutchinson, Minn. 485 also. 500 ml. Hutchinson Elec. Service Co. Daily ex Sun, 1 pm, markets etc. Central.

WFAQ, Cameron, Mo. Cameron Radio Co. and Mo. Wesleyan College.

WFAE, Sanford, Me. Hall & Stubbs.

WFAS, Fort Wayne, Ind. United Radio Corp.

WFAT, Sioux Falls, S. Dak. 485 also. 400 ml. Argus Leader. Daily ex Sun, 10:15-12:15 pm, 2:15, reports; 7:30 pm, music, Tues, 8-9 pm, concert, Central.

WFAV, Boston, Mass. Edwin C. Lewis.

WFAW, Lincoln, Neb. 485 also. 300 ml. Univ. of Neb. Daily ex Sun, 10-10 am, weather, markets, Sat, 9:00 pm, concert, Central.

WFAW, Miami, Fla. Daily Metropolis.

WFAV, Independence, Kan. 500 ml. Daniels Radio Supply Co. Daily ex Sun, 12 m, 4 pm, news, Mon, Tues, Wed, 7:30-8 pm, entertainment, Thurs, Fri, 7:30-8 pm, Sat, 7-9 pm, music, Sun, 11 am, church services, Central.

WFAZ, Charleston, S. C. 400 ml. S. C. Radio Shop. Daily ex Sun, 12 m, reports, news, music, Tues, Thurs, 8-10 pm, Eastern.

WFJ, Philadelphia, Penn. 400 and 485 only. 350 ml. Strawbridge & Clothier. Daily ex Sun, 1:16 pm, news; 3:30-4:30, concert; 5:30-6, sports, Mon, Fri, 6:30-7 pm, Radio talk, Wed, Fri, Sat, 7:30-8:30 pm, concert, Fri, Sat, (alternate weeks) 7:30 pm, concert at 8:30 pm, Sun, 4 pm, church service, Eastern.

WFO, Dayton, O. 485 also. 300 ml. Rike-Kumler Co. Daily ex Sun, 9 am, 11, 4 pm, music, news, reports, Mon, Wed, Fri, 8 pm, concert, Sat, 11:30 pm, concert, Central.

WGAB, Houston, Tex. 250 ml. QRV Radio Co. Daily ex Sun, 8:30-9 am, police reports; 1:30-2:30 pm, concert, agramms; 4-5, concert, police reports, Central.

WGAD, Ensenada, Porto Rico. 250 ml. Escuela Hispano Americana de Radio Telegrafia, Inc. Sat and Sun eve.

WGAH, New Haven, Conn. New Haven Elec. Co.

WGAJ, Shenandoah, Ia. 100 ml. W. H. Gass. Mon, Thurs, 7:30-8 pm, Central.

WGAK, Macon, Ga. Macon Elec. Co.

WGAL, Lancaster, Pa. 35 ml. Lancaster Elec. Supply & Construction Co. Mon, Wed, Fri, 7-8 pm, concert, lecture, Sun, 3-3:30 pm, church service, Eastern.

WGL, Philadelphia, Pa. 2,000 ml. Thos. F. J. Howlett. Tues, Thurs, Sat, 7:45-11:30 pm, concert, Eastern.

WGM, Orangeburg, S. C. 150 ml. Orangeburg Radio Equipment Co. Daily ex Sun, 10 am, markets, weather; 11:55, time; 4 pm, Radio talk, markets, baseball; 6, music, lecture; 10, time, weather, entertainment, Sun, 11 am, church service; 11:55, time;

10 pm, time, weather, music, Eastern.

WGAN, Pensacola, Fla. Cecil E. Lloyd.

WGAP, Shreveport, La. 500 ml. Glenwood Radio Corp. Daily ex Sun, 8 pm, music, Sun, 11 am, 7:30 pm, church service, Central.

WGAS, Port Smith, Ark. Southwest American.

WGAS, Chicago, Ill. 1,000 ml. Ray-di-co Organization, Inc. Daily ex Sun, 9-9:20 am, 11:15-11:30, 1:30-1:45 pm, 2:45-3, 5-6, music, 12:15-12:30 pm, 4:45-5, 4:30-4:45, reports, Wed, Fri, 10-11 pm, music, Central.

WGAT, Lincoln, Neb. 100 ml. Am. Legion, Dept. of Nebr. Mon, Wed, 9 pm, announcements, Fri, 9-10 pm, patriotic program, concert, Sun, 8-5 pm, sermon, Central.

WGAU, Wooster, O. Marcus G. Limb.

WGAW, Altoona, Pa. Ernest C. Albright.

WGAX, Washington, D. C. H. O. 75 ml. Radio Elec. Co. Daily ex Sun, 9 am, 2 pm, music, news, Mon, Wed, Fri, 9:30 pm, concert, news, Sun, 10:30 pm, sermon, Central.

WGB, Madison, Wis. 100 ml. North Western Radio Co. Daily ex Sun, 9-10 am, financial news; 11:30, news, opening markets; 4 pm, news, closing markets, Mon, Wed, Thurs, Sat, 7:30-8:30 pm, concert, Sun, 10:30-12 am, sermon, Central.

WGBZ, South Bend, Ind. 200 ml. South Bend Tribune. Daily ex Sun, 9-9:30 am, household hints, menus; 2-3 pm, music, 7-8 pm, music, Central.

WGF, Des Moines, Iowa. 485 also. 300 ml. Register and Tribune. Tues, Fri, 7:30 pm, entertainment, Sun, 8 pm, church service, Central.

WGI, Medford Hills, Mass. 485 also. 200 ml. Am. Radio and Research Corp. Daily ex Sun, 7 am, setting up exercises; 9:30, 11:30, 8:25 pm, music; 10:30 am, 1:30 pm, 3, 6, 6:30, reports, news, Mon, Wed, 7 pm, entertainment, Tues, 8:30 pm, fashion talks, concert, Thurs, Fri, 9 pm, concert, Sat, 8 pm, concert, Sun, 4 pm, concert; 6:30 pm, reports; 7:30, church service; 8:30 concert, Eastern.

WGM, Atlanta, Ga. 400 only. Atlanta Constitution.

WGR, Buffalo, N. Y. 485 also. 300 ml. Federal Tel. & Telg. Co. Daily ex Sat and Sun, 12:15 pm, weather, agramms; 2, music; 3, lecture; 4 music; 5:30, reports; 7:30, bedtime stories; 8:10, concert, Eastern.

WGV, New Orleans, La. Interstate Elec. Co. WGY, Schenectady, N. Y. 400 and 485 only. 1,000 ml. General Elec. Co. Daily ex Sun, 11:55 am, 12:30 pm, 6, 10, reports, time, sports, Mon, Tues, Thurs, Fri, 2-2:30 pm, 7:45, concert, Fri, 10:30 pm, special, Sun, 10:30 am, 4:30 pm, church service, Eastern.

WHA, Madison, Wis. 485 also. 600 ml. Univ. of Wis. Daily ex Sun, 12:30-1 pm, weather, markets, Tues, Thurs, Fri, Sat, 12-1 pm, weather, markets, time, Tues, 8 pm, concert, Fri, 8-9:15 pm, news, concert, Sat, 1-1:30 pm, instruction, Central.

WHAA, Iowa City, Ia. 200 ml. State Univ. of Ia. Daily ex Sun, 4-8:30 pm, lecture, concert, sports, news, Sun, 10:45-12 am, church service, Central.

WHAB, Galveston, Tex. 300, 485, 600 also. 500 ml. Clark W. Thompson Co. Daily ex Sun, 9:45-10:15 am, 3 pm, 5 pm, reports, music, news, Mon, Wed, Fri, 8 pm, entertainment, Sun, 10 am, church service, Central.

WHAC, Waterloo, Ia. 150 ml. Cole Bros. Elec. Co. Daily ex Sun, 6:15 pm, news, sports, Mon, Wed, Fri, 9:30 pm, concert, Central.

WHAD, Milwaukee, Wis. 485 also. 100 ml. Marquette Univ. Daily ex Sun, 10:55 am, time; 11:20, weather, Wed, 7:30-8:30 pm, music, entertainment, Central.

WHAE, Sioux City, Ia. 200 ml. Automotive Elec. Service Co. Daily ex Sun, 12:30-5:30 pm, music, reports, Thurs, 7:30 pm, music, Central.

WHAF, Pittsburgh, Pa. 200 ml. Radio Elec. Co. Daily ex Sun, 11:30-12, 3-3:30 pm, music, news, Sun, 9-10, music, Eastern.

WHAG, Cincinnati, O. 100 ml. Univ. of Cincinnati. No definite schedule.

WHAH, Joplin, Mo. John T. Griffin.

WHAI, Davenport, Ia. 30 ml. Radio Equip. & Mfg. Co. Daily ex Sat and Sun, 2-2:30 pm, 4:30-5:30, 10-11, Sat, 10-11 am, 2-2:30 pm, 5-5:30, 11-11:30, Central.

WHAK, Clarksburg, W. Va. Roberts Hdwe. Co. 50 ml. No definite schedule.

WHAL, Lansing, Mich. 200 ml. The Capital News. Daily ex Sun, 9:15-9:45 am, 12:30-1 pm, 3:45-4:15, 7:30-8:30, Sun, 2:30 pm, Central.

WHAM, Rochester, N. Y. Univ. of Rochester.

WHAN, Savannah, Ga. 100 ml. Frederick A. Hill. Daily, 9:30-10 pm, Eastern.

WHAP, Decatur, Ill. 100 ml. Dewey L. Otta. No definite schedule.

WHAQ, Washington, D. C. 75 ml. Semmes Motor Co. Mon, 7-8 pm, lecture on automobile upkeep, music, Eastern.

WHAR, Atlantic City, N. J. Paramount Radio & Elec. Co.

WHAS, Louisville, Ky. 1,500 ml. Courier Journal and Louisville Times Co. Daily ex Sun, 4-5 pm, 7:30-9 pm, 9:57-10:45 am, 4-5 pm, church service, Central.

WHAY, Wilmington, Del. 200 ml. Wilmington Elec. Spec. Co. Daily ex Sun, 12-1 pm, music, Mon, Wed, Fri, 6-8 pm, concert, Tues, Thurs, Sat, 6-7 pm, music, Eastern.

WHAW, Tampa, Fla. 50 ml. Pierce Elec. Co. Daily ex Sat, Sun, 12-1 pm, 4-5, music, agramms, Sat, 12-1 pm, 8-10, music, entertainment, Eastern.

WHAY, Huntington, Ind. 75 ml. Huntington Pub. Co. Daily ex Sun, 12 m, 3 pm, music; 1:30 pm, 6, reports, sports, Mon, Wed, Sat, 8 pm, concert, Central.

WHBZ, Troy, N. Y. 400 only. 500 ml. Rensselaer Polytechnic Inst. Mon, 8:15-9:30 pm, music, Eastern.

WHB, Kansas City, Mo. 400 and 485 only. 1,000 ml. Sweeney Auto & Tractor School. Daily, 10 am, 3 pm, 5, weather. Daily ex Sun, 2 pm, ladies' hour; 7, bedtime stories, Tues, Thurs, Sun, 8-10 pm, concert, Central.

WHC, Morgantown, W. Va. 100 ml. W. Va. University. Daily, 4-6, 7-7:30, news etc. Eastern.

WHK, Cleveland, O. 300 ml. Warren R. Cox. Daily ex Sun, 1:30-2 pm, 4-4:30, 6-6:30, Tues, Thurs, Sun, 9:30 pm, concert, Eastern.

