

Blueprint Section Every Month

RADIO AGE

The Magazine of the Hour



(See Story page 15)

September
1926

**Blueprints of Power
Supply Devices ◀ Grid
Meter Driver and a
Wavemeter ◀ Radio
Beacons for Planes —**

25¢

Complete Broadcast List and Log
In Each Issue

An Index to the Best in Radio Hookups!

HOW long have you postponed making that favorite hookup of yours because you couldn't find reliable and clear diagrams? We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups and diagrams to be found in them. Select the ones you want and enclose 30 cents in stamps for each one desired.

June, 1924

- Important Factors in Constructing a Super-Heterodyne.
- A Universal Amplifier.
- Adding Radio and Audio to Baby Heterodyne.
- Radio Age Data Sheets.

July, 1924

- A Portable Tuned Impedance Reflex.
- Operating Detector Tube by Grid Bias.
- A Three-Tube Wizard Circuit.

August, 1924

- Breaking Into Radio Without a Diagram.
- The English 4-Element Tube.
- Filtered Heterodyne Audio Stages.
- An Audio Amplifier Without an "A" Battery.

September, 1924

- How Careful Mounting Will Improve Reception.
- One Tuning Control for Hair's Breadth Selectivity.
- Four Pages of Real Blueprints of a New Baby Heterodyne.

November, 1924

- Blueprints of a Single Tube Loop Set and a Capacity Feed-back Receiver.
- A 3-Tube Low Loss Regenerator.
- Mastering the 3-Circuit Tuner.

January, 1925

- A Six-Tube Super-Het.
- An Efficient Portable Set.
- A Tuned Plate Regenerator.
- Making a Station-Finder.

February, 1925

- A Three Circuit Regenerator.
- A Real Low Loss Set.
- Blueprints of a 3-tube Reflex.

March, 1925

- A 5-Tube R. F. Receiver.
- How to Wind Low Loss Coils.
- A Short Wave Receiver.
- Blueprints of a Two-Tube Ultra Audion and a Regenerative Reflex.

April, 1925

- A 3-Tube Portable Set.
- "B" Voltage from the A. C. Socket.
- An Amplifier for the 3-Circuit Tuner.
- Blueprints of a Five-Tube Radio Frequency Receiver.

May, 1925

- A "Quiet" Regenerator.
- How to Make a Tube-Tester.
- A Unique Super-Het and an Improved Reintartz.
- A Six-Tube Portable Receiver Illustrated with Blueprints.

June, 1925

- Reducing Static Disturbances.
- A Seven-Tube Super-Heterodyne.
- Browning-Drake Receiver.
- Overcoming Oscillations in the Roberts Receiver.

July, 1925

- Learning Tube Characteristics.
- How Much Coupling?
- Blueprints of Conventional Radio.
- Symbols and Crystal Detector Circuit.

August, 1925—50c per copy

- How to Attain Smooth Tuning.
- Alternating Current Tubes.
- Deciding on a Portable Super.
- And a big 60-page blueprint section.

September, 1925

- Thirty-one ways to prevent self-oscillation.
- Tuning efficiency with two controls.
- Ideal Audio Amplifier Circuits.
- Blueprint section.

October, 1925

- Auto-Transformer Coupling.
- Some Facts about Quality.
- An Improved Slide-Wire Bridge.
- Blueprints of Circuits Using Single and Dual Controls.

November, 1925

- A Good Audio Oscillator.
- An Efficient Short-Wave Transmitter.
- Blueprints—Adding R. F. Stages.

December, 1925

- Tuned R. F. and Regeneration.
- Radio Age Model Receiver.
- Inductive Gang-Control Receiver.
- Tuning with Chart Curves.

January, 1926

- Radio Age January Model Set.
- A Four-Tube Toroid Set.
- Power Supply Device—Blueprint Feature.
- Finishing Your Radio Cabinet.

February, 1926

- February Radio Age Model Set.
- Plug-in Coil Receiver.
- Universal Testboard—Blueprint.
- Eliminating Audio Distortion.

March, 1926

- Improving the Browning-Drake.
- Rheostatless Tubes in a Set.
- Which Type Intermediate?
- How to Make a Wavemeter—Blueprint.

April, 1926

- Shielding Your Receiver.
- Home Testing Your Tubes.
- Balanced Capacity Receiver.
- Several Sets on One Antenna.

May, 1926

- Short Wave Transmitter—Blueprint.
- Simplifying Battery Charging.
- List of European Broadcasters.
- Protecting your Inventions.

June, 1926

- Antenna Design.
- Simple Crystal Set.
- Improving the Neutrodyne.
- Golden Rule Receiver—Blueprints.

July, 1926

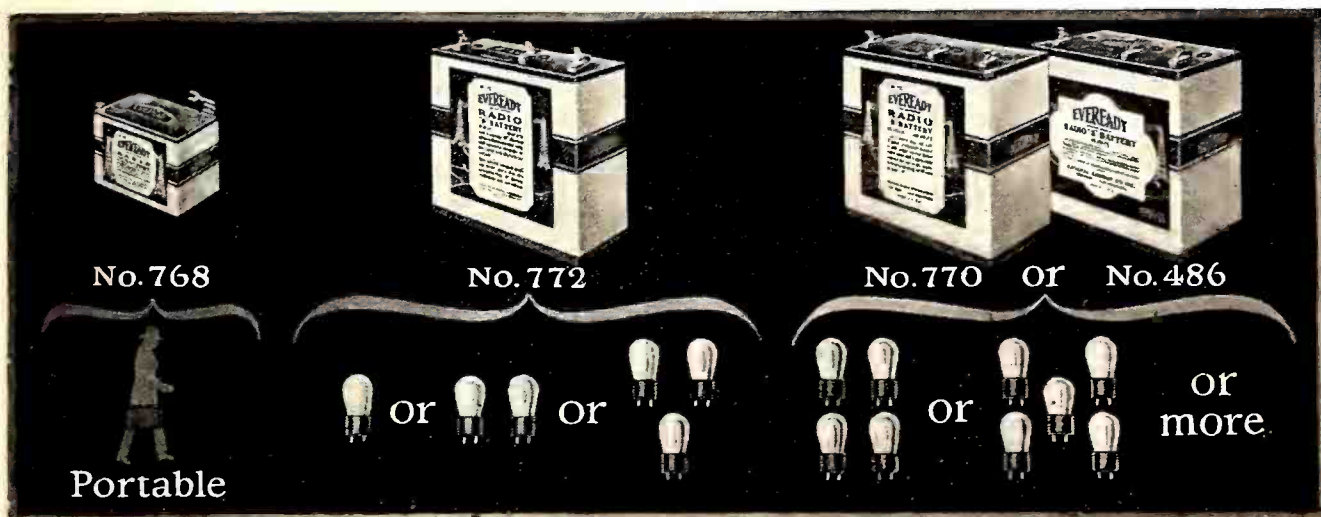
- Compact Portable Super.
- Short Wave Receiver.
- Shielded Golden Rule Set.

August, 1926

- Receiver, Transmitter and Wavemeter.
- Beginners 200 mile Crystal Set.
- History of Anateurs.
- Changing to Single Control.

Radio Age, Inc., 500-510 N. Dearborn St., Chicago

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*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a "C" battery.

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In addition to the batteries illustrated, which fit practically all the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. There is an Eveready dealer nearby.

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RADIO AGE

The Magazine of the Hour

Established March, 1922

Volume 5

September, 1926

Number 9

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Chats With the Editor

THERE is no occasion for agonizing over the broadcast situation as we see it. We believe the inherent spirit of fairplay amongst the broadcasters, plus the attitude of the listeners, will to a great extent prevent wholesale pirating of wavelengths, at least until the next session of Congress when suitable legislation for the control of broadcasting can be passed. The broadcaster does not want pirating; the public does not want wavelength confusion, and the manufacturers do not want anything that will disturb the tranquility and prosperity of the industry.

Two excellent construction articles are given this month by Messrs. Hoffman and Schnell on the building of a grid meter driver and a shielded short wave wavemeter. Another constructional article is written by J. E. Coombes in the blueprint section and details the makeup of a power supply device par excellence.

As an indication of the tasty manner in which the farm programs are to be put on by the Department of Agriculture we invite your attention to Mr. Eisenhower's article "Papa Bedbug Takes to Radio."

Armstrong Perry is back in the ring again with a slant on radio prophets, while Dorothy Brister Stafford tells our readers who pay our radio pipers.

First pictures of KYW's new crystal control transmitter are shown on page 14. Amateur readers are given the benefit of Radio 8BHM's experience with a Hertz antenna for use on a variety of wavelengths. Further use of radio transmission is covered by S. R. Winters in an article dealing with radio beacons for guiding aircraft across the continent.

Frederick Smith

Editor of RADIO AGE.

RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor

Papa Bedbug Takes to Radio

Vital Information
Given to Farmers
by New Means

By MILTON S. EISENHOWER *

"Station XYO calling. Stand by just a moment, folks; there is a most peculiar looking individual here in the studio who wants to talk to you. He calls himself 'Papa Bedbug' and he says he's going to give you his autobiography."

THIS announcement will be heard from stations in every corner of the United States when the enlarged radio farm program of the United States Department of Agriculture goes into effect on October first. The autobiographies of pests, including bugs and rodents, is only one feature of a comprehensive program which is designed to touch every phase of American agriculture. These life-histories will show vividly the damage being done annually by pests and will give methods of eradication.

Have you ever seen trees practically stripped of their foliage by some pest? Have you ever discovered the framework of your house weakened by some unknown enemy? Have you ever walked through an alfalfa field and found the crop partially de-

stroyed by rodents? Do you know who the enemies of your crops and vegetable garden are? Your loud speaker or your ear 'phones are going to tell you what to do in such emergencies.

THIS is the first of a series of articles pertaining to radio on the farm. Next month Mr. Eisenhower will describe the present relationship between radio and the dairy industry. Dairying is one of the chief courses included in the government's National Radio Farm School.

—Editor.

Scientists have conducted campaigns for years in attempting to eradicate rodents and bugs which are harmful to crops, to people, and to buildings. In several instances, notably in the case of rats, the pests continue to be victorious. One of the chief deter-

rent forces in these crusades has been the slowness with which the information could be disseminated to all parts of the country; in fact, it is recognized that one of the main obstacles in the way of agricultural progression has been the difficulty with which timely, pertinent farm information could be sent to the workers of America's basic industry, agriculture.

The radio has solved this difficulty. Today, when scientists discover a plague, a harmful rodent, an outbreak of foot-and-mouth disease or of tuberculosis in cattle, the information can be put into the air immediately and the information is within a dial's turn of the American people. Farmers are no longer skeptical of the scientists; indeed, they have learned that they too are really scientists of first importance. If a farmer in one locality discovers something which he feels would be a benefit to others in agriculture, he is anxious that the information be broadcast to every corner of this vast country. The fact that some 4,000 letters are received by the U. S. Department of Agriculture from American farmers daily, and the most

*U. S. Department of Agriculture.

pertinent of these are answered by radio, is some indication of the heightened interest of farmers in sound, scientific information.

The farmer has not taken to radio only because he loves the entertainment which is always available in the air; he really looks upon the radio as a dollars and cents proposition. Not long ago a farmer in Kansas went to his banker and borrowed \$100 in order to buy a radio—and he got it. That farmer says the radio keeps his five sons on the farm and that it has easily paid for itself by keeping him in touch with the daily markets, by sending him weather reports, and by stimulating in him a desire for every type of information about the business of farming.

The U. S. Department of Agriculture does not hope to give complete details of farming over the radio. It does not expect to pull a man from behind a counter in a city department store and teach him to grow soybeans, sweet-clover, alfalfa, and red clover; rather, the Department desires to use the radio to give timely warnings, market reports, and to create a taste for sound informa-

tion so that a farmer will seek the sources of information already open to him—agricultural colleges, bulletins, books, farm magazines, and newspapers.