WHN, Ridgewood, N. Y. Times Printing & Pub. Co.

WHX, Des Moines, Iowa. 50 ml. Iowa Radio Corp. Daily, 12:30-1 pm, 6-6:30, Sat, 3 pm, sports, Central.

WIAA, Waupaca, Wis. Waupaca Civic & Commerce Assn.

WIAB, Rockford, Ill. 50 ml. Joslyn Automobile Co. Tues, Fri, 8:30-9:30 pm, music, Central.

WIAC, Galveston, Tex. 485 also. 100 ml. Galveston Tribune. Tues, Thurs, Sat, 7 pm on, bedtime story, evening prayer, concert, Central.

WIAD, Ocean City, N. J. 200 ml. Ocean City Yacht Club. Fri, Sat, Sun, 8-12 pm, Eastern.

WIAE, Vinton, Ia. 75 ml. Zimmerman Radio Co. Tues, Thurs, Sat, 9 pm, music, news, Wed, 8 pm, band concert, Sun, 2:30 pm, music, Central.

WIAF, New Orleans, La. 300 ml. NoLa Radio Co. Sun, 10-11 am, music, lecture, Central.

WIAH, Newton, Ia. 200 ml. Continental Radio & Mfg. Co. Daily 12:30-1 pm, music, news, Mon, 7:30-8 pm, Central.

WIAI, Springfield, Mo. 100 ml. Heer Stores Co. Daily ex Sun, 9:30-10, reports, news, Tues, Thurs, Sat, 7:30-8:30 pm, music, Central.

WIAJ, Neenah, Wisc. Fox River Valley Radio Supply Co.

WIAK, Omaha, Neb. 485 also. 300 ml. Daily Journal-Stockman. Daily ex Sun, 7:45 am, 9:10, 10:15, 12 m, 1:50 pm, 3:50, markets, weather, Central.

WIAO, Milwaukee, Wis. 200 also. 100 ml. School of Engineering. Mon, Tues, Thurs, Fri, 10:15-10:30 am; 11:30-11:45, news; 11:45-12:10 pm, lecture; 5-6 pm, news; 7-7:15, music; 7:15-7:30, lecture, Central.

WIAQ, Madison, Ind. Chronicle Pub. Co.

WIAR, Paducah, Ky. 150 ml. J. A. Rudy & Sons. Daily ex Sun, 11-12 am, markets, weather, news, music; 4-5 pm, same and sports; 7:30-9, concert, lectures, etc. Sun, 11-12 am, church service, Central.

WIAS, Burlington, Ia. 400 ml. Hawk-Eye Home Elec. Co. Tues, Thurs, 8-9 pm, concert, Central.

WIAT, Tarkio, Mo. Leon T. Noel.

WIAU, Le Mars, Ia. Am. Trust & Savings Bank.

WIAV, Binghamton, N. Y. N. Y. Radio Lab.

WIAW, Saginaw, Mich. Saginaw Radio & Elec. Co.

WIAZ, Lincoln, Neb. 200 ml. Capital Radio Co. Thurs, 8 pm, music, entertainment, Sun, 2:30 pm, 8, 9, church service, Central.

WIB, Washington, D. C. 200 ml. Woodward & Lothrop. Daily ex Sun, 10:30-11:30 am, 2-3 pm, music, Sat, 8-10 pm, concert, Eastern.

WIBZ, Miami, Fla. Flagler St., Elec. Supply Sales Co.

WIK, McKeesport, Pa. 600 ml. E. & L. Elec. Co. Daily ex Sun, 6:30-7 pm, Tues, Thurs, 9:30-10:30 pm, Sun, 1:30-2:30 pm and 6:30-7 pm, Eastern.

WIL, Washington, D. C. 100 ml. Continental Elec. Supply Co. Daily 5:30-7 pm, music, entertainment, Eastern.

WIP, Philadelphia, Pa. 400 meters only. 1,000 ml. Seiber Bros. Daily ex Sun, 2:30-3:30 pm, Mon, Wed, Thurs, 7-7:30 pm, Tues, Fri, Sat, 7-12 pm, Sun, am, pm, church service.

WIZ, Cincinnati, O. 485 also. 200 ml. Cino Radio Mfg. Co. Daily ex Sun, 12 m, 3:30 pm, 7-8, repp, entertainment, Central.

WIAB, Lincoln, Neb. 200 ml. American Radio Co. Mon, Wed, 8:30-9 pm, Central.

WIAC, Joplin, Mo. Redell Co.

WIAD, Waco, Tex. 485 also. 500 ml. Jackson's Radio Engrg. Lab. Daily ex Sun, 12:30-1 pm, markets, news, music; 3:30-4, news, music; 6-6:15, sports; 8:45-9:45, concert, news, Sun, 11-12 am, church service; 3:30-4 pm, music; 6-6:15, sports; 8:45-9:45, music, Central.

WJAE, San Antonio, Tex. 500 ml. Texas Radio Syndicate (Evening News. Mon, 9:30-10:30 pm, Tues, Thurs, Sat, 7:30-8:30 pm, concert, Central.

WJAF, Muncie, Ind. 100 ml. Muncie Press and Smith Elec. Co. Daily ex Sun, 8:30-4 pm, Mon, Wed, Fri, 7-8 pm, Sat, 6-7 pm, Central.

WJAG, Norfolk, Neb. 485 also. 150 ml. Norfolk Daily News. Daily ex Sun, 10:30 am, 12:15 pm, 3:30, 5:30, reports, Central.

WIAB, Rockford, Ill. Central Park Amusement Co.

WIAC, Dayton, O. M. C. A.

WIAD, Stockdale, O. 485 also. 250 ml. White Radio Lab. Daily ex Sun, 10:30-10:50 am, music; 11:05-11:20, reports, news; 6-6:30, music, news, Wed, 8-9 pm, concert, Sun, 2-2:45 pm, church service, Central.

WIAL, Portland, Me. Victor Radio Corp.

WIAM, Cedar Rapids, Ia. 50 ml. D. M. Perham. Mon, Wed, Fri, 7-8 pm, music, Central.

WIAN, Peoria, Ill. 300 ml. Peoria Star and Peoria Radio Sales Co. Daily ex Sun, 11:30 am, markets, weather; 1:30 pm, closing markets, agramms, bond news; 6:45, sports, Tues, Thurs, Sat, 9:15-9:45 pm, concert, Central.

WIAP, Duluth, Minn. 200 ml. Kelley Duluth Co. Mon, Thurs, 8-9:30 pm, music, Sun, 11-12 m, pipe organ, 12-1 pm, church service, Central.

WIQA, Topeka, Kans. Capper Publications.

WIAR, Providence, R. I. The Outlet Co.

WIAS, Pittsburgh, Pa. 150 ml. Pittsburgh Radio Supply House (Pittsburgh Leader). Daily ex Sun, 11-11:30 am, 2:30-3 pm, Mon, Tues, Fri, 7-8 pm, Eastern.

WIAT, Marshall, Mo. 100 ml. Kelley-Vawter Jewelry Co. Daily ex Sun, 2-2:30 pm, 5:35-6, concert, Central.

WIAX, Cleveland, O. 485 also. 500 ml. Union Trust Co. Daily ex Sat pm, Sun, 9:35-9:45 am, 10-10:45, 2-2:45 pm, 3-3:45, music, financial reports, news, Eastern.

WIAB, Chicago, Ill. Chicago Radio Lab.

WID, Granville, O. 100 ml. Denison University. Daily, 6-8 pm, concert, lecture, Central.

WIL, Washington, D. C. 100 ml. White & Boyer Co. Daily ex Sun, 1-2 pm, music, Tues, 7:45-10 pm, music, Eastern.

WIK, Toledo, 300 ml. Service Radio Equipment Co. Daily ex Sun, 2-3 pm, reports, Mon, Wed, Fri, 7:30-9 pm, concert, Sat, 2-5 pm, sports, news, Sun, 11-12:30 pm, 7:30-8:30, church services, Eastern.

WIJ, New York, N. Y. De Forest Radio Telephone & Telegraph Co.

WIJ, Newark, N. J. 485 also. 1,500 ml. Westinghouse Elec. & Mfg. Co. Daily ex Sun, 15 minutes hourly from 9 am to 6 pm; 12-12:30 pm; 7-10:15 pm. Miscellaneous program of highly varied nature. Sun, 8-10:15 pm, music, Eastern.

WKAA, Cedar Rapids, Ia. 200, 485 also. 200 ml. H. F. Paar. Daily ex Sun, 12:45 pm, reports; 5:30, reports, agramms; 6

ESKIMOS STEP TO TUNES FROM CFCN

Explorer, Returned from Far North, Tells How Radio Aided Party

CALGARY, ALTA.—Eskimos on the far side of the Arctic Circle in the land of eternal day, danced last summer to musical selections broadcast by CFCN, the station of W. W. Grant Radio, Ltd., Calgary, according to Mr. J. P. Henderson, of a Dominion Government exploration party, who has just returned from the country north of the mouth of the Mackenzie river.

Mr. Henderson carried a Radio receiving set chiefly for checking time observations, a valuable aid to survey work. Mr. Henderson stated that he was in constant touch with powerful Radio stations in all parts of the world, and that there was no other piece of exploration equipment so highly appreciated by his party. It was necessary to ascertain the correct time daily to within one-thousandth of a second in order that the latitude and longitude of various points might be determined accurately and placed on maps being prepared by the Dominion survey party Mr. Henderson accompanied.

Hear Plant 2,000 Miles.

Tests were carried on between CFCN and the explorer when the party was located at the mouth of the Mackenzie river, a distance of more than 2,000 miles. By this means lonely members of an isolated survey party, placed on vast wildernesses in the unmapped north, were kept in direct and daily touch with the important happenings in the outside world.

At Lake Chippawyan, hundreds of miles north of Calgary, musical selections broadcast by the station came in loudly enough to be heard distinctly ten feet from the phones, while even farther north, at Fort McPherson, well within the Arctic Circle, the music was loud enough to fill a large igloo. It was on this occasion that the native Eskimos held an impromptu dance, stepping the weird measures of the native dance to the tune of the latest fox-trot.

W. W. Grant, announcer at CFCN, is now the proud possessor of an unpronounceable name conferred on him by the Fort McPherson natives which, literally translated, means "the voice from the box."

"Wave Filter" Is Devised by Expert

Coupled Circuit Elements Separate Signals of One Station from Another

MADISON, WIS.—The Radio problem of separating the signals of one station from those of other stations, has been the subject of a number of mathematical investigations carried out by Prof. Edward Bennett, chairman of the electrical engineering department, Prof. H. M. Crothers, and Leo J. Peters, research instructor in the University of Wisconsin College of Engineering.

The most recent of these investigations carried out by Mr. Peters, has resulted in the devising of an electric wave filter, built up of coupled circuit elements. An article giving a quantitative mathematical study of the operation of these coupled circuit wave filters in the steady state, and presenting methods of designing these filters for any specified set of conditions, has been prepared by Mr. Peters, and will be published in the near future.

"The whole story of the value of a wave filter when used to eliminate disturbances is not given by its 'steady state' proper-

ties alone," said Mr. Peters. "Of equal or of even greater importance is the action of these devices in the 'transient state.'"

"A quantitative mathematical formulation of the action of a wave filter in the transient state is difficult and complicated, but methods of handling the problem are being devised and used which should make it possible to obtain some interesting and valuable results in the near future."

The chief importance of these results so far lies in the fact that, although they do not give any new solutions, they do show why so many attempts fail.