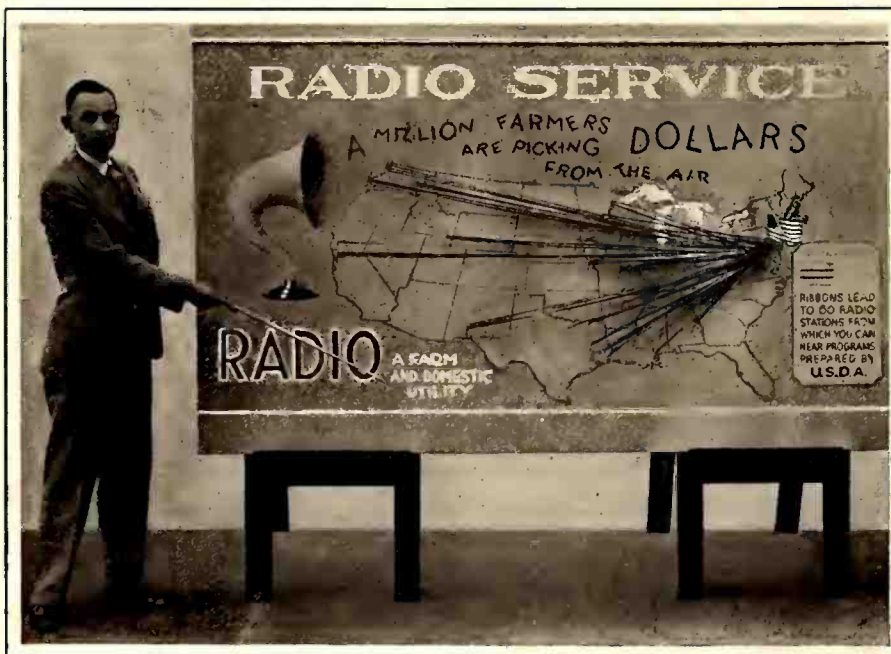
Want More Sets

FOR this reason there is an active interest in doubling the number of radio sets on farms. The simplest mathematics prove that the present number of sets, which is approximately one million on the farms, multiplied by two doubles the effectiveness of the government radio service to farmers. Farmers in all parts of the country are purchasing sets or are installing home-made sets. An interesting account has been received from a farmer in Kansas who built a set and found the agricultural programs so helpful that he connected his set with a barbed-wire fence and sent the program to his father's place two miles distant.

But Papa Bedbug has been mumbling while these observations were being made. Tune in your sets, folks, and hear what he has to say!

"I'm mighty glad you folks listenin' in tonight can't see me—

'cause I'm a bedbug. If you could see my little flat, red body, you'd probably squash me. I don't know why folks of this country have taken such a dislike to me and my race lately—everywhere people are tryin' to kill us bedbugs. Looks as if we'd have to get deportation papers from immigration officials an' go back to Asia. We're all in the country illegally, I guess—none of us ever had a visa or that sort of thing. Some of our ancestors came over in the Mayflower. My family genealogy shows that my ancestors lived in Asia and later in Rome—gosh, those must have been the dignified days—'cause bugs could live without bein' gassed, or choked, or burned. My ancestors were called Cimex, which doesn't sound so bad, but when the old folks migrated to England in 1503 and later on came to the colonies, this deuced American slang wiped out our good old family name and now we're just called—Bedbugs. When my ancestors came over in the Mayflower, they were the only ones who didn't get seasick; great granddad—I don't know how many "greats" should prefix



Sam Pickard, Chief of Radio for the U. S. Department of Agriculture, points out the fact that a million farmers are picking dollars from the air. Radio programs of the Department of Agriculture may be heard from approximately 100 broadcasting stations

Charles Ostrand, farm boy of Shawnee County, Kansas, who built this three tube set in order to listen in on helpful agricultural programs. He has also built sets for several of his neighbors



the granddad—crawled into an old suitcase an' he didn't have to pay any passage money either. By the time the Mayflower arrived on this side of the Atlantic, there were thousands of my great-aunts and great-uncles ready to land. Other families sneaked into the country every time a boat came over from Europe. All the clans lived in the seacoast towns for a while, but the folks soon saw grand opportunities for migration, so it wasn't long before bedbugs were in every corner of the country.

"I was born about five years ago behind a piece of wainscoting in a bedroom. Most bedbugs are born and live in dirty rooms, but I have often lived in clean places—that ol' crack where I was born was the only place in the room that had a spot of dust. I remember when I was about three months old, I went with a bunch of other bugs to have dinner. We live, you know, almost exclusively on human blood. Just as I was puffed up with food, I heard someone yell, 'I smell bedbugs!' I crawled away as fast as I could—but a lot of the other fellers

were killed. That 'buggy' odor of ours always gives us away! I hid in the old crevice behind the wainscoting; the man thought he'd starve me out, I think, but I stayed there for three months without a bite to eat. Shucks, that's nuthin'—I had a granddad who lively nearly a year once without eating; it's mighty hard to starve us bedbugs. I was sick of that home, though, so one day I hid in the cuff of the man's trousers and when he got on the street car, I crawled into a crack of the wooden seat. As soon as another man sat down, I sneaked into his pocket and went home with him. Living was a lot easier at that place, 'cause the rooms weren't so clean and I had more places to hide. However, the house was soon sold and the newcomers fumigated the rooms with hydrocyanic acid gas. Luckily, I escaped, but all my pals were smothered. I've lived many places since then—in cracks of wooden beds, behind bits of torn wallpaper, and many other places. At one old house red ants came in—they're our worst natural enemies, you know! I

saw 'em comin' so I shouted to the fellers to line up for trouble. It was no use of all of us tryin' to hide in a crack, 'cause those ants could have gone any place we could. Well, we lined up in battle formation and tried to make those ants think they didn't have a chance. But they came tearin' into us; I saw it was no use, so I slipped into a crack and watched the fight. Gosh, do you know that those little ants, many times smaller than our fellers, simply picked Bill, an' Tom, an' Jack, and the other bedbugs right up off the floor and carried 'em away—I suppose they ate 'em, but I didn't wait to see; I made my get-away as soon as I could! At another place the man kept the rooms too cold, so I left—I like the temperature to be about 70 degrees. Once too, the housewife burned sulphur in the rooms and only a few of us could get away. My brother Jimmy escaped with me, so the two of us went to a neighboring house—I think we crawled in by some water pipes. Jimmy was hungry, so he went out in the broad daylight, looking for something to eat, and he got

stepped on—but most of us bedbugs have enough sense to hide during the day. It's dark when we have our fun.

"I'm now livin' in this western town and I have a pretty good time; occasionally I go out with the fellers to annoy people when they're tryin' to sleep. The other day I heard a big fat man with spectacles say we bedbugs had caused some disease to be carried—that tickled me. I'm gettin' a little old, so I'm not so particular about my food any more—if I can't find a human, why I get some blood from a rat. But as I said at first, people are be-ginnin' to make it hot for us in this country. Agricultural colleges and the United States Department of Agriculture have put out bulletins, tellin' folks how to kill us all, and I hear that many people are writing for these bulletins so they can learn all about us. Oh, well, if I get scared I'll just climb into a suitcase and go back to Europe. Perhaps then I could change my name from 'Bedbug' to somethin' nice like 'Cimex' or 'Red Coat.' I'm sure o' one thing—if I go to another country I'm goin' where people aren't so well educated, 'cause it seems that as soon as folks get an education they start fumigatin' and raisin' heck with us fellers."

Interestingly Told

THIS brief talk illustrates one of the methods which will be used, beginning in October, to catch the interest of the farmers. The autobiographies of infamous bugs and rodents will be given each week and will continue for 32 weeks. Many of the pests discussed will be those which are not widely known but which cause millions of dollars in damage every year.

The chief interest of the government's scientists is being centered on the agricultural courses, known as the National Radio Farm School, which deal with livestock, poultry, and dairying. Twenty-four short courses of eight lessons each are being offered. Students who regularly

enroll and follow a lecture course through an eight weeks' period and report on one or more laboratory assignments—these assignments carried out in accordance with instructions received by radio—will receive official recognition of their work in the form of a certificate issued by the Secretary of Agriculture and chiefs of the bureaus sponsoring the courses. Approximately 18,000 farmers have enrolled to date. The radio service anticipates a total enrollment of approximately half a million people. Thus the largest educational institution known in history will become a powerful force in the development of American agriculture.

Buying and Selling

DURING the past few years the people of the United States have heard a great deal about the position of agriculture in the international economic structure. It has been pointed out that, because of surplus products of the soil, farmers must sell in an open world market, while they must buy in a market protected by a high tariff wall. Chief interest is focused on devising a means of correcting this situation. Elaborate legislative methods of controlling the surplus agricultural products have been discussed. In the midst of a haze of economic and political discussions, it is not forgotten that the development of agriculture and of farm prosperity in the past has been due to a steady improvement of farming methods—diversification, soil improvement, proper rotation of crops. It has been pointed out that today the radio is one of the most important factors in the dissemination of pertinent information to farmers. It is only logical to believe that, should a practicable method of cooperative marketing, of purchasing the surpluses, or of directly controlling agricultural prices be worked out, the radio will again be an important factor in the plan. Immediate dissemination of information re-

garding the probable supply, the market prices of the various grades of different crops, the domestic and foreign demands for the different crops, etc., is an essential factor in all plans submitted for decreasing the disparity between the agricultural dollar and the general commodity dollar. Do farmers in general appreciate this value of the modern radio? Let us see.

Million Sets Used

IN 1923 there were approximately 145,350 sets in use on American farms. The first agricultural school of the air came into being during the latter part of 1923 and met with immediate success. In 1924 there were 364,800 sets on farms and by September, 1925, this number has increased to 553,000. At that time there were several states in which forty per cent of all farms were equipped with radios. The latest estimate is that there are between 900,000 and 1,000,000 radios being used by farmers. These radio owners are manifesting a keen interest in up-to-the-minute agricultural information. In the various states agricultural colleges have vast radio audiences. As previously stated, some 18,000 farmers have enrolled in the National Radio Farm School. Enrollment cards may be obtained from broadcasting stations, radio dealers, or direct from the U. S. Department of Agriculture.

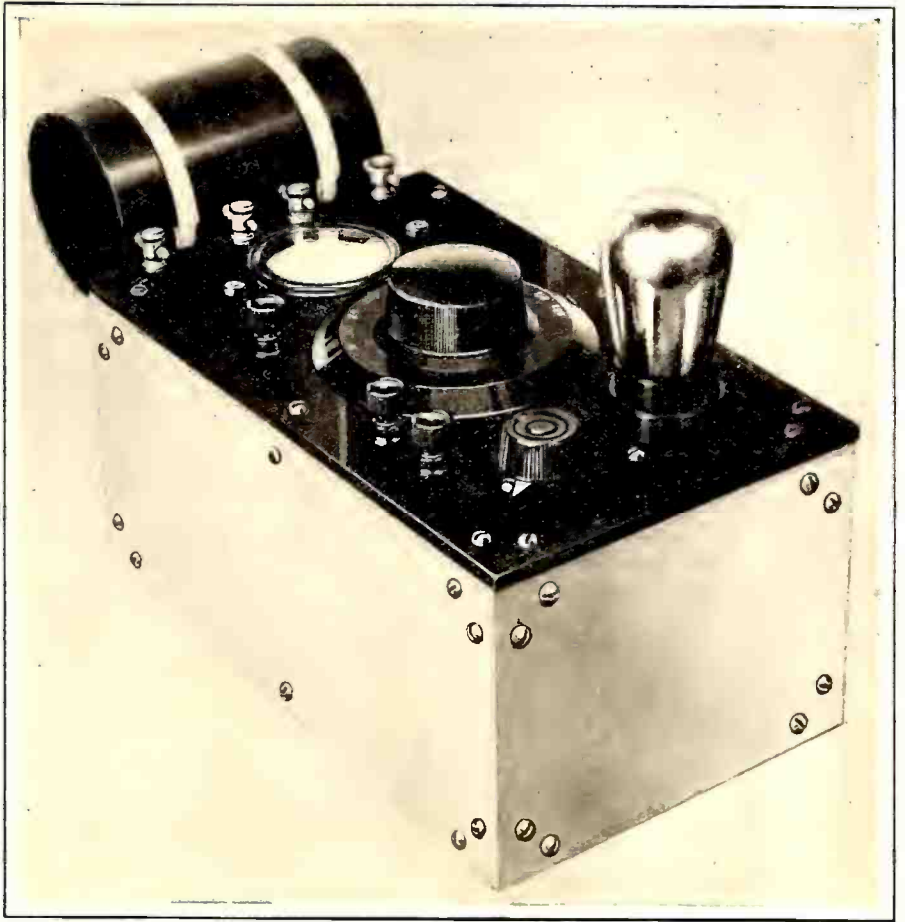
In modern business, cooperation is the criterion of success. Farming in the United States has been, until recent years, a life of individual work. Cooperation is a new light of agriculture. Even now only a small percentage of farmers belong to cooperative associations. The radio is a potential possibility in the unification of American farmers. Over 100 broadcasting stations in this country are prepared to aid in sending information to the workers of our basic industry. Actually, only the fringe of the real possibilities of the radio on the farm has been touched.

A Grid Meter Driver

By

W. H. HOFFMAN*

(9EK-9XH)



Grid meter driver completely assembled as described by Mr. Hoffman

MEASUREMENTS at radio frequencies depend largely on some form of radio frequency generator. Such generators are commonly referred to as drivers. A glance through the new issue of Robinson's Manual of Radio Telegraphy and Telephony, (a splendid manual and authority on latest radio practices) shows that out of 26 measurements described, 16 require the use of a radio frequency driver.

Some of the measurements where a driver is required or most useful are listed as follows: Measurements of Antenna constants, Wavelength, Inductance, Capacity, High frequency resistance, Phase difference, Fundamental and harmonic frequencies of oscillation, of coils, Decrement. Also for calibration of Wavemeters, Condensers, Thermocouples and galvanometers, and sensitivity of a receiver.

Only a few years ago the common buzzer associated with a wavemeter or other form of radio frequency circuit was largely used in measurement work and the monotonous squeal of the little high fre-

quency vibrators was often to be heard in the radio laboratories for hours at a time.

For drivers as well as for transmitters and receivers, the vacuum tube oscillator has pushed its way to the front. It is only required that suitable circuit arrangements having proper constants shall be associated with the tube, and a driver having stability and flexibility unequalled in any other manner can be produced.

WE are very glad to present to our readers in this issue two exceptionally fine construction articles, the first on building a grid meter driver written by Mr. Hoffman at 9EK-9XH and the other by Mr. Schnell (page 11) on the construction of a shielded short wave wavemeter. These articles, we feel quite sure, will be highly prized by our broadcast as well as amateur readers and most especially by the true experimenters.

—The Editor

A driver should be a persistent oscillator at all the possible adjustments of the constants making up the radio frequency circuit. If energy of variable strength is to be transferred to other circuits, the variation can easily be brought about by means external to the oscillator.

It should only be necessary, then, to connect proper A and B power supply to the driver unit and to make the required adjustment for wavelength or frequency.

A driver filling these requirements, and having a range from 12 to 800 meters, has been in use for making all sorts of radio measurements at the C. F. Burgess Laboratories, Inc., Madison, Wisconsin, for more than a year and has not yet failed for the first time when hooked up and pressed into service. Recently this driver has been duplicated in a convenient and compact form and a complete description with photographs is given in the following paragraphs.

*C. F. Burgess Laboratories Inc., Madison, Wis.

General Arrangement

ALL the parts are mounted on the top panel which consists of a piece of 3/16" hard rubber 6"x10". This panel is securely screwed to the top of an aluminum case built up on brass angle pieces in the corners and around the top and measures 6"x4½"x10" outside dimensions.

A double unit Cardwell (receiving type) condenser is mounted in the central portion of the panel and equipped with a National velvet vernier dial for adjustment. At one end of the panel the tube socket and filament rheostat are mounted while at the other end there are four binding posts for receiving the driver coils and a 0 to 15 Jewell milliammeter for registering the grid current.

Five plug-in coils are provided, each wound on 3" bakelite tubing. (Gen. Radio type 274-P plugs).

Circuit Arrangement

THE schematic diagram shows the circuit arrangement. Capacity reactance is included between the tube elements in a manner which maintains a one to one ratio for all adjustments. The inductances are each di-

vided into two equal halves. The milliammeter is in series with the grid leak resistance and registers the grid current of the oscillator or driver tube. A resistance is included in series with the A battery supply. No

COIL TABLE

Coil 1, 2 turns each section, No. 16 DCC wire, 12 to 32 meters.
 Coil 2, 5 turns each section, No. 16 DCC wire, 25 to 67 meters.
 Coil 3, 13 turns each section, No. 16 DCC wire, 54 to 150 meters.
 Coil 4, 33 turns each section, No. 22 SCE wire, 135, to 370 meters.
 Coil 5, 74 turns each section, No. 22 SCE wire, 310 to 800 meters.
 (Coil 5 Bank wound)

LIST OF PARTS

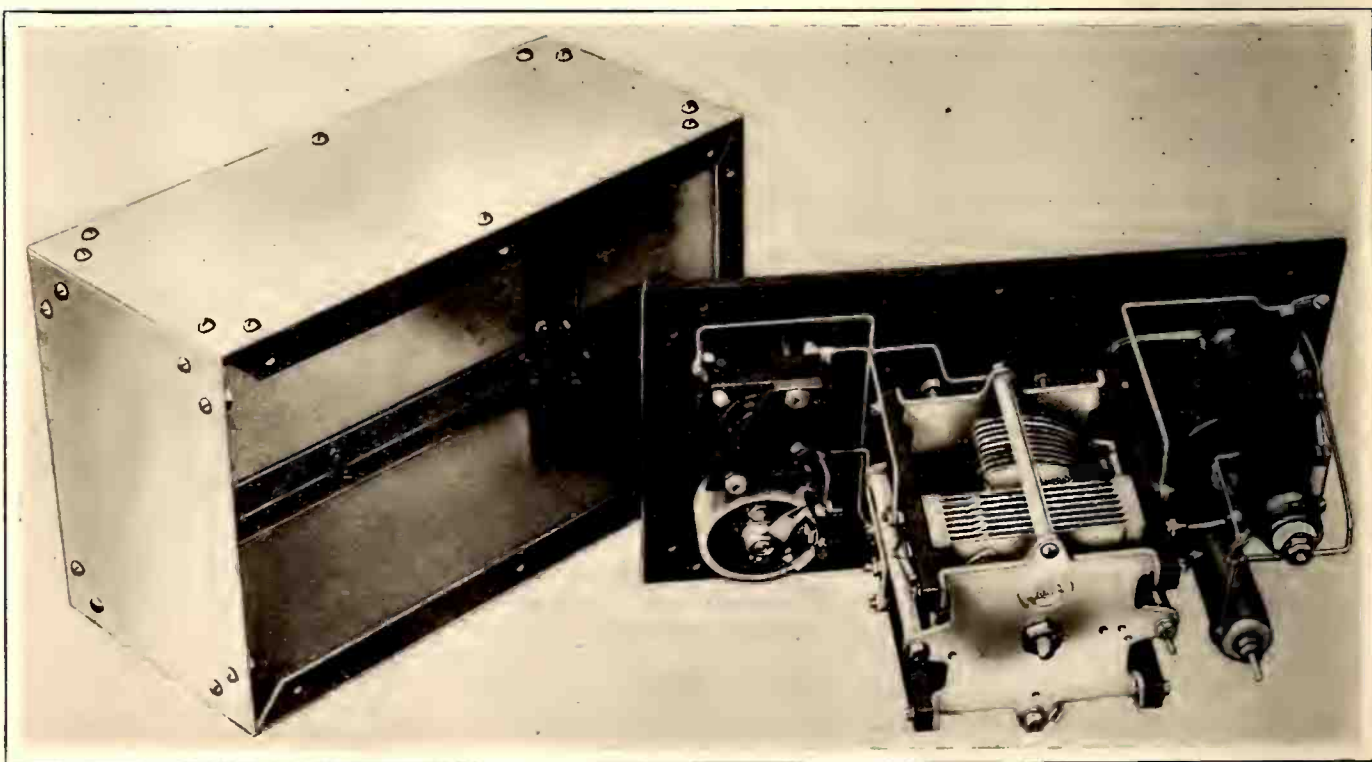
A—Jewell 2" Milliammeter, 0 to 15.
 Cg & Cp—Cardwell, double unit condenser, .00035 mfd. each unit.
 Cs—Dubilier Micadon fixed condenser, .006 mfd.
 T—tube, 199, 201A, or 210 type, depending on power required.
 Rf—Filament rheostat.
 Rl—Grid leak resistor, 5000 ohms.
 Rp—Plate supply resistor, Ward Leonard, 125 ohms (100 to 500 O. K.)
 Lg & Lp—Coils on common tube, 3" dia., 4½" long.

choke coils are required at any frequency.

The driver will operate equally well with the 199 type, the 201A type or the 210 type tubes. It is only necessary to connect the proper A and B battery supply voltages for operation of the tube to be used. These voltages are determined by the manufacturers rating of the tubes. The receiving tubes furnish sufficient power for most measurements, using from 45 to 135 volts B battery. The 210 tube will furnish more power when required for such measurements as high frequency resistance, and plate voltages as high as 350 or more may be used.

Shielding

THE driver is not shielded. To effectively shield a driver would require a relatively large case within which the A and B power supply would have to be



Inside view of grid meter driver showing integral parts and the aluminum shield used to house the driver

included. After this precaution is taken a portion of the shielding would have to be removed to get coupling to the circuit or apparatus under measurement. The driver as herewith described can just as well be placed within a separate shielding case together with its power supply, should requirements be such that shielding is necessary.

The grid milliammeter is for indication of resonance when the driver is coupled to another tuned or resonant circuit.

This method of detecting resonance makes use of the fact that the value of grid current in an oscillating vacuum tube circuit drops off sharply at resonance with a coupled circuit. Resonance is indicated by a pronounced dip of the milliammeter. The point in minimum deflection denotes resonance between the coupled circuits. Quoting from Robison's manual (page 676), "This method is second to none in the degree of

accuracy that can be attained by its use."