Detroit Amateurs Send Christmas Messages Free

DETROIT.—If you are a Detroitite and have friends living in Hawaii, Canada, Porto Rico, Alaska, or in any part of the United States, to whom you would like to send Christmas greetings by Radio, the Detroit Radio Association, will undertake to transmit Christmas cheer to them free of charge. Blanks for transmission, similar to telegraph blanks, have been placed by the association in several downtown stores handling Radio apparatus, and in the lobby of The Detroit News.

All a person need do is to get one of these blanks, write a message on it, and leave it in charge of the person who supplied the blank. A messenger comes around every evening to pick up messages and distribute them to various owners of amateur transmitting stations. These amateurs will send the messages by Radio, and other amateurs at the receiving end deliver them.

MILLIONS TO RADIO

(Continued from page 5)

and a chance to put their ideas and inventions before the public."

Helps Young Fans.

Col. Green cited the case of five little boys in New Bedford, the oldest only twelve, as a sample of what he proposes to do for the young amateur. They had each made a receiving set, but could not make them work, and went down to Round Hills House seeking help in solving their difficulties. With Mr. Price of the Western Electric Company, a visitor at Round Hills at the time, Col. Green worked over their sets at the 100-watt station and had six of the ten sets the boys brought with them in working order before they left. There are hundreds of such boys, as well as young men and experimenting college professors whom the Colonel wants to help.

Interested First in 1898.

The mystery of Col. Green's interest in Radio is no mystery at all when the facts are known. He became a "bug" back in 1898, but through pressure of business, was obliged to drop it. Not long ago, when on a sick bed down in Texas and needing something to fill in the empty hours, he recalled his interest in Radio. He took it up again and resolved to make it a hobby worth while, with practical results from it to follow. Now he eats, thinks and sleeps in terms of Radio.

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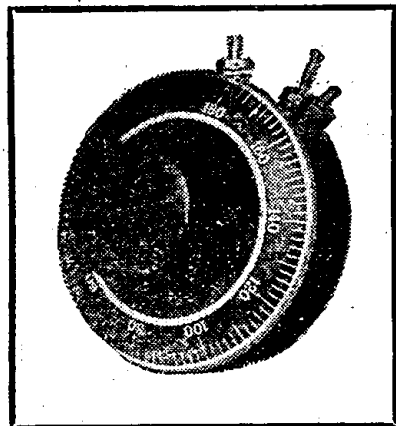
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VARIABLE CONDENSERS

- \$4.30 Value, 43 PLATE, now \$1.75
- \$3.70 Value, 23 PLATE, now \$1.45
- \$3.30 Value, 11 PLATE, now \$1.35
- \$3.10 Value, 5 PLATE, now \$1.25
- \$2.70 Value, 3 PLATE, now \$1.15

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U. S. Army Signal Corps, Type B. C. 14-A. Radio Sets, \$23.95

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Solid Copper Aerial Wire, 100 ft.35c	2-Slide Tuning Coils, at \$1.95	Anti-Capacity Switches.....\$1.50
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Cord Tip Plugs.....60c	Phone Caps, for mostly all phones \$25c	Hydrometers, now at \$45c
Lightning Arresters.....95c	Signal Corps Hot Wire Ammeters, at \$5.45	Radico Crystal, at \$35c

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Talking with Yesterday

"Turn Back Time in Thy Flight, Make Me a Boy Again—"

RECENTLY an owner of a transmitting station on the Atlantic coast asked a gentleman in Hawaii the time of day. The answer came back in four minutes and eighteen seconds, "11:35." The newspaper item said, "The message sent out from the Atlantic coast Wednesday morning reached Hawaii on Tuesday night the day previous." The message was, of course, relayed across the United States, as interested fans took up the message and passed it on to find out the result. The distance covered was between 5,000 and 6,000 miles.

Four-minute connections between the Atlantic and the Hawaiian Islands without any preliminary arrangement to notify the receiving end to be ready for a message is of course an achievement which might have been frustrated but for favorable circumstances. But it indicates the possibilities of Radio in the hands of amateurs as was the case in this instance.

But the reason we do not become excited over it is because we know that in a short time we will be able to talk with yesterday in less than four minutes. Talking with yesterday is easier than guessing the possibilities of tomorrow.

What Is the Limit of Wave Lengths?

There May Be a Wave Length for Each Transmitter

ABOUT the only means of knowing to whom you are listening in when the air becomes filled with interfering messages and thousands of operators are "pumping the key," will be to assign a definite wave length to each station. This may be impractical at present, for we have very little knowledge concerning the ultimate in limitations of Radio selectivity. At present the lowest used wave lengths range from 150 to 200 meters. These are the lengths to which amateurs are confined. This is the practical low limit for Radio transmission at present time, according to scientists. The question arises, how far can we go below and above this wave band?

It is now claimed that a test has been designed and is in operation that uses wave lengths as high as 500,000 meters. If so, and at any one time there are 1,000,000 transmitting licenses, then each plant may have a certain definite measurement of a half meter.

The highest wave length in practical use now is 25,000 meters, the high length for secret naval communication. Commercial companies use wave lengths of 1,500 to 1,800 meters, while government stations send out public reports on wave lengths of 2,500 to 3,000 meters. Experiments are being carried on to see if much higher wave lengths can be used satisfactorily.

Sounds That Broadcast Best

Not All Musical Instruments Transmit Well

FROM many months' experience the managers of broadcasting stations state that the human voice will be more easily picked up at the receiving end than any other sound. The soprano will be most faithfully reproduced by the transmitting microphone and the receiving instruments.

The brass instruments are most difficult to transmit. The saxophone and bassoon cause trouble by the clicking of the stops. When these instruments are played on the stage the working of the stops is not heard, but in broadcasting all of these clicks are caught and are not only reproduced, but exaggerated. The piano gives some trouble, and it has been only recently that broadcast managers have been able to send instrumental music through the air with any degree of faithfulness. Experimentation with all kinds of microphones has nearly solved the troubles.

Stringed instruments have given no trouble from the start. Especially is this true of the violin. Instruments of percussion, such as the bells and xylophones, and woodwind instruments, like the clarinet and flute, are very easily reproduced.

It is quite an art for the broadcast manager to place the pieces of an orchestra so that the best will be obtained from each instrument. If brass instruments are too close to the microphone the clicks from the keys will be heard through all the music.

Condensed

By DIELECTRIC

My receiving set happens to be one of the thousands in the East ready on an instant's notice to tune in opera from the Metropolitan Opera Company—when it comes. Will they stand off a great while longer against the pleas that are pouring into their offices? It is a fortunate thing the fans in this section of the country have such a friend, as RADIO DIGEST, at court. If the plan to have operas from KYW relayed becomes an accomplished fact, then everybody will be assured some wonderful evenings, for Our Mary is much beloved in these parts—not to mention other great artists in the Chicago company. Just a little patience, my anxious music lovers, and we shall see what we shall hear!

Were a member of your own household to leave for a distant point and no word come to you of safe arrival, after several days, worry would be the thing you would do the most. To secure some news of the lost one what means would suggest itself to you? Police headquarters, in New York City, broadcasted a message which announced just such an incident as described here. The wife of a New York senator had left in an auto for Atlantic City, N. J., and all trace of the car and occupant had been lost. Many heard that beseeching message to report any information regarding the case. This is merely a practical example of but one of the uses of Radiophony.

It is to be noticed that one station after another is giving heed to the request for silent periods. In time even those of us who have sets incapable of being tuned for distant stations, when the nearby ones are roaring in, will have a chance to play "Radio Golf."

If Station WGM continues to give the broadcasting service which that station is now rendering, there is reason to believe it will continue to be a class B station. And how I do like to hear the announcements from that Southern gentleman, whose voice is vibrant with hospitality for the entire fraternity of listeners in. Even in Canada the programs from this station in Georgia are picked up and enjoyed. Did you ever stop to think of the cost were you to listen to a voice over the telephone wires for that distance? Let the stations know of your appreciation of their efforts to please. It will help them more than you think possible.

Don't lose sight of National Radio Week, for many new fans will be added to the ranks if each of us does all he can to boost. You may think that because there are so many now interested in Radio that little can be done to increase the number. There are always a multitude of skeptics who hesitate to accept any new thing until they have tested the thing for themselves. You will come across some of these creatures, and when you do, get them to listen in. We have proof enough to convince the strongest disbeliever. Provide it.

Another of the multiplying instances where Radio is made use of to supply a valuable service is to be found in the recent announcement by the United Fruit Company. This company will give free medical Radio service to ships at sea from its hospitals in Central America and from its ships. What this will mean to many a sufferer far out on the ocean is obvious. Many vessels are without medical advice, except as they may receive it from some more fortunate source. Selfishness is seldom to be found, at least unadulterated, in the spheres of Radio's influence. As time goes on, this medium will receive a larger share of attention as a humanitarian instrument.

One evening not long ago Gordon Selfridge, Jr., talked from Station WJZ in the hopes that his father, who is in England, would hear him. Think of the possibilities ahead of us when a voice from Europe may be heard without difficulty by listeners in on this side the Atlantic. In case some catastrophe befall a town in a country through which your dearest friend is passing, he can dispel your fears for his safety in a manner impossible heretofore. A message in cold type does not carry the conviction that an oral one brings. To hear the voice that you know so well coming through your receiving set from thousands of miles away will make you more than ever grateful to those who have labored to bring this feat to pass.

Those of you who were so fortunate as to hear the wonderful concerts of the New York Philharmonic Orchestra, thanks to Station WEAJ, upon the occasion of their playing in the City College, will permit me to express here the emphatic success of the venture. To shut-ins it must have been a thrilling experience to hear the strains of classical music from one of the greatest orchestras in the world; to listen as Prof. Palmer gave in delightful manner a resume of the lives of the composers and an intelligent critique of their compositions on the orchestra's program; and to feel the sense of nearness to it all when thunderous applause followed each number. The cultural effect of such concerts, in my estimation, is of considerable importance to the progress of our society and should prove a determining factor in considering the continuance of broadcasting orchestral concerts.

The scientific achievement which has made possible transmission of organ music, so that its reception is entirely natural, should receive the unstinted praise of those devotees of this great instrument. Through the generous aid of Mayor Kohler, of Cleveland, Ohio, many of us heard recently a concert given on the new city auditorium organ through Station WJAX and it was well worth listening to. The organ is in a class by itself and not easy to broadcast.

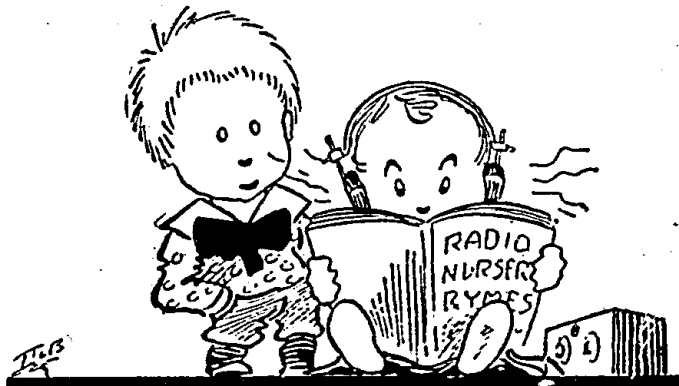
RADIO INDI-GEST

Hatching Well Behaved Chickens

At a Radio show in Salt Lake City a "trained egg" was exhibited: Must have been an important adjunct to a perfect "set."

1922 Nursery Rhymes

Old King Cole was a merry old soul,
You'll note that we say he "was."
They're after his pipe, having taken his bowl,
But he still gets his Radio "buzz."