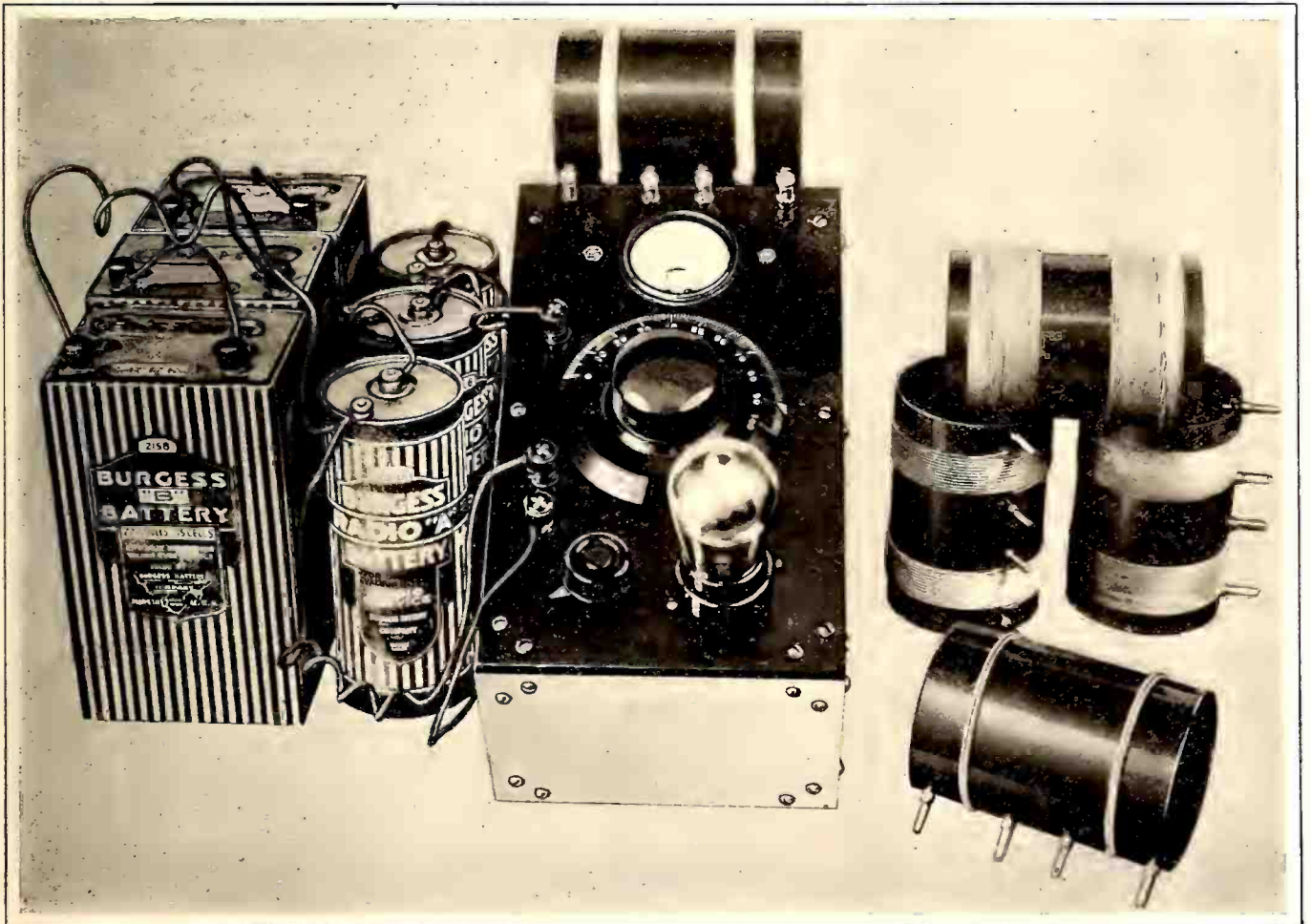
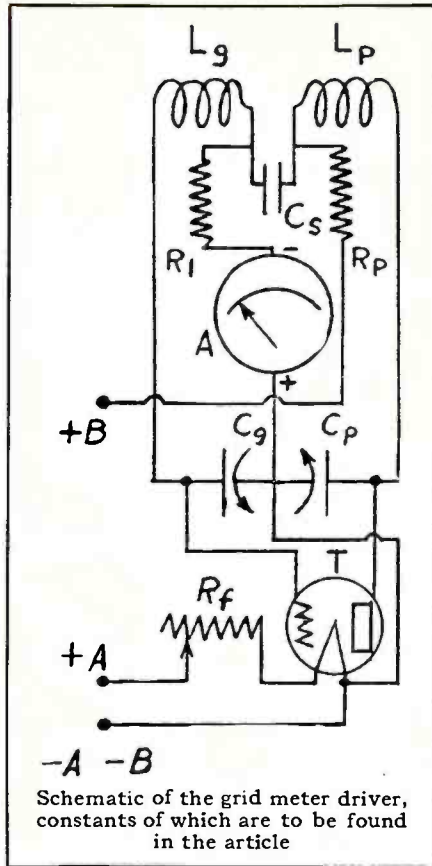
The click method of resonance indication may be used if desired by connecting a pair of head phones in series with the plus B battery supply.

Resonance may also be indicated by the maximum deflection obtained on a thermo galvanometer which has been connected in the circuit that is under measurement. A flashlight bulb may be used in place of the galvanometer. Maximum brilliancy will indicate resonance.

Some Applications

ONE important use for the driver that should be of interest to the amateur is the accurate calibration that can be obtained on a wavemeter from the standard frequency transmissions. The procedure is as follows:

Tune in the standard frequency signal on a receiver in
(Please turn to page 32)



Driver ready for operation with batteries connected, tube in socket, and coil in place. Spare coils for the different bands are shown to the right of the driver

Making Use of a Hertz for Multi-Wave Transmission

Phillips of 8BHM Gives Benefit of His Experience

DATA of an interesting nature concerning the operation of an antenna system is contained in a recent communication from Rob Roy Phillips, radio 8BHM at Hornell, N. Y., who passes the information along for the benefit of amateurs and others interested in short wave transmission.

The general idea can be conveyed by the diagram, Figure 1, which shows the method of feeding the antenna and counterpoise at a point 6 feet from the exact center of each. The total length of the antenna is 58 feet and that of the counterpoise the same. Further description is gained from 8BHM's letter which follows:

"Having tried all forms of antennas, counterpoises and grounds in the last four or five years, being an Official Broadcasting station I had to have an antenna and counterpoise that would shift easily and work on three different wave bands efficiently so have finally come to a system that works wonderfully well here.

"To a certain extent it is a

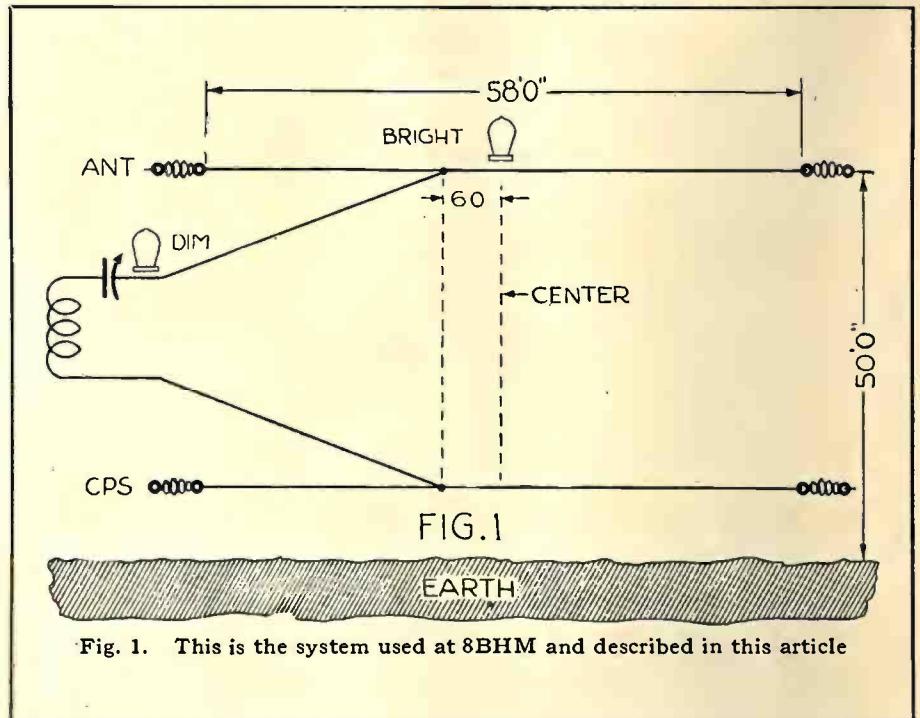


Fig. 1. This is the system used at 8BHM and described in this article

voltage feed Hertz, or an antenna and counterpoise with a feeder wire. Most of the amateurs are situated as I am with no place to put their radiating system near the transmitter so as a last resort must use some kind of a radio frequency feed-

er wire. Up to the present time I have not seen published an exact system like this one so it may help a good many.

"It is equally good for local as DX work on the 40 meter band. The signals are very steady and strong at 100 miles as well as at 3,000 miles. This is its best point as a large percentage of the 40 meter systems are nil below 500 meters. Then again the system has extreme flexibility for with it work is carried on with the 20, 40, 80 and 150 meter bands by using coils in proportion to the primary only. The secondary remains the same after once having been adjusted.

Adjusting Frequency

JUST a few words about adjusting the set for greatest efficiency. Insert the usual bulb or lamp in the antenna at the center. Also insert a smaller lamp in series with the feeder next to the series con-

(Please turn to page 43)

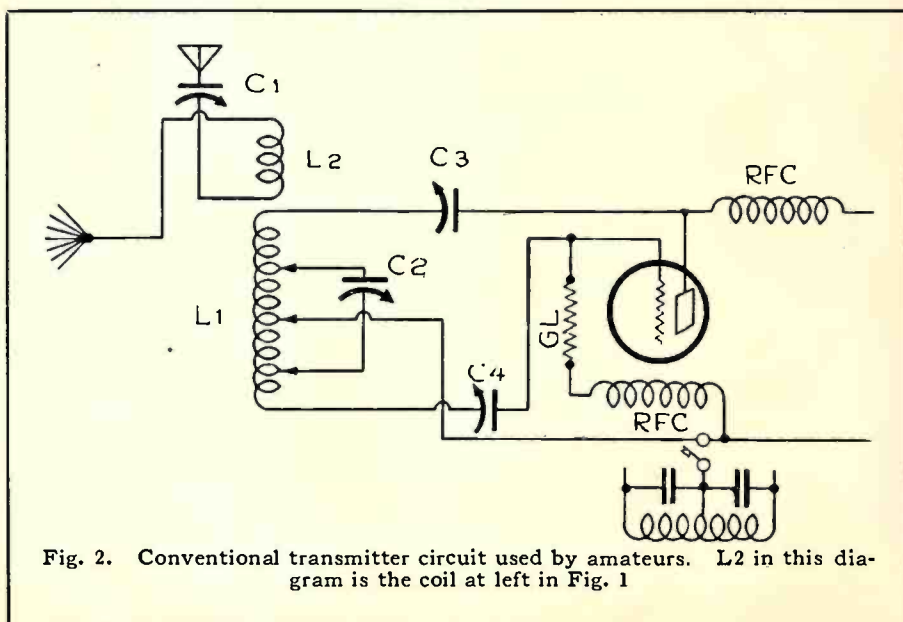


Fig. 2. Conventional transmitter circuit used by amateurs. L2 in this diagram is the coil at left in Fig. 1

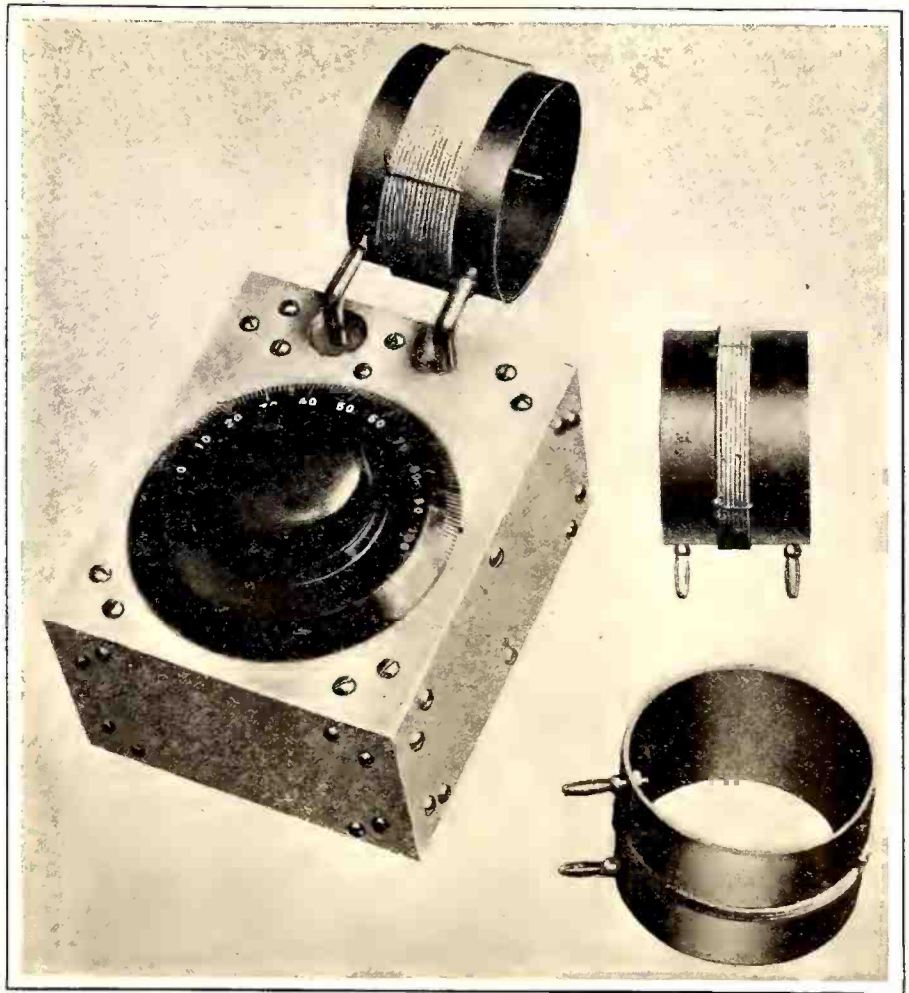
A Shielded Short Wave Wavemeter

By

F. H. SCHNELL*

(9EK-9XH)

THERE is one reliable way to determine the wavelength of a transmitter or a receiver with any degree of accuracy and that is by actual measurement with a calibrated wavemeter. A wavemeter is not a hard instrument to make, in fact, it is one of the simplest



Construction of the wavemeter above is described by Mr. Schnell in this article. This meter and the driver described by Mr. Hoffman on page 7, are inseparable as far as the experimenter is concerned. The two articles present the entire case of precision and accurate measurements for the experimenter

and easiest to make. Care is required in its construction and in the selection of good pieces of

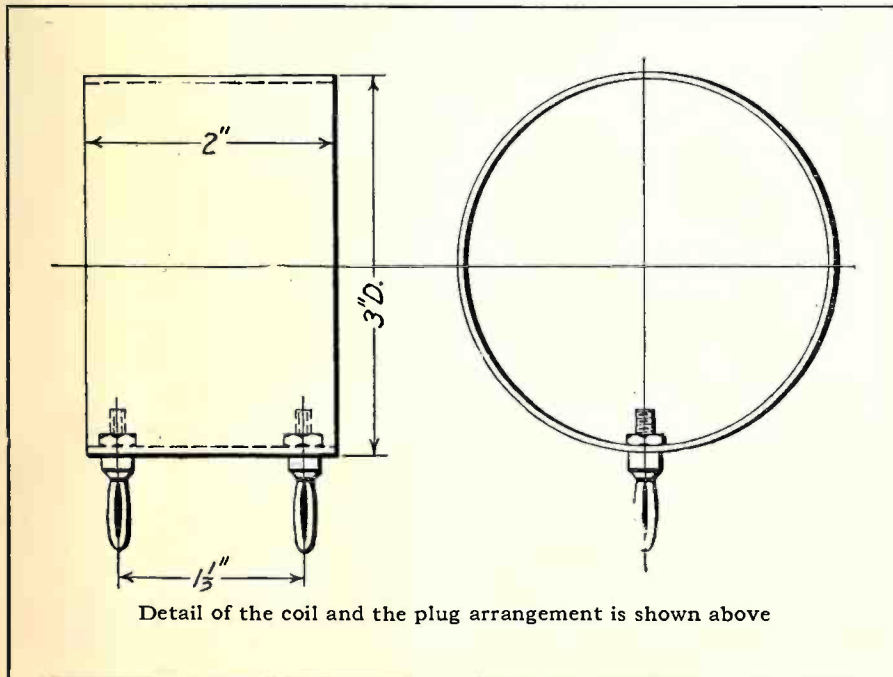
apparatus from which it is constructed.

The Department of Commerce is making an effort to bring all amateur stations within the prescribed amateur bands. There has been entirely too much "slipping over" into the wavelength bands assigned to other services.

It is also true that some amateurs have been "off wavelength" knowingly and with full knowledge that this sort of operation is detrimental to the amateur game in general. For the shortcomings and nearsightedness of a few unruly amateurs, the whole amateur fraternity is apt to suffer. This situation is one which must be corrected by amateurs themselves before the supervisors of radio take more drastic action.

To the amateurs who have the interest of the entire fraternity at heart and who are

*C. F. Burgess Laboratories, Inc., Madison, Wisconsin.

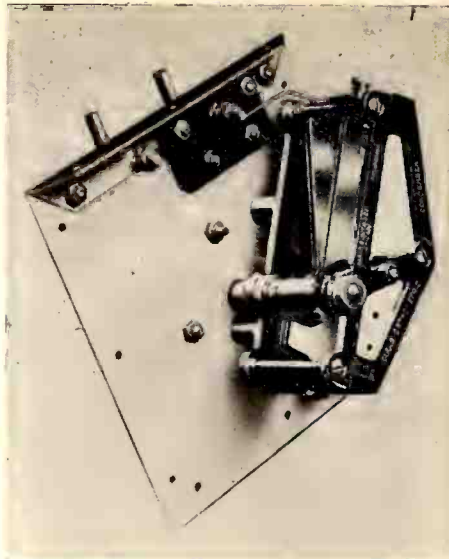


desirous of correcting any improper adjustments in their transmitters and receivers, this word of warning will be taken seriously.

Here are photos and descriptions of wavemeters constructed at the C. F. Burgess Laboratories, Inc., Madison, Wisconsin, and which were described in the lecture course at the Hudson Division A. R. R. L. Convention last May.

The circuit is simply the inductance spanned by the condenser, the simplest thing available.

Two wave meters were made, one using a 5 plate Karas (.0000972 mfd.) Orthometric condenser and calibrated in meters; the other using a Cardwell (.000150 mfd.) tapered plate, type 167-E, condenser is calibrated in kilocycles. Each condenser is mounted in an aluminum case for shielding, the



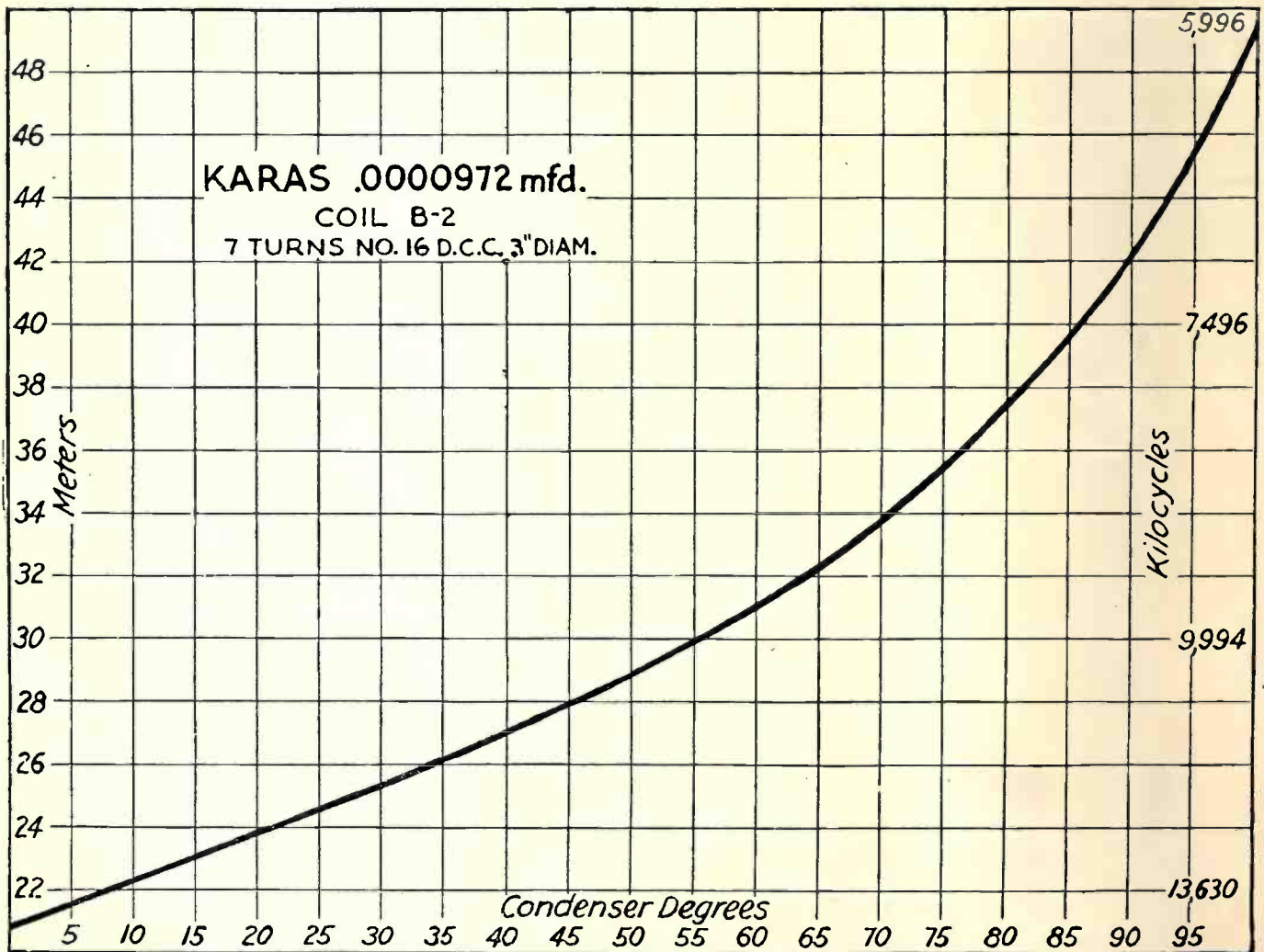
The Karas condenser is affixed to the under side of the meter panel

rotary plates and frames of the condensers being grounded to the top of the case. The aluminum is 0.051" in thickness. Brass angle strip is used to sup-

port the top, bottom and sides, 6-32 screws $\frac{1}{4}$ " long being used throughout. The lead from the fixed plates comes through an insulating support of $\frac{1}{4}$ " hard sheet rubber, a hole of $\frac{3}{4}$ " in diameter in the top of the aluminum case provides plenty of clearance. Jacks are spaced 1- $\frac{1}{2}$ " to take the coils. National velvet vernier 4 inch dials are used on each wave meter.

Mounting of the Karas condenser is shown in Fig. 2, Cardwell shown in Fig. 3. The Karas condenser case is 5 $\frac{3}{4}$ "x5 $\frac{3}{4}$ "x3" and the Cardwell case is 4 $\frac{1}{2}$ "x5 $\frac{1}{2}$ "x3".

Formica tubing 3" in diameter (1/16" wall) is used for supporting the windings. Each coil is wound with No. 16 D. C. C. copper wire. The Formica tubing is cut into lengths of 2" and each coil is fitted with two General Radio type 274-P plugs, spaced 1 $\frac{1}{2}$ ", Fig. 1. Each coil

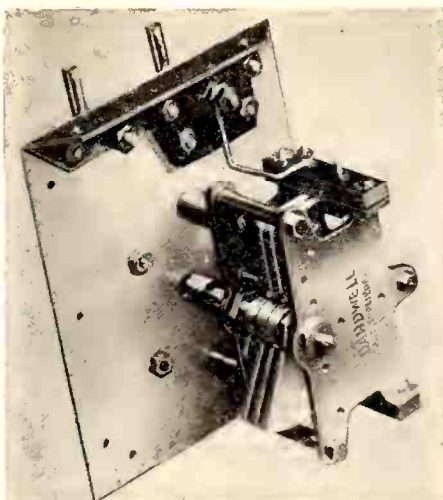


In this graph can be seen the curve secured with the coil B-2 which in this case had a range from 22 to 48 meters. The meter shown is calibrated directly in wavelength

is given two coats of moderately thin shellac. A wave meter is not a low-loss high efficiency receiver. The coils must be fixed permanently if the calibration is to remain somewhere near accuracy—hence the shellac. Before the coils are shellacked they are tied in four places with linen twine which acts as a means for preventing the windings from slipping.