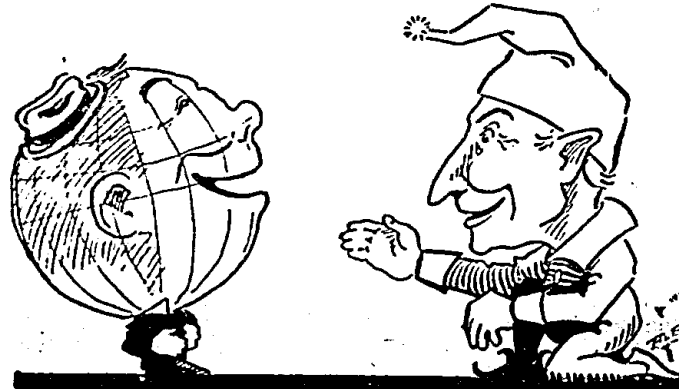
Jack and Jill went up the hill
And put up their "antenny";
Now every night, with music bright,
They entertain the many.

Daniel Never Entered One!

Santa Ana, Cal., has a "Radio Den." It is the business home of a couple of foxy dealers.

Radio

Inland so deep all roaring waves are still;
So far at sea that dock lights long have died,
And there's no sound of any train or mill;
Across the mountains high and deserts wild,



Where are lights flare, or candles softly glow;
Past harbors where ships lie with canvas furled;
From sunrise to the twilight's afterglow,
Man's puny voice is heard around the world.
—NEW YORK HERALD.

Quod Erat Demonstratum!

Jimmy—You take this wireless receiver I just finished making, and go down stairs in the cellar; hold it close to your ear and listen.

Freddy—(after waiting in suspense for several moments in the cellar)—Aw—it's a fake; I don't hear a thing.

Jimmy—Good! That shows it's workin' right. I didn't say anything yet.

The Medium

Invincible am I, no matter what folks say,
They may lie, just as they like; but the truth will have its way,
The Radio am I—and no matter where you are,
Your secret thoughts I will reveal, just as your spoken are.



I am the secret messenger of Him who made the earth,
I record all your thoughts and words from the moment of their birth,
But more than that, I'll tell you; just as sure as you are born,
That sheep feed in the meadow, and cows get in the corn;
There is a man just now on earth,
Whose spirit's had a second birth.
In earliest days of earth he walked,
He whistled, sang, he leaped and talked.
Who is this man? Well, I don't know
That you'll believe. Therefore I'll go.

Effective Radio Frequency Amplification

Part I—Advantages and Disadvantages of Amplifying Methods

By Laurence C. F. Horle, Research Engineer for The Federal Telephone and Telegraph Company

IN THE past the need for means for effectively amplifying Radio telephone and telegraph signals has been met by methods for amplifying the telephone currents made available through the medium of a detector, either of the vacuum tube or crystal type. This problem is a comparatively simple one since it involves the manipulation of currents of comparatively low frequencies. These currents, since their frequencies are of the order of 50 to 5,000 cycles per second, are identical in

that with a highly effective amplifier of the inductively coupled type several cascade stages of tube-transformer combinations are quite reliable and satisfactory in operation, but that the addition of one or more additional stages does not make available increased amplification, but, on the other hand, the whole system is made unusable by the resultant noises, usually of the form of "singing" or "howling." This "howling" is usually due to inter-

voice currents. When amplification of the energy of these higher frequencies is accomplished in conjunction with voice frequency amplification a degree of amplification is made available that is quite impossible of attainment by amplification at a single frequency.

R. F.-A. F. Scheme Doubly Effective
This scheme of amplification at two different frequencies, namely, first, at the Radio frequency as it exists before the signal current is rectified by the detector,

and rectification by such detectors as crystals and vacuum tubes. This comes about through the fact that while the number of cascade steps of amplification at any frequency is quite definitely limited by the "howling" which results from the use of too many stages, it is quite possible to amplify the unrectified Radio frequency currents with several cascade steps of tube-transformer combinations, and then after the signal currents have been rectified by the detector, to amplify the voice

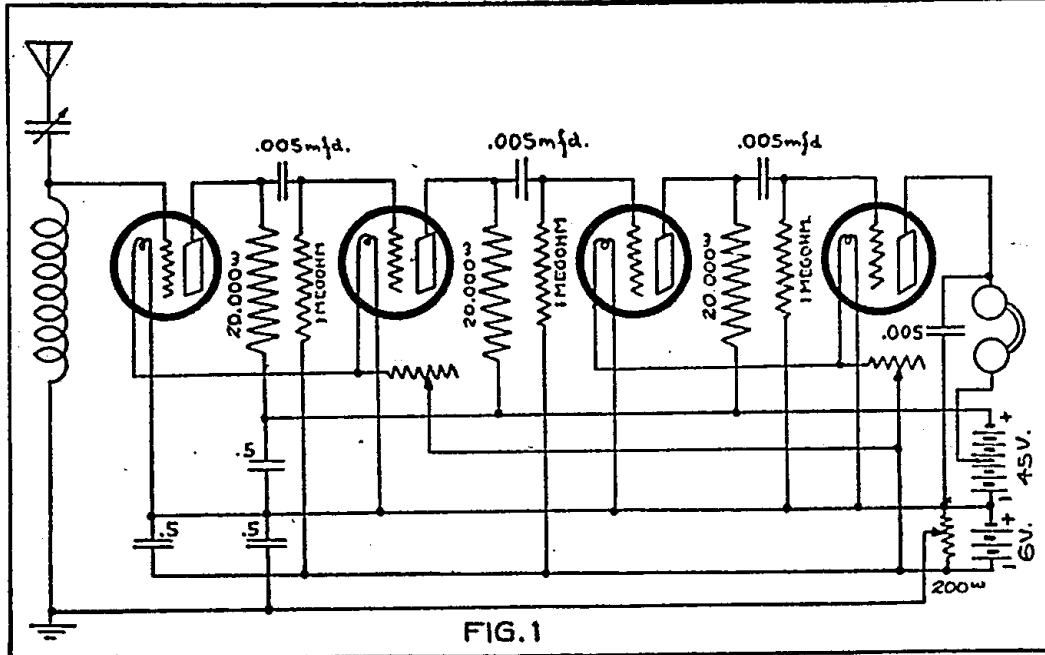


FIG. 1

their nature with telephone currents and have been operated upon by the same methods and with the same types of equipment as have been used in voice transmission in the very common wire telephony. The problems met with in the design and operation of such amplification equipment are comparatively simple since the characteristics of the commonly available materials at voice frequencies are well known and the means for investigation of the incidental phenomena well established.

Disadvantages of A. F. Amplification
Low frequency amplification, notwithstanding its comparative simplicity, has its very definite limitations and disadvantages. By its very nature it amplifies interfering signals and noises as well as those that are desired and, unless great care is used in the design and construction of the equipment, it introduces by its use interfering sounds that may make

actions in the amplifier that are quite inherent in tube-transformer combinations and usually limits effective amplification to two or at most three cascade stages.

Means of Extending Amplification
It has therefore been necessary to devise some other means for extending the degree of amplification that may be secured beyond that of the audio frequency or voice frequency amplifier of ordinary Radio practice. The obvious means for securing this increased amplification is that of the amplification of the signal energy as it exists in the antenna circuit and before it has been rectified by the detector.

As is well known, signal energy before passing through the detector exists in the form of currents having exceedingly-high frequencies; in broadcast telephone reception, for instance, the frequency of these currents is approximately 800,000 cycles and hence many times the frequency of the

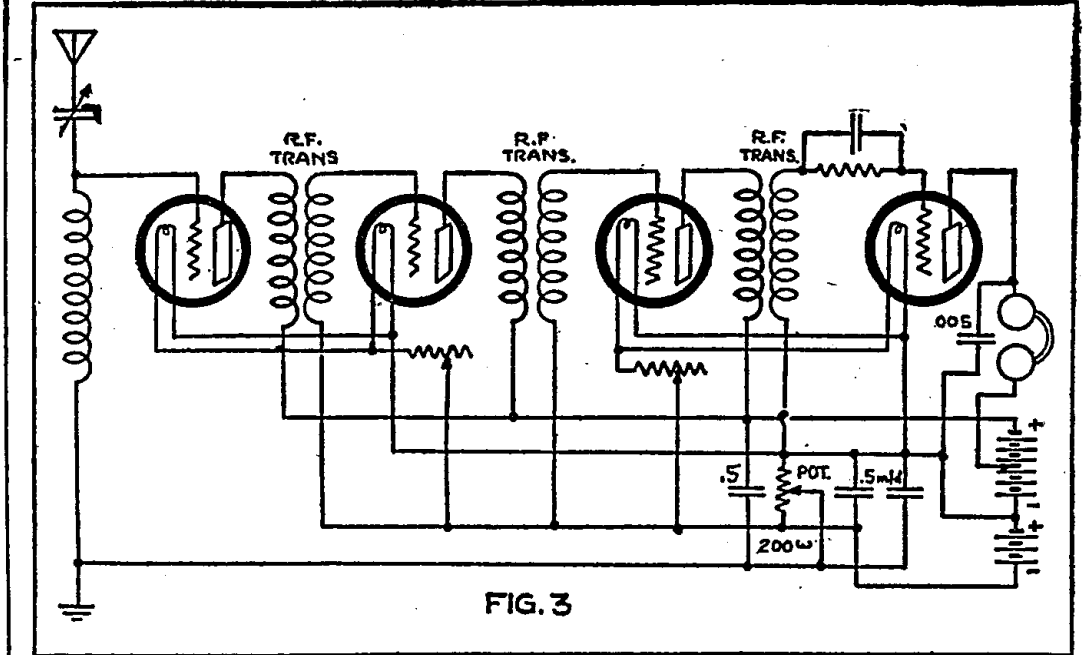


FIG. 3

and second, at the voice frequencies as they exist after rectification by the detector, is doubly well suited to the characteristics of the cascade amplifying scheme

frequency currents without serious interaction between the Radio frequency amplifier and the voice amplifier.
(Continued on page 12)

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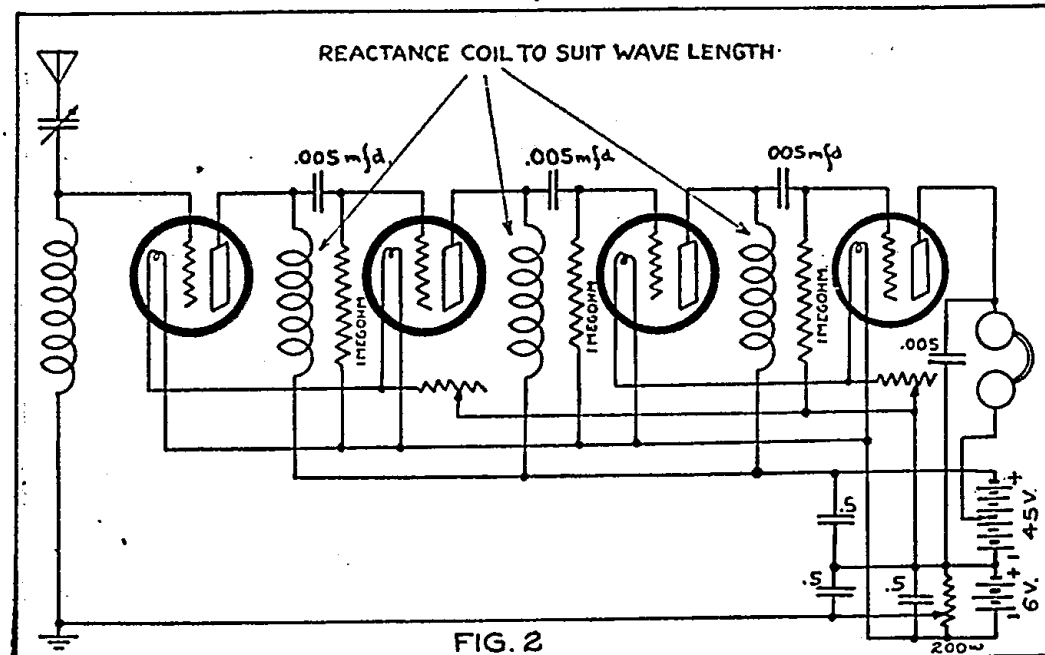


FIG. 2

the amplified signals less intelligible than the unamplified and weaker signals.