Coil winding data for the Karas condenser is shown on page 40.

The curves show just about what you may expect if you follow dimensions as given. Of course, it is quite obvious that no

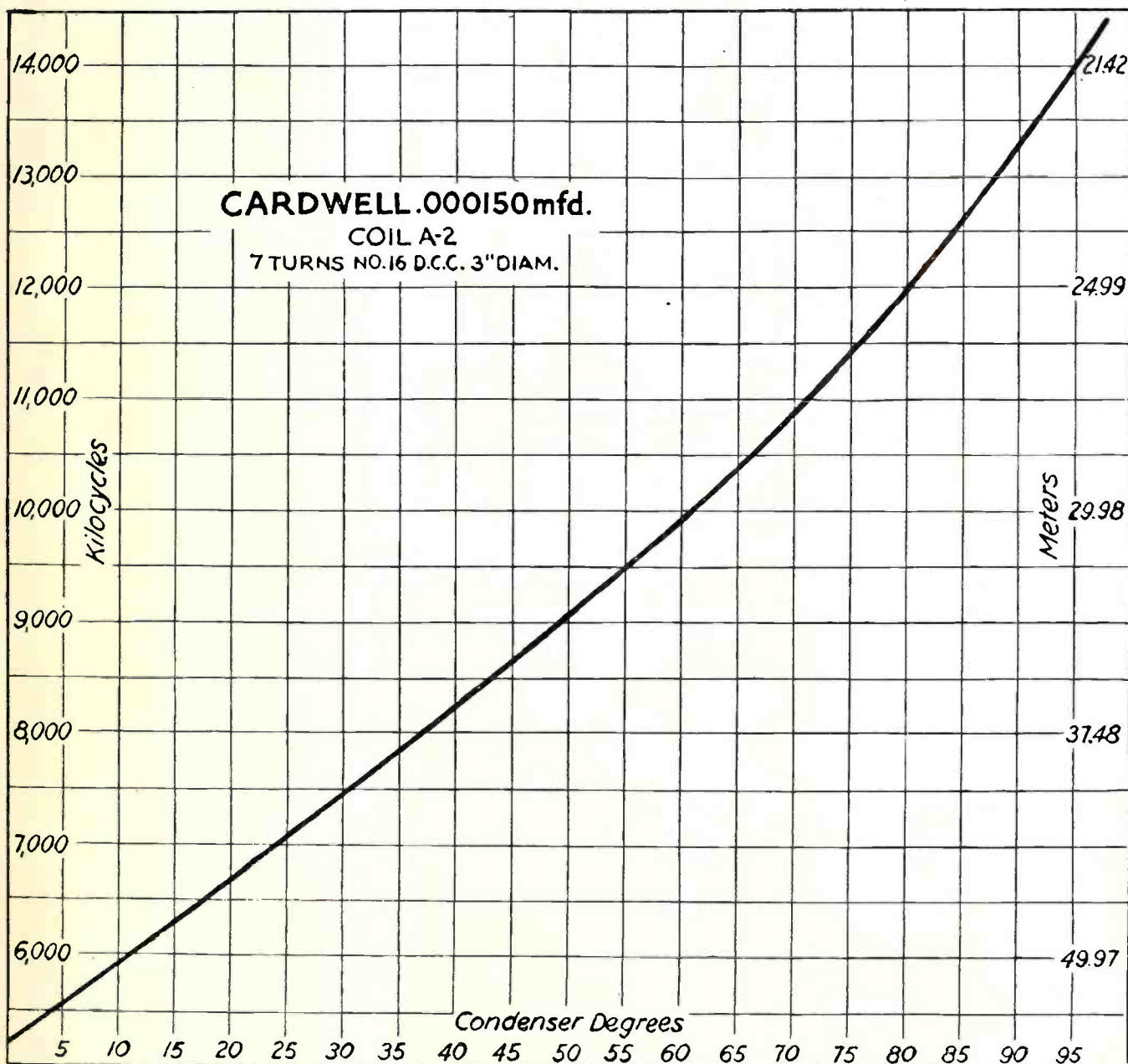


In this picture is shown the Cardwell condenser mounted on the under side of the wavemeter panel

two coils will be exactly alike in every respect, but they will be near enough so you can count on similar ranges when you are ready to calibrate your wave meter.

If you do make one or the other of these meters, *do not* rely on the curves shown for this particular meter and don't make the mistake of trying to correct the standard transmissions of the Bureau of Standards. They are right! You may be wrong, therefore check from them. With your receiver you can pick up these standard transmissions and by setting on zero beat you

(Please turn to page 32)



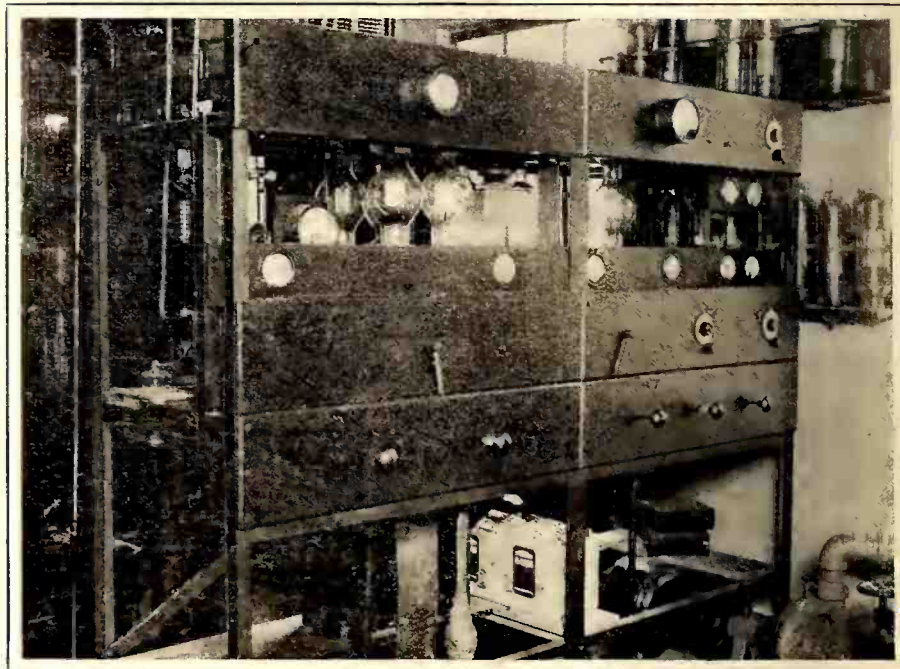
Calibration by frequency is shown in this graph which represents the curve of the Cardwell condenser and coil A-2 with a range from 14,000 kc to 6,000 kc

KYW First Crystal Control Set West of Pittsburgh

*New Chicago
Transmitter
Now in
Development
Stage*

QUARTZ crystal as a frequency control is becoming more popular each day and now that many of the troubles have been ironed out of its operation through intensive developmental work on the part of government branches and the large communication interests, radio fans will see many of their favorite stations using that form of control before many more years elapse.

Chicago is now to have the first crystal controlled high power transmitter West of Pittsburgh with the completion of the new control at KYW, the Westinghouse station at Chicago, according to recent advices from that organization.



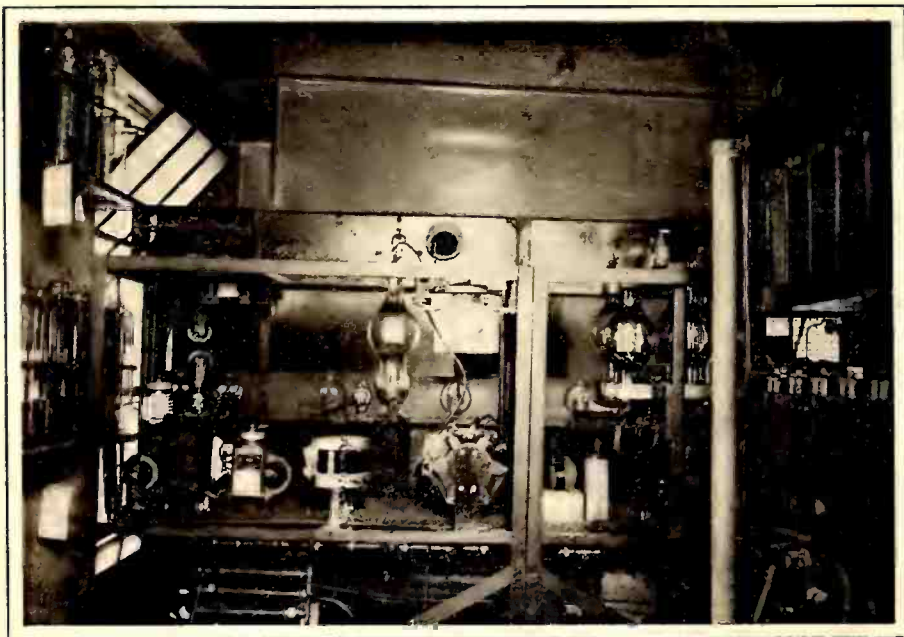
Front view of Crystal Control set being developed at KYW

All of the material is on hand and has been installed in proper panel form; preliminary tests have been run on the various stages from the 5 watt up to the 500 watt stages, and all that now remains is the addition of the ten kilowatt power amplifier stage which is now undergoing developmental work by

the Chicago radio staff of the Westinghouse interests, headed by Walter C. Evans, chief engineer in charge of the station. Engineers from Pittsburgh who have been accustomed to the work of the crystal controlled outfit at KDKA have visited KYW on several occasions and are interested in helping to get the new type of transmitter on the air.

The new form of transmitter is divided into five sections. The crystal oscillator is a 5 watt tube with the 560 kilocycle crystal placed from grid to plate (instead of from grid to filament) in order to secure better stability (although at a sacrifice of power in the crystal stage). Grid bias value is secured from a resistance, grid to filament. The first power amplifier is a 7½ watt tube; the next a 250 watter; then two 250 watters in parallel for the 500 watt stage, and finally the ten kilowatt stage which consists of two five kilowatt tubes in parallel.

Amplification is at the funda-
(Please turn to page 32)



Rear panel view of the Crystal Control outfit

Radio Beacons to Guide Planes Across Continent

*This Practical Service Will
Lessen Flying Hazards*

By S. R. WINTERS

DEFINITE decision has been made that radio is to be employed in directing airplanes from one point to another or, perhaps, across the continent. Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards, upon his return from McCook Field, Dayton, Ohio, where he conducted experiments with radio beacons in guiding aircraft, assures this writer that radio waves will soon be applied in practical service of lessening the hazards of flying. He describes these new devices as double-beam radio beacons—that is, they transmit two radio beams or waves from two large coils of wire or transmitting antennae.

Instead of depending upon altimeters, magnetic compasses, conspicuous signs at landing fields, great beacons of light, and other visual means of signaling—devices for making known the altitude and location of an airplane—the use of radio beacons as a means of directing aircraft safely from one point to another is assured. Recent and frequent wrecks of airplanes and fatalities to personnel emphasize the weakness of present methods of determining the altitudes and positions of aircraft in flight.