This latter difficulty has been satisfactorily overcome in careful transformer design and proper location of the constituent parts of the amplifier relative to one another, but not without a definite limitation as to the degree of amplification that may be secured by this method of amplification.

Experience has shown, for instance,

RADIO MAILING LISTS
22,400 Radio Dealers, covering U.S. by states Per list \$ 7.50
2,512 Radio Mfrs., covering U.S. by states Per list \$ 5.00
2,757 Radio Supply Jobbers, covering U.S. by states Per list \$ 5.00
200 Radio Stations Per list \$ 4.00
257 Mfrs. who make and assemble complete Radio Sets Per list \$ 4.00
25,000 Radio Amateurs & Mfrs. of Radio Stations. Per list \$ 7.50
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Serviceable Homemade Loose Coupler

Tuner Made of Parts Found in Home Shop

A good and serviceable loose coupler may be made by the amateur at little cost, and with ordinary tools. The necessary parts are as follows: One piece of wood

WORKSHOP KINKS? EARN A DOLLAR—

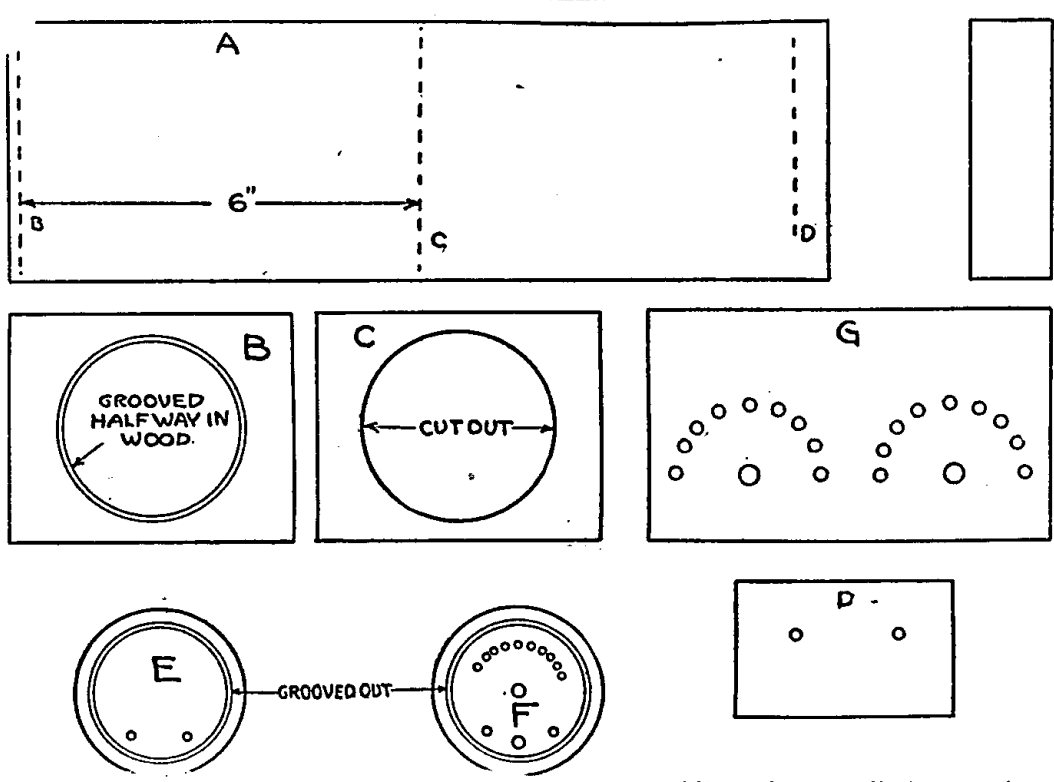
THERE are many little kinks worked out at home that would aid your fellow Radio worker if he only knew about them. There are new hook-ups, new ways of making parts and various unique ways of operating sets that are discovered every day. RADIO DIGEST is very much interested in securing such material.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

RADIO KINKS DEPARTMENT,
RADIO DIGEST,
123 West Madison St., Chicago, Ill.

12 inches long and 4½ inches wide; two pieces 4½ inches long and 4 inches wide for the uprights of the primary coil; one piece 3 inches long and 2 inches wide for the secondary slide rods; one piece 6 inches long and 4 inches wide for the switch points of the primary and two pieces 2½ inches in diameter.

The primary coil which is wound on the cardboard covering of a common dry cell is wound with No. 26 single cotton covered soft copper wire. The piece B is grooved halfway in so as to receive the primary tube, the piece C is cut out as

WOODEN PARTS FOR COUPLER

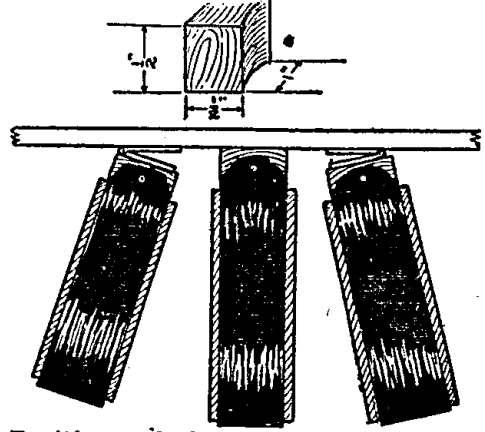


shown in the illustration so that it will receive the other end of the primary tube. In winding the primary tube it is tapped about 15 or 20m time, the ends being connected to the switch points on the piece G. The pieces E and F are the ends of the secondary tube which is 2 inches in diameter and 4 inches long. Both are grooved to receive the tube. If desired, the secondary, which is wound with No. 28 single cotton covered copper wire, may be tapped and brought out to the switch points on F.

In assembling the set, B fits on A on the dotted lines marked B, and C fits on C on the same lettered dotted line and D on its respective lettered lines. The part G goes on either side as desired and is fastened to the sides of B and C. The secondary slides on rods that are fixed to B and D, either by jointing or by running them all the way through and fastening with nuts. The rods run through the secondary and through the small holes bored in E and F. The two terminals of the secondary are carried through a small hole and fastened to binding posts on A. The two primary terminals are brought to binding posts on G.—Rowland Atwood, Edmonds, Washington.

How to Make Simple Honeycomb Mounting

An inexpensive honeycomb coil mounting can be made as shown in the illustration. The mounting consists of three small blocks ½ inch square and 1 inch long and two small hinges about 1 inch wide with a ¼-inch wing. One side of each block is hollowed out to fit the coil side and these are fastened to the coil with a black tape tacked to the blocks. Two of the coils are made to swing by fastening the hinges to the supporting blocks. The hinges are attached to the panel.



Positions of the coils are obtained by swinging them on the hinges, using a small stick to prevent body capacity effects.—Charles Smith, St. Joseph, Mo.

If you have aspirations to own a transmitting set you must first learn to receive code at the rate of ten words per minute before a license will be granted to you. An examination on theory is also given.

An inside aerial will not work very well with a crystal detector.

R.F. AMPLIFICATION

(Continued from page 11)

plification and voice frequency amplification system, so that as many stages of voice frequency amplification may be used as when no Radio frequency amplification is used. The Radio frequency amplifier, therefore, allows us to secure additional amplification which may be used either with or without the well established methods of voice frequency amplification.

Telephone Response Squared

Another and exceedingly important advantage arises from the fact that in the use of a vacuum tube as a detector, the response in the telephones in the plate circuit for a given signal voltage applied to the grid is not directly proportional to the voltage applied to the grid, but on the other hand, for grid voltages less than a certain limiting value, no response may result in the telephones, while for voltages somewhat in excess of this "threshold value" the response is more nearly proportional to the square or some higher power of this voltage. That is, if by Radio frequency amplification between the antenna circuit and the detector tube, the voltage made available to the grid of the detector tube is doubled, the telephone response is not doubled, but is increased to four or more times its original value.

Thus not only is it possible to secure greater amplification without serious instability and "howling" through the use of R. F. amplification, but by its means it is possible to make available signals of such insignificant intensity as would be quite indistinguishable without it, and where signals of noticeable intensity are available, to take advantage of the square law of the detector by amplifying before rectifying.

R. F. Limitations Modify Results

There are, however, serious limitations that occur in the use of Radio frequency amplification that make its application somewhat less generally useful than it might otherwise be. The most serious limitation comes about through the fact that the wave length range over which it may be depended upon to have reasonable efficiency is always seriously limited, regardless of the method used to secure amplification. It is found, for instance, that if resistance coupling, Figure 1 is used, as is usually the case where a wide wave length range of amplification is desired, the amplification at longer waves will almost invariably be better than the amplification at the extremely short waves and usually it will be found that the maximum amplification will occur over a comparatively narrow band of wave lengths.

Transformer Type of Coupling Best

The reactance coupled type shown in Figure 2 and the inductively coupled type of Figure 3 are subject to the same difficulty but in a greater degree than in the case of the resistance coupled type. These latter types give so much greater amplification per stage, however, than does the resistance coupled type that the narrower wave length range is usually well justified by the greater amplification which is available.

The reactance coupled type can be con-

structed to have a somewhat broader wave length range than has the usual transformer coupled type, but the additional complication and certain irregularities in its action have militated against its general use, so that at this time the transformer coupled type is finding widest use.

It is essential, however, in using high frequency amplification that it be borne in mind that it is essentially a device of narrow wave length range and that where great amplification per stage is desired, a sacrifice of range must, by the very nature of the scheme, be countenanced.

High Amplification Instability

In addition to the limitation of wave length range which is inherent with Radio frequency amplification, there is an additional difficulty met with in this amplification scheme, due to the instability which invariably accompanies high amplifications. In this, Radio frequency amplification differs not at all from audio frequency amplification since both suffer from instability when high amplification per stage is obtained.

This instability results directly from the fact that where transformers of high impedance, as compared with the tube impedances, and low loss are used, the coupling between successive stages of amplification which is inherent in the interelementary tube capacities becomes sufficiently great to allow of the entire system to generate. In the case of the A. F. transformer coupled amplifier, the system generates currents of audible frequencies and we say that it "howls" or "sings." In the R. F. amplifier, however, when the system generates, due to the tube couplings, the frequency generated is usually of Radio frequency and is, therefore, inaudible. This generating state is quite fatal to the amplification that may be secured from the device and satisfactory means must be provided whereby it can be avoided.

Editor's Note.—In Part II to appear next week, Mr. Horle will tell the methods of avoiding R. F. generation, his experimental results in testing the efficiency of various makes of transformers, and many other salient points of interest.