Visual Not Enough

UNFORTUNATELY visual means of signaling an airplane are incapacitated when they are most needed—during foggy or other adverse weather conditions. Then, merely to know the height of the flying machine, by noting the readings on the altimeter, is of little avail to the aviator. He needs information that will guide him along a pre-appointed course and above or below the storm area, which unfortunately, the pilots of the dirigible

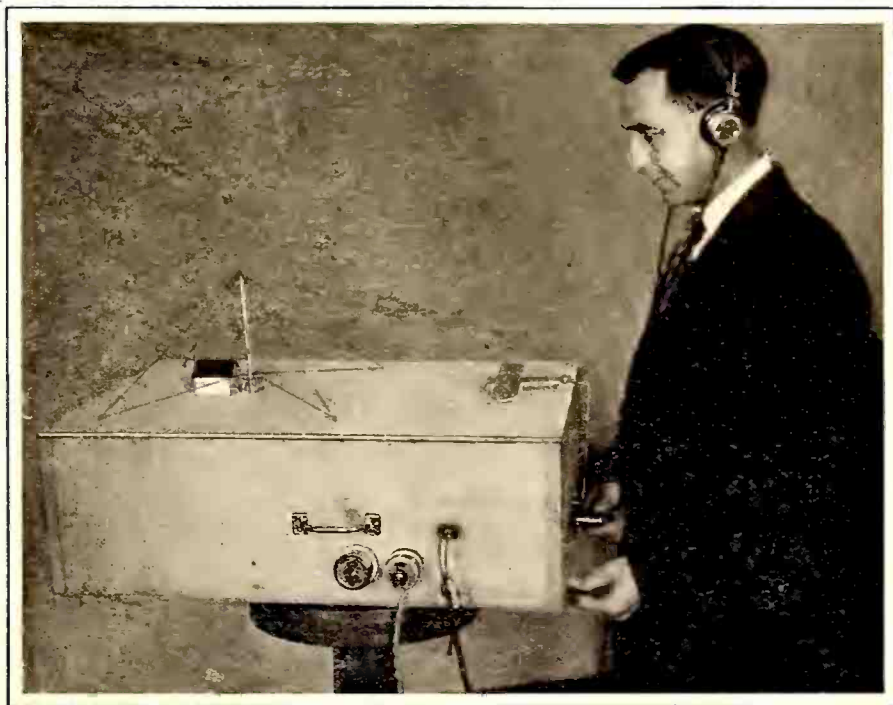
Shenandoah did not possess. Obviously, great searchlights, brilliant though they may be, are unable to penetrate dense fog.

Radio waves, though they are referred to as invisible, are not circumscribed by such a limitation. They travel through fog, rain or sunshine at 186,300 miles per second. Now, according to the proposal of interests devoted to the development of commercial aviation, radio waves are to be harnessed, so to speak, and used in guiding an airplane along a certain path, zone or sector. Ships already come into port safely by virtue of the guiding hand of radio; even when the powerful lighthouses fail to project their illuminating force to the mariner groping in fog or thick weather.

The radio beacon is not new in

theory and in an experimental way is not novel in its application to aircraft. Early experiments were made when Colonel Paul Henderson was identified with the United States Post Office Department, tests being conducted by the Air Mail Service at College Park, Maryland. J. E. Edgerton was in charge of radio activities of the Post Office Department, and Francis W. Dunmore of the Radio Laboratory of the Bureau of Standards was then working on the development of a radio beacon. The original beacon contemplated the flashing of two radio signals from a transmitting station and an airplane equipped with a radio receiving set intercepted these signals, with the assurance that the flying machine was navigating

(Please turn to page 53)



Model of double beam radio beacon developed in Radio Laboratory of the Bureau of Standards

Spirit of Modern Music Subject of Prize Essay

WITH the co-operation of Mark Rigg, Jr., general manager of radio station WGR, Buffalo, N. Y., Harold F. Gieser, director of the Vincent Lopez Hotel Statler dance orchestra, recently put on an essay contest, offering a prize of \$50.00 to the person between the ages of seventeen and twenty-one years within the range of WGR, who submitted the best contribution

By LLOYD S. GRAHAM

cerning modern, high quality jazz. Several hundred essays were received from every part of the United States and Canada. Many of them were excellent.

ONE of the interesting developments of the contest was the interest shown by the parents of contestants, indicating, Mr. Gieser believes, that largely through radio, good jazz now holds a position of recognized importance in the American home. The orchestra which Mr. Gieser directs is on the air four times a week from WGR; Mondays and Fridays at 11 p. m., and Tuesdays and Thursdays at 6:30 p. m.; and is one of the station's chief features.

Mr. Rigg was chairman of the contest judges. The other judges were Jack Yellen, song writer; Stanley Jenkins, president of the Beaux Arts Club of Buffalo; Vincent Lopez, and Mr. Gieser.

The Spirit of Modern Dance Music

By Elizabeth K. Emery

"America, so we hear, is known as the land of Jazz. This fact is looked upon with great alarm by many serious-minded musicians and music lovers. And yet where can they find harm in this new type of music? Classical music reaches at the most a minority, but the reason for the popularity of our modern dance music is easily seen.

"Our country is without question a nation of nations. The people who live here have come from all parts of the world. The natural result of this is that our music is a combination of the music of the different countries. Right here, may I state that I refer only to Jazz as played by the best orchestras. To continue, in our jazz, if you listen closely you will hear the lilt of Irish melodies, the bright, flashing sound of the Spanish, the melodious crisp-

ness of the French, the sweetness of the English and Scotch, the squareness and firmness of the German tunes and the melancholy of the Russian.

"The spirit of Jazz is essentially the American spirit of the day; the spirit which is full of restless energy, an after-product of the war and constant seeking for new pleasures. These things we hear and feel as we hear the



Harold F. Geiser, director of Vincent Lopez Hotel Statler orchestra at Buffalo



Miss Elizabeth K. Emery, of East Aurora, who won prize for best essay

of 500 words or less on the subject, "The Spirit of Modern Dance Music."

The competition lasted over a period of a month and was won by an eighteen-year-old high school girl who is also a radio enthusiast; Miss Elizabeth K. Emery, 471 Main St., East Aurora, N. Y. Incidentally Miss Emery was the only entrant from her home town and was easily the winner with an essay of less than 300 words. In a ceremony held before the microphone of WGR at the close of the contest, Mr. Gieser presented Miss Emery with the prize and she made her radio debut by reading the essay which won the money to the radio audience.

It was Mr. Gieser's object to discover if possible what is in the minds of his radio audience con-

orchestras on the radio or in the dance hall.

"In saying this, I do not mean to condemn Jazz. On the contrary, I believe that it is a wonderful thing; wonderful in that its harmonies are an artistic production and wonderful in its perfect expression of the average American spirit.

"Let us take the pride in our Jazz and as other nations have won their musical laurels along other lines, let us win ours by having our jazz become the music used internationally for the gayest recreations. No one can work well who does not play well.

"With our jazz made up as it is of the music of many nations who knows but what it will be a factor in drawing nations together in understanding and so promote world peace."

Who Pays Our Pipers?

By
DOROTHY BRISTER
STAFFORD

OUR radio set had ceased to be a mechanical marvel, the sound of voices a thousand miles away was no longer a miracle, but as commonplace as the telephone—even the thrill of getting California had palled—and the family had settled down like thousands of other comfortable folk to the regular routine of listening to the dozen or more stations they had learned were worth hearing, and whose reception could be depended upon to be painless, when Junior sprang the inevitable query.

"Mother, who pays that lady for singing?"

"My goodness, I don't know," returned his mother, who had been accepting the wealth of good music that filled her living-room nightly as manna from Heaven. "I don't suppose she gets paid. I never thought about it."

"Why, Mother," expostulated seventeen-year-old Betty, with sophomoric wisdom. "She's a Metropolitan singer. It's piffle to say she'd sing for nothing."

"Well, then ask your father. He knows everything."

Father came out from under the Sunday supplement. "You've heard it no less than four hundred times. Mr. Atwater Kent pays her."

"But why should he pay her, Dad, to sing for us and everybody?" pursued Junior, with the persistency of his years.

"Good gracious, don't you know



Cliquot Eskimos Quartet heard frequently through WEAJ and its chain of "hookups"

anything, it's advertising," said his father. "But don't ask me anymore. I don't know how it's done or why they do it, but I'll find out."

Searching For Data

HOWEVER, he didn't at once. He went about for a week discussing the subject with other listeners, who seemed to be divided into two classes—those, who like Mother calmly accepted their entertainment as a matter of course, thinking, if they thought at all, that the artists were altruistic souls who worked for the sheer joy of working; and on the other hand the listeners who were curious but had no means of finding out. And then one day Father barged into our office. He had copies of several magazines of general circulation in his hand.

"How come," he demanded, "that none of these people seem to print anything about radio? Here's a write-up of a movie-queen's new house, how a cigar

salesman became a millionaire, what becomes of chorus girls, two pages of what can't be anything but press-agent bunk for a singer, and not a line about something millions of people are interested in. You'd think these editors didn't know radio existed."

"Ssh!" we cautioned, "it's the horrible stigma of advertising. It's pretty hard to do anything about prominent radio features without dragging in the name of the corporation that is footing the bill. You'll occasionally find an article about a prominent announcer, but most of the features are taboo."

"But I don't see—"

"No, you probably don't. But it's ethics. Don't you know that publishers have an unwritten law—(probably something like the Hippocrates oath, or whatever it is you doctors take)—father is a surgeon—"that makes you believe you'll be eternally damned if anything like paid publicity ever smirches your name) that

renders it impossible for the name of an advertiser to ever appear in the literary columns of a magazine? It simply isn't done, that's all. While it is now considered good form to facetiously refer to 'Halitosis Hal,' 'the three out of four,' and 'you just know she wears them,' the actual name of the advertiser would no more appear in reading matter than you would run a page ad in the *Bladepaper* with your picture in it. Look at the radio page of the *New York Times* and see the painstaking care expended to avoid using the names of sponsors of radio hours. It will say, 'A program featuring English music will be broadcast by WEAF Tuesday at nine o'clock.' or 'Nathaniel Shildkret's Orchestra will play Thursday at 8:15,' though everybody in the radio world knows Tuesday at nine as the *Eveready Hour*, and the orchestra that plays Thursday at 8:15 is certainly not known as Shildkret's."

"But they use Atwater-Kent and Victor," objected the doctor.

"Well, I suppose there is no way of getting around that, and their offerings are too important

to be ignored. Better buy you some radio magazines. They are too interested in all branches of the industry to be so squeamish, and that's about the only place you'll find your radio friends."

"But I don't know anything about their diagrams and blithering gadgets," protested the enquirer. "They might as well be printed in Greek for all the good they do me, and I still can't see why a magazine of general circulation should so avoid anything of such general interest."

Good Will

"**W**AIT a minute, and you will. Suppose you were running a magazine—though it's rather difficult to visualize you or any other professional man in such a capacity—and one of your pet advertisers whose account has been running into the hundred thousands for several years, turns up with his appropriation, say \$150,000 short. His agency informs you that that sum has been diverted to radio advertising, or what the bang-up stations prefer to call 'good-will publicity.' Are you likely to have a very warm place in your heart for the inter-

loper that's come along out of a clear sky and lifted that hundred and fifty thousand out of your pocket? Possibly it's a little far-fetched to say that any one magazine loses such a sum from any one account, but multiply it by several clients and it mounts up. Is it any wonder the magazines don't exactly love radio?"

"But you don't mean to tell me anyone is spending \$150,000 a year for radio advertising."

It was our turn to be astonished by his ignorance. When he left, loaded down with statistics for Junior, he said he was a sadder and wiser man, and was going to approach the "good-will" programs in the future with something akin to awe, now that he knew what each golden moment was costing the venture-some advertiser.