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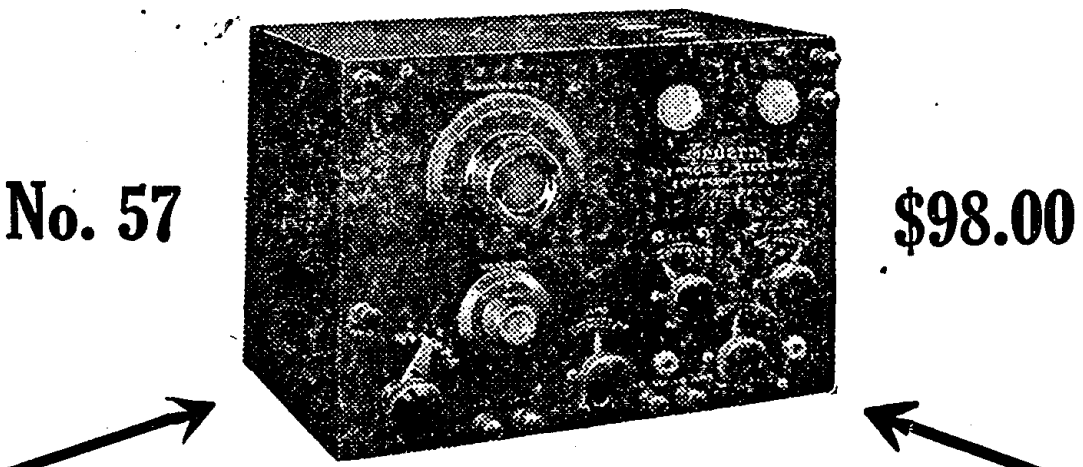
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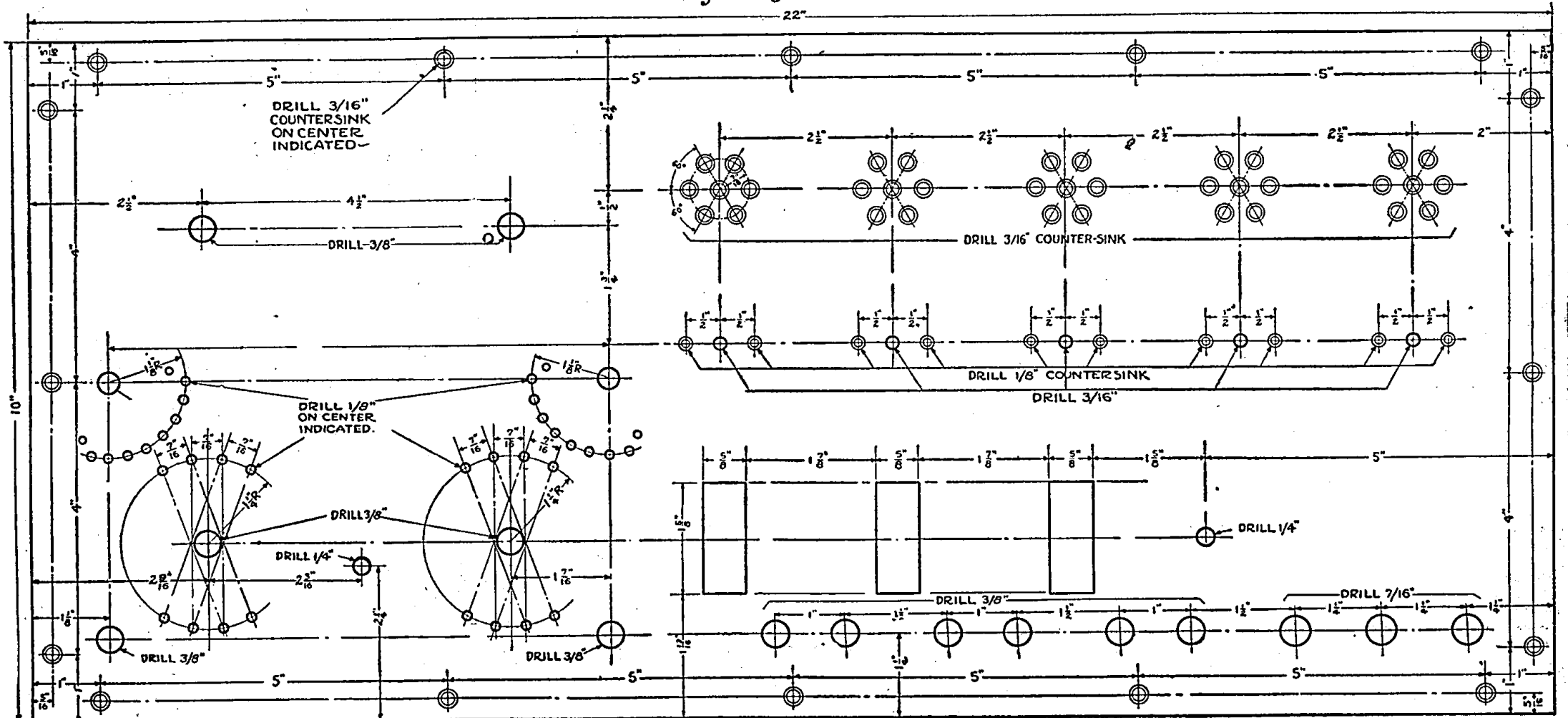
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Five Tube Radio and Audio Frequency Receiver

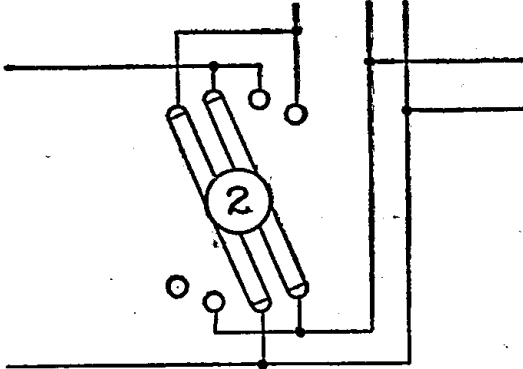
Panel Layout for Popular Circuit Described November 18

By H. J. Marx



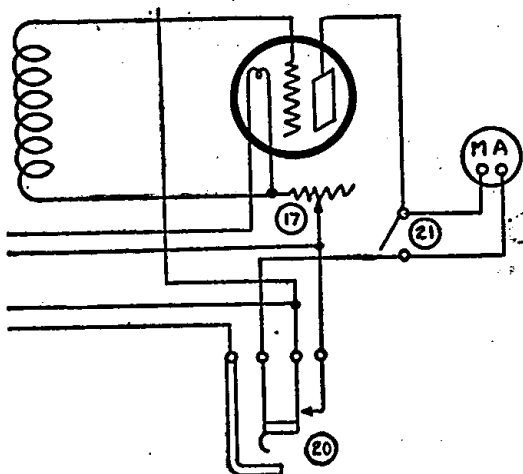
THE LURE of vacation and summer recreation with its decided attractions for outdoor life was the cause of a decided loss of interest in the field of Radio. Immediately a host of joy-killers, with an "I-told-you-so" expression, gleefully reminded the Radiophans that Radiotelephony was only a fad which had reached its last stages and would soon be buried in the past. In spite of the enthusiasm of the old timers, the expected return of its popularity was considerably delayed until even the most faithful began to grow skeptical.

Now, however, this is all gone and past.



Not only do we have with us the old host of amateurs and dyed-in-the-wool-fans, but a new army of Radio bugs have taken possession of the country. The newcomers naturally are taking up the simpler and more easily operated circuits, while the older fans are greedily searching for new hook-ups more advanced and more efficient in operation and more flexible than ever before.

In the November 18th number of RADIO DIGEST ILLUSTRATED, this circuit was given together with a complete description and list of apparatus required. Furthermore, it included a promise of a second article giving a description of the



2ND STAGE AF.

panel lay-out in assembly of the instruments. Unfortunately, the demands for the Flewelling and the Rheinartz circuits were so insistent and numerous that the continuation of this first article had to be delayed. The popularity of the hook-up of this type, however, was evinced in the fact that three telegrams, eight special delivery letters, and several hundred other letters were sent in requesting information

relative to the date of continuation of the article and further details regarding the circuit. Before going further, it will be necessary to state that due to the haste in which the drawings for the first article were made, an error was discovered in the diagram, the correction for which was made on page 13 of the November 25th number, and in addition another change has since been made. Both corrections are shown on this page.

Circuit Absolutely Practical

Many of the letters requested information as to the practicability of the set. A statement might be made at this time that this circuit is not a mere guess-work and pencil creation. On the contrary the lay-out given on this page is taken from assembled sets, one of which is completed and a number of which are being made by the author for various friends.

A few slight changes were made due to the size of the panel permitting only a limited number of instruments and also because one or two parts were not absolutely essential. Both the ammeter and milliammeter with the switch No. 21 were omitted, while the series-parallel switch No. 1 was omitted not only because of lack of space, but also because it is a simple matter to change the connections from the outdoor antenna to the loop antenna when desired. In fact a small neat double pole double throw knife switch can be mounted on the wall where the lead-in and ground connection are fastened with the two loop aerial terminals on the opposite side of the switch, and the center post connected to the two terminals on the cabinet. Thus either type of aerial can be utilized by means of the knife switch. It was found that the two variable condensers 11 and 12 could easily be omitted without unfavorable re-action on the efficiency of the circuit.

Type of Apparatus Used

As far as possible it is advisable to use only the best type of instruments obtainable. Unfortunately this is not always possible. Then again, the difference at times hardly warrants the recommendation of any particular makes. In laying out the panel the maker is cautioned to consider the dimensions in mounting details of the apparatus he is using, as slight variations may be required. In the case of variable condensers, only the shaft location is given on account of the various mountings used by the different manufactured instruments. While the size of the holes along the edge of the panel for the screws that fasten it to the wooden cabinet, are given, these holes also may have to be larger or smaller depending on the size of the cabinet and the method of mounting used. The combination type of socket rheostat was used for the mounting of the vacuum tubes. Off hand, it would appear that these are mounted rather low, but it should not be overlooked that sufficient room had to be provided to permit the insertion and extraction of the tubes.

Description of Parts Used

Condenser No. 4 has 43 plates and does not require a vernier. Condenser No. 7, however, is a 23-plate variable with vernier to permit more accurate tuning of the secondary circuit. The series-parallel switches can be any of the standard types,

many of which are on the market. The variocoupler should be preferably of the highest grade such as the molded bakelite kind. In regard to the anti-capacity switch, this should be of the single row, six spring type, of which there are only one or two makes on the market. Care should be taken in the selection of proper and efficient Radio frequency transformers. Similarly the audio frequency transformers require careful consideration, although many more of these will be found on the market. The jacks require no special description, as a number of good ones are easily obtainable.

Location of Apparatus on the Panel

The two variable condensers, 4 and 7, are on the top of the left end of the panel. The coarse and fine adjustment tap switches of the primary of the variocoupler, are immediately below. The two series-parallel switches, 2 and 3, are below the tap switch locations. The variocoupler is located between these. The antenna and ground connections are indicated by the two 3/8-inch holes on the bottom along beside the lower end of the series-parallel switches.

Instead of binding posts, the small jack type connections, in which an ordinary telephone cord tip is simply plugged in, are used. This facilitates easy connections and avoids the troublesome binding post problem with their usual unsightly appearance.

The five sets of seven circles running along the top of the panel on the right are the peek holes for observation of the tube lighting. The sets of three holes directly underneath are for the mounting of the socket rheostat combination.

Mounting Anti Capacity Switches

The three rectangular slots are for the anti capacity switches, 8, 9 and 10. A hole is required above and below this slot for fastening each switch to the panel. It is advisable, however, to drill these holes with the switches in place.

One hole on the right side of these three rectangular slots is for the mounting of the potentiometer. The six holes

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below furnish the location of the battery connections, although seven are indicated in the original diagram. The negative poles of the plate batteries were connected together to a common negative terminal, thus eliminating one jack. The jack used is similar to that described for the antenna and ground connection. The three holes to the right and in line with these are for the three jacks, 18, 19, and 20, controlling the detector tube and the tubes for the audio frequency amplification stages.

Cabinet and Panel Details

The panel dimensions as shown are 10 inches by 22 inches and should be of either formica or bakelite, one-quarter (Continued on page 14)

Government Radio Storage Batteries

Absolutely new Signal Corps Aeroplane batteries. Edison 3-cell, type BB-4, \$4.50; Willard 4-cell, type SYL-13, \$4.25; Willard 2-volt, 40 A. H. for WD-11 tubes, \$4.75; 6 volts Edison, \$7.75; Edison "B" battery elements, 4c each.

Flewelling .006 Condensers

Ruby mica, Bakelite mounted, with binding posts, set of three, \$2.90.

Flewelling Variable Grid Leaks

Clear up music and increase signal strength of any circuit, 75c.

Reinartz New Spiderweb Coils

Green silk wire, Bakelite form, \$1.95.

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Far better than condensers. Use on light or phone wires. Complete, \$2.90.

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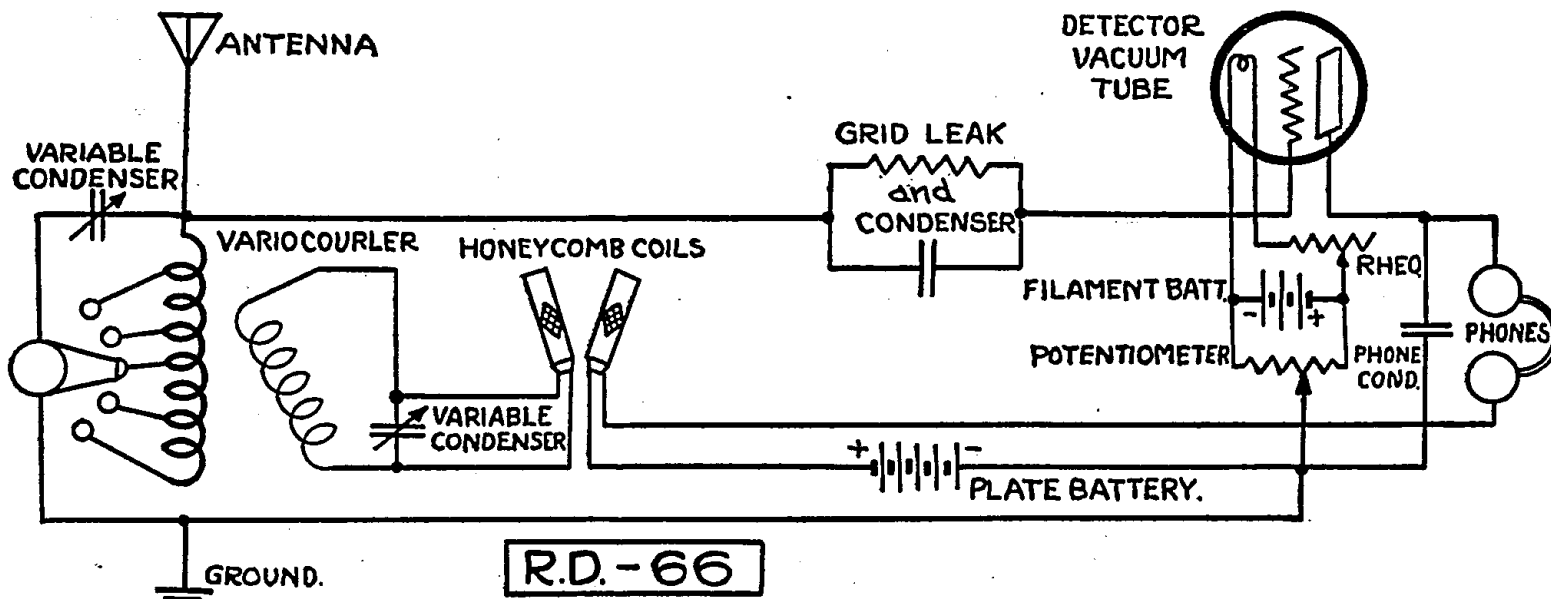
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HOOK-UP HAVING SELECTIVE QUALITIES



R.D.-66

THIS hook-up is of the regenerative type. It has peculiar selective qualities which make it especially desirable for the amateur who has considerable trouble with interference. The fixed, tapped winding of the variocoupler is used for both the antenna and grid circuits, while the rotor is connected to a honeycomb coil and tuned by means of a variable condenser. Regeneration is accomplished by means of another honeycomb

coil which is inductively coupled to the first one. The values of the honeycomb coil should be 25 turns for the first one and about 50 turns for the one in the plate circuit. The grid leak-condenser combination employs values of about 1 megohm and .00025 mfd. A detector vacuum tube is used, the filament of which is controlled by rheostat. Twenty to 30 volts are used in the plate circuit. A .001 mfd. phone condenser is connected as shown. A 200-

ohm potentiometer controls the grid potential and is of additional assistance in tuning selectivity. The multiplicity of controls makes the circuit somewhat difficult to operate at the start.

Dip Varnish on Coils Removed Centrifugally

When honeycomb coils were first manufactured for Radio work, they were dipped in an insulating varnish to hold the turns together securely without the possibility of damaging them from handling and to protect the insulation on the wire.

It was known, however, that energy losses occurred in the varnish, as it acts as an imperfect dielectric between the turns. Therefore, if the varnish could be removed, except for a thin film, from the interior of the coils, the capacity and high-frequency resistance would be reduced.

Of a number of tests to accomplish this result, the last was the simplest, most effective and most economical. The coils were dipped and then put upon a revolving shaft. Centrifugal force threw off the excess varnish and dried them so that the time required for baking was greatly reduced.

Honeycomb coils are all treated in this manner now, with the result that they are much more efficient electrically than before the centrifugal method was adopted.

Less efficient broadcasting stations have poor modulation. The voice and music is not clear. This can be eliminated by the transmitting station.

The Reader's View

Flewelling Is Armstrong "Flivver"

Careful study of the Flewelling "super" circuit shows it to be nothing more than a modified form of Armstrong's "flivver" embodying the latter's principle of negative resistance. Flewelling certainly deserves credit for a bit of originality in simplifying a difficult circuit, but it strikes me that too much claim has been made about a new method of obtaining super-regeneration. The regeneration obtained by means of the "condenser bank" cannot possibly compare with the tremendous amplification of Armstrong's circuit.

Comparing the original sketch by Major Armstrong with the "new" circuit, Flewelling substitutes a variable resistance leak and condenser for the "C" battery, and another leak and condenser to take the place of Armstrong's large inductance coils. Otherwise both diagrams are essentially the same. However, my hat is off to Flewelling for a good simple "super" circuit!—B. F. Morroy, New York City.

Interference from City Lines

The other morning while listening-in on WLAG there was a considerable noise as if some "ham" had tied down his Ford coil key which I was unable to tune out. In the meantime the lady of the house wished to dust the parlor fixtures and it was up to me to remove them. Before replacing the lamps I turned on the switch for some reason or other and as I screwed the lamp in I heard an awful scratching noise coming from the Magnavox. That gave me an idea. Perhaps the interference was due to the city current. I hurried to the main switch and pulled it out and immediately all the noise ceased and the music came in very clearly.—F. W. Lovgren, Virginia, Minn.

On election night in New York the Radio receiving board of the McAlpine hotel was the central for receiving returns. The figures were rushed to the accounting department, there tabulated and forwarded to the printing department. From there printed bulletins were distributed to the guests by the bellboys.

FIVE TUBE RECEIVER

(Continued from page 13)

inch thick. The transformers are mounted on the base of the cabinet. The cabinet used by the author is of solid mahogany with a removable back and is capacious enough for accessibility of construction and insertion and removal of tubes. If desired, the battery connections can be made on the rear of the cabinet. All wiring is made up of number 14, tinned wire covered with black, Grade A spaghetti. The connections should be carefully soldered and all leads kept as short as possible. Careful attention should be paid to avoid a confusing mass of twisted wiring so that the circuit can be checked through easily in case of necessity in verifying proper connections. It will be found necessary to re-check all connections after the set is completed, as the complex character of the wiring allows plenty of possibilities for omissions and errors in connections. Care should be taken to avoid proximity of wires which would increase the possibility of short circuit.

The simplicity of the circuit eliminates any probability of doubt as to operation, and for this reason it will be found that unsatisfactory operation is undoubtedly due to wrong connections, poor apparatus, or some source of trouble outside the hook-up.

The trend of the times is shown in the naming of one of New York's streets "Radio Drive."

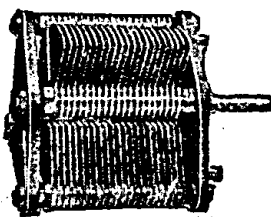
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Questions and Answers

Coil Data

(1159), FL, Englewood, N. J.
As a subscriber of your weekly paper I am contemplating building panel units for my receiving set. The information desired is as follows:

I want to use a variocoupler having a tickler rotor rotating on opposite end from secondary rotor. What I am in doubt about is the length of the main coil, number of turns, and the position of the rotors, number of turns of wire and direction of wire on same. The tuning unit I want to build is the same as is used in hook-up on page 14 of the September 2nd issue, lower diagram, using panel units, but using three stages of audio frequency. Would this give the best results for short wave reception? Kindly give correct hook-up.

A.—The coil in question should be eight inches in length, having fifty turns on the primary, forty turns on the secondary and thirty on tickler. Direction of wire is immaterial as a half turn of rotors will give the opposite direction.

The circuit you contemplate will give very good results if properly executed. For diagram see page thirteen of both the July 1st and August 19th issues, adding an additional step of audio frequency if desired.

Long Speaker Reception

(1209) HJR, Rice Lake, Wis.
We have a "Tresco" tuner and two-step audio frequency amplifier. We also use a Magnavox, but find that the distant stations do not come in strong enough for use in our auditorium, so we plan to add further amplification. Would you advise adding more audio frequency amplification, or would it be better to add a Radio frequency amplifier? How about use of power tubes in an additional step?

If power tubes were used would it be possible to light the filaments from a 6-volt battery? Would anything be gained by using two tubes in parallel as a power amplifier? Can you give me a diagram of the Magnavox power amplifier and specifications as to tubes and transformers to use?

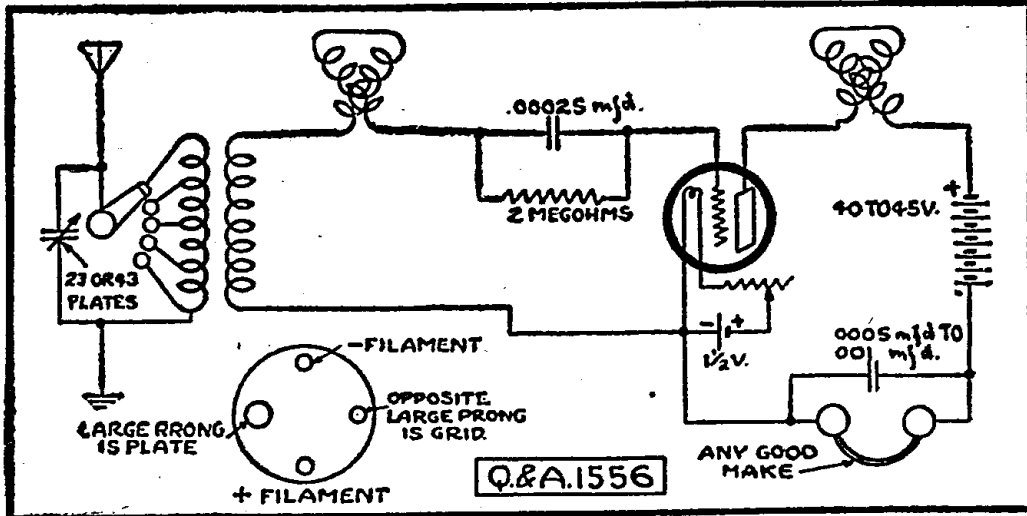
A.—With reference to amplification for receiving apparatus to be used in auditorium, a power amplifier would probably be best. In this case it would be practical to light filament with six-volt battery as suggested. More volume could be secured by using two tubes in parallel. The circuit for the Magnavox power amplifier is patented.

Dry Cell or WD-11 Tube

(1556) WZ, New York City
As you know, much interest has been aroused over the dry cell tube. I am thinking of constructing such a set. Will

signals on a loop antenna equal those from an ordinary aerial, the rest of my set remaining as at present

3. If it would take many steps of Radio to make signals from a loop as strong as I



you very kindly send me a hook-up of a dry cell tube set using a variocoupler, condenser across secondary, dry cell tube, and also giving markings for positive and negative of the A and B dry batteries. Is 22 1/2 volts enough on plate circuit?

Will you please send me the name and address of the young man you have pictured on page 16 of issue of November 11th, 1922, at the extreme left of the page on bottom? I would like to communicate with him. If you have any interesting comments on the dry cell sets, please let me hear from you.

A.—The dry cell tube shown is known as a WD-11. It requires ordinarily 40 volts on the plate. The picture is of a manufactured set, made in your city.

Using regeneration, tuned grid, tuned plate, with one WD-11 tube, I have succeeded in bringing in phone for over 1,000 miles.

Diagram and explanation of tube connections is shown herewith by Figure labeled Q.-1556.

QRM

(1106) OCB, Toronto, Canada.

1. How to hook up one or two stages of Radio frequency amplification. (I already have two steps of audio.)
2. How many steps of Radio frequency amplification would it take to make the

am getting now with a detector and two can be used successfully on the new stages of Radio frequency? It would seem that they would be cheaper to operate on account of them being capable of being operated on a dry battery.

4. In the hook-up, you will notice that the line from the bottom of the secondary coil crosses the lead from the negative terminal of the filament battery. That imposes a negative current on the grid. What would be the effect of imposing a positive current on the grid?

5. On page 14 of your issue of July 29th you show a panel unit (S.10) for one stage of Radio frequency, but I cannot figure out how to hook it up between my tuner and detector. Should there not be a variable condenser on either the primary or secondary circuit of the transformer? If so, what capacity would you suggest?

6. What make of Radio frequency transformer would you recommend?

7. What is meant by QRM (see page 12 of your issue of August 12th).

A.—Page thirteen of August 19th issue steps of audio frequency, would it not be wise to wait and see if the peanut tube RADIO DIGEST affords a diagram of wiring for Radio and audio frequency with honeycomb coil circuit. Two stages of

Radio frequency will maintain the signals on loop antenna equal with those of ordinary aerial.

Frankly speaking, Radio frequency does not afford as good results as audio frequency.

Imposing a positive current on the grid would very materially weaken signals.

Variable condenser in circuit in question will help and should be .0005 mfd. Experimentation will prove best position.

Any standard Radio frequency transformer will be satisfactory.

QRM is an abbreviation for the question, "Are you being interfered with?"

E. F. Myers Tubes, Loop Aerial

(1212), JLB, Oakland, Calif.
Referring to page 13, August 19th issue, showing hook-up for honeycomb coil circuit using two stages Radio frequency, detector, and two stages of audio frequency.

Please advise the best type of Radio frequency transformers to use and if Myers tubes will work satisfactorily? Also, could a loop be used with this circuit? Are two A batteries necessary?

A.—Any standard Radio frequency transformer will be suitable for the circuit named. Myers' tubes are satisfactory. One A battery is sufficient, although the use of two will reduce much howling. A loop aerial can be used, although speaking from a personal viewpoint, the outdoor antenna would have the preference.

Hang Aerials Taut

In many cases stray capacity in the receiving set may be reduced by paying more attention to the antenna lead-in. If the wire passes close to a building or other structure the lead-in should be held taut to prevent swaying. When the wire is allowed to hang loose the ever-changing distance between it and the building produces the effect of a constantly changing variable condenser.

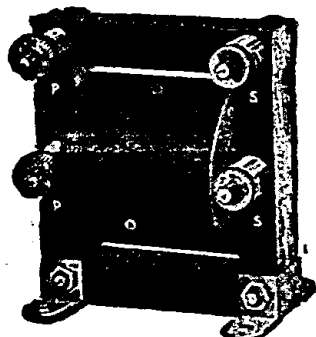
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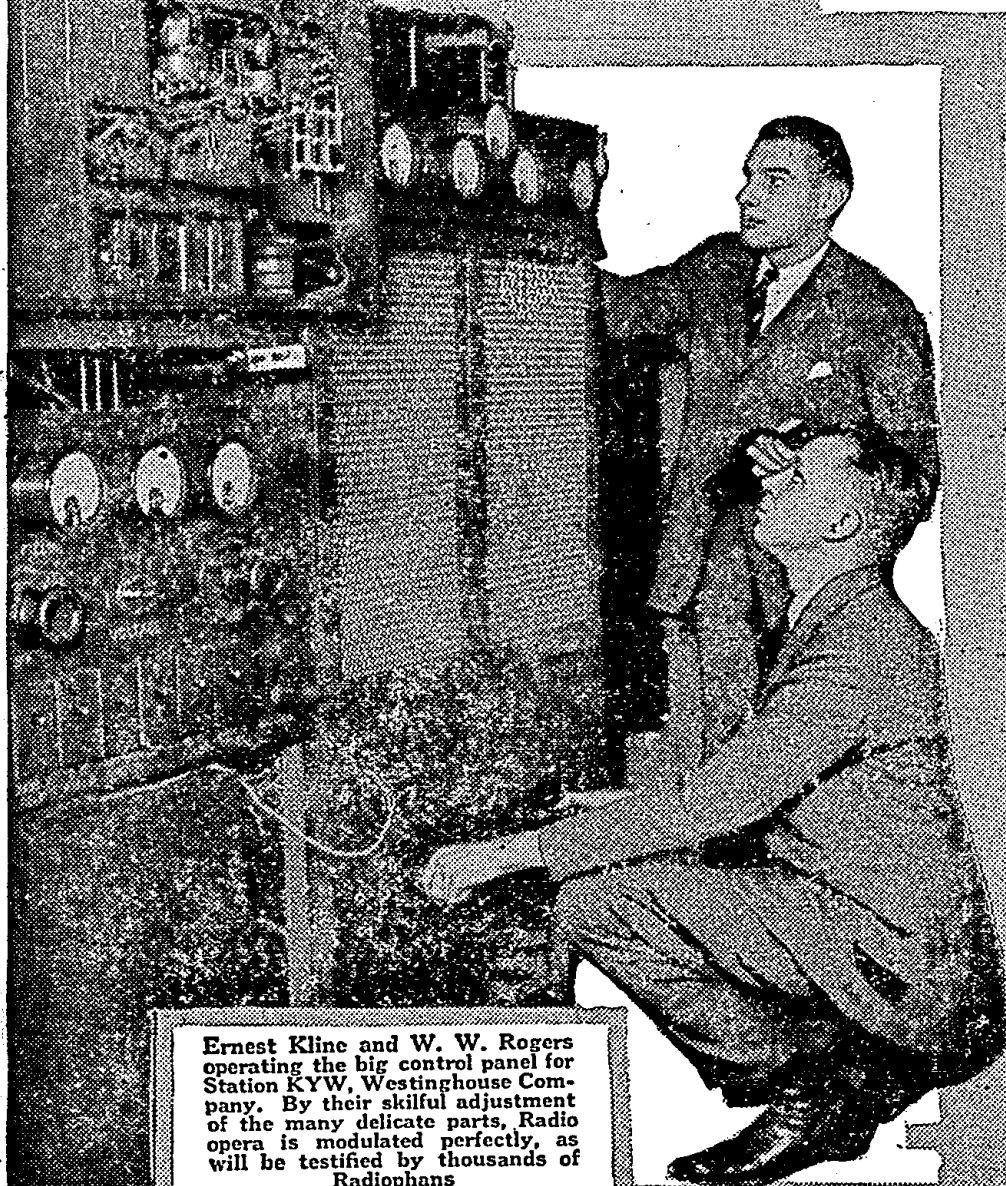
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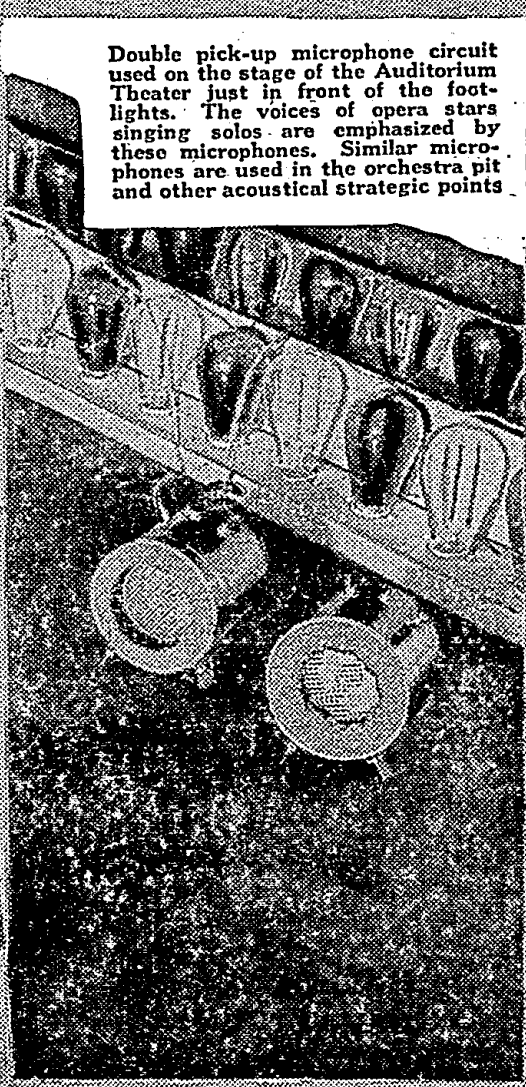


Louise Homer, the famous American dramatic contralto, has been heard in several operas broadcasted by Station KYW. One of her favorite roles is that of Azucena in "Il Trovatore." The photo shows her costumed for this role

At the left is Walter C. Evans, KYW engineer, seated in the audience at the Auditorium Theater, Chicago, controlling the pick-up microphones connected by wire direct to Station KYW. Upper right corner of page shows one of the two sixty-foot steel towers atop the Edison Building which support the famous station's antenna



Ernest Kline and W. W. Rogers operating the big control panel for Station KYW, Westinghouse Company. By their skilful adjustment of the many delicate parts, Radio opera is modulated perfectly, as will be testified by thousands of Radiophans



Double pick-up microphone circuit used on the stage of the Auditorium Theater just in front of the footlights. The voices of opera stars singing solos are emphasized by these microphones. Similar microphones are used in the orchestra pit and other acoustical strategic points



Ina Bourskaya as the shepherd, Lehl, in "The Snow Maiden" (Snegurotchka). Radiophans have heard Miss Bourskaya twice in this role