In contemplating this interesting side of broadcasting, it is amusing to look back a year or so ago to the hullabaloo that was raised about advertising, and how it was going to be the curse of radio. Where, might one ask, would broadcasting be today without it? With a few exceptions, all our best music is coming



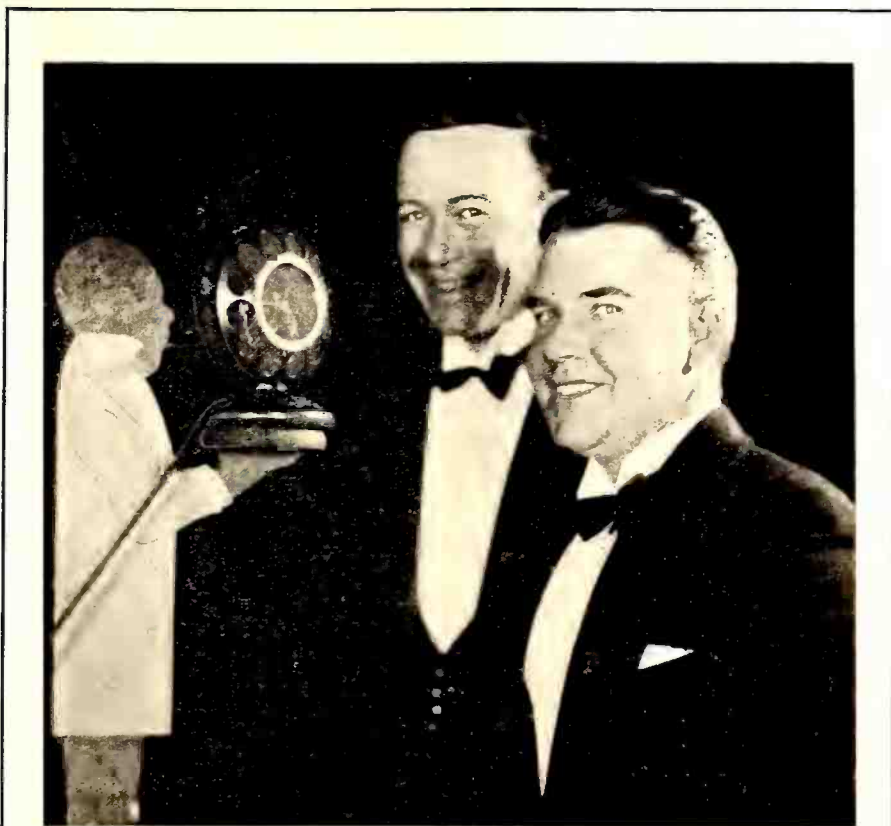
Our author remarks she would rather remember dental hygiene through music of these Ipana Troubadors than any other method

to us by this means, and so carefully is it camouflaged in many instances, that one wonders if oftentimes it does not miss its point. We recall the dear, musical soul who went about last winter talking of George Barrere's "Royal" Little Symphony Orchestra, without the slightest suspicion that she was using the name of an advertiser. True, in the case of a number of small stations that are maintained solely for the exploitation of some commodity, advertising is a pest; but the canny listener long ago learned to give these town criers a wide berth, and the expense of upkeep with little or no returns in sight, forces a few more of them off the air each month.

In the case of the large stations that specialize in these good will programs, the listener is no more annoyed by the small minimum of publicity that seeps into his ears than he is by the advertising he has to climb over in a magazine to get to the end of his story; and if he is a thinking person, he is bound to realize that the radio station with the largest income from its publicity is going to give him the best programs, just as the magazine with the heaviest advertising section can give him the highest paid writers. The American of today surely has been shouted at in 36-point type and colorature layouts long enough to lose any sensitiveness he may have had originally in regard to advertising. To us it seems rather absurd to take exception to it. So long as we haven't yet reached that millennium when "no one shall work for money and no one shall work for fame," it is obvious that somebody has to pay for our entertainment.

Pleasant Advertising

AND when one comes to think of it, isn't it a rather nice way to bring to our attention the fact that there are beverages and batteries and unguents and what not for sale? Personally we'd rather be reminded of a tooth preparation by the strains of a rollicking orchestra than by a horrible drawing of a decayed tooth. Formerly we couldn't see where the advertiser got his re-



Billy Jones and Ernest Hare, known as the "Happiness Boys," entertain from the WEAf chain on Friday evenings

turns from radio publicity. But we are just getting the point of view. We have been analyzing a page ad in color of a national advertiser, who also is using a radio hour. This ad consists of a marvelous still life painting by a well-known illustrator, showing the advertised product. Although knowing more about the price of still-life paintings and the breathtaking page-rate of this magazine than we do about the market value of songs from the throat of a famous tenor, we will still wager that the same amount of money expended on radio entertainment will get the name of the product into the minds of more people than this beautiful example of art, combined with the most carefully written copy. We were attracted to it because it is a wonderful painting, but to the average reader it is just another pretty picture, and he sees so many of them that it is doubtful if the name of the product is going to register after he turns the page. But let him *hear* the name of that product twenty times in the course of an hour in connec-

tion with music he is enjoying, and we will bet our pet detector-tube that it is going to stick in his head. Anyone who has studied a language by means of phonograph records knows the importance of the spoken word upon the memory cells. We couldn't learn the French numerals in a lifetime from the printed page, but the reiterated drone of a bass voice with a Parisian accent coming from the phonograph cabinet is going to stay with us forever. We don't know if the radio stations have used this argument with the advertiser. If they haven't they are welcome to our humble discovery.

While today almost every station, both large and small, is selling some of its time in an endeavor to break somewhere near even on the tremendous cost of broadcasting, it is of the workings of WEAf, which with its complicated network of telephone hookups is reaching millions of listeners, that we would speak. The exquisite "Two Guitars," which heralds the arrival of the Gypsies, the strains of "Smiles,"

with which the Ipanas come on the air, Goldy and Dusty's "Good evenin' to yuh, white folks," and the chimes of Silvertown, are now as much a part of everyday life in thousands of homes as the coming of the evening paper. Those fortunate enough to live within good reception of any one of the many relaying stations are assured of regular programs of proven quality at all times, for such is the dependability of the telephone hookup, that it is only on nights of unusual storms that the programs suffer from any interference. And as usually is the case with anything that becomes such an accepted and everyday fact, probably only a small per cent of the listeners realize how much expense and effort is put forth—aside from the marvelous mechanical accomplishment—to bring entertainment of this quality into our homes night after night.

How It Is Done

To begin at the beginning. The advertiser is convinced that an hour or half-hour of the "good-will publicity" will further his in-

terests. He finds that for the comparatively trifling sum of six hundred dollars per hour his program will be put on the air from WEAF alone. If he desires "to engage the facilities" of the hookup, this is reduced to five hundred per hour for the New York station, with an average of two hundred and fifty dollars for each additional hookup station. If your arithmetic is the same as ours, you will find that a fourteen-station hookup, such as is used by a number of features, will cost somewhere in the dangerous proximity of \$3,750 for the hour. If the broadcaster continues weekly for a year, as we know many of them do, a little figuring with 52 as the multiple will give you a result that may cause you to eye the loud-speaker with a little more respect the next time you hear that imposing list of stations. One trusts they get something off for cash.

Then when his time is all arranged and it has been decided which and how many stations shall relay the programs, does the advertiser pick up a pianist here and a fiddler there and call up a

singer or two he happens to know to put on his entertainment? Not precisely—any more than he would pay five thousand dollars for a page in a magazine and attempt to write the copy himself. Just as the large advertising agency maintains a force of expert copy-writers and art specialists, so WEAF employs an expert staff in program arrangement. Prior to the signing of a contract, this department works up a program along the lines expected to appeal to the client, the artist's bureau collects such musicians as they feel will be adequate, and when the entire hour of entertainment is assembled, an audition is given to the client. If it meets with his approval, the artists are engaged under contract just as if they were appearing upon the stage, and the feature is all set and ready to go, with the trifling exception of paying the performers. As we said awhile back, we are somewhat uninformed as to the market value of musical ability—but have you, for instance, hired a dance orchestra lately—even a little one?



Harry Horlick directs the musical destinies of the "A and P Gypsies" which is still another of the nocturnal features from WEAF and its allied stations

One of our young friends, who is going through the most serious period of his life, carrying the burdens of a high school fraternity upon his shoulders, set out the other day to provide music for the annual dance. It was to be quite a swanky affair, so he approached the leader of a popular small orchestra, which had become well-known through its broadcasting. Yesterday he roared in waving a telegram.

"What do you suppose he wants?" he shouted. "Eighteen hundred for the orchestra and five hundred more if he comes to lead them! Can you beat that, and they play for the radio for nothing."

"Oh, they do? Who told you that?"

"Well I just supposed all orchestras—" he stopped, as the light began to dawn. "Does that real estate company pay them? Well I'm a dumbunny."

One of the best-known hours of dance music was coming through on the hookup.

"What," demanded the enlightened young manager, "do you suppose that outfit pulls down for an hour's work?"

We pleaded no official figures on the subject, but volunteered a sum that we had heard rumored as this orchestra's fee for the hour.

"Good night!" he shouted. "I am going to borrow a radio set and we'll dance to that."

And while we have never been one to apply the rule of dollars and cents to any line of artistic achievement, it is obvious that anything representing such a considerable outlay of money as the hookup broadcasting cannot afford a mediocre standard. The sixteen or seventeen features to which we have been listening the past year over the WEAf chain, have seemed to us, with scarcely an exception, all that even a critical listener could ask of radio broadcasting. Occasionally there is a program which may not appeal to us personally—but as is always the case with radio—we will probably hear a dozen other listeners say it was the best they'd ever heard. The program arrangers at WEAf have been running to the contin-

uity type of program the past year, and it apparently has a wide appeal.

All Tastes Considered

HEADED by the Atwater-Kent broadcasts, which have represented the best in music and talent that intelligence and money could procure, the entertainment provided by the chain has run the entire gamut through light opera, lectures, chamber music, and dance orchestras to singing comedians. It seems that no variety of taste in music has been overlooked, and the individual who always thinks he can do things a little better than they are being done, would be hard put to find better talent than is represented in the personnel of these radio hours. Recruited from the concert stage, the music halls and symphony orchestras, many of these entertainers enjoyed wide reputation before coming into the field of radio; a number of them have achieved such success in radio that they are now constantly in demand for personal appearances. And so far reaching is the scope of their work, that quite a few of them are now household words in thousands of homes that know nothing of the favorites of the stage and opera house. The feature of the WEAf hookup that seems to enjoy the widest popularity with the older, quieter, stay-at-home type of listener is the Eveready Hour—those veterans of the air, who from the beginning have adhered almost exclusively to the continuity program—presenting in a tabloid setting a concert usually embracing music of the type that appeals to the home-loving, less sophisticated mind. Thus it is that hours such as the "Golden Wedding" have been repeated several times in response to listeners' requests. This versatile group, in addition to Max Jacobs and his Salon Orchestra, includes such well-known entertainers as Betsy Ayres, Rose Bryant, Charles Harrison, Wilfred Glenn, and many other artists who are featured in special programs. We still contend, after almost two years, that our favorites among the many Eveready hours we have heard are those put on by

Red Christianson, the sea-going taxi-driver who got himself shipwrecked on Galapagos, and the vivid extracts given by Merien Cooper from his book, "Grass."

We know of no sincere lover of good music among our radio friends who does not place the A. & P. Gypsies at the very top of his list of radio favorites—for from the very beginning of the broadcasting of this feature their standard has been exceptionally high. Under the leadership of Harry Horlick, this orchestra has been specially noted for its artistic rendition of little-known compositions—many of foreign origin. Whether themselves of that mystic elusive band that follows the *patteran*—these musicians play gypsy and wild Hungarian melodies, with a verve and abandon unlike the technique of any other group we have heard either on the air or the concert stage. When they do interpret any familiar composition, there seems to be some mysterious virtue in their strings that sets their rendition apart, and causes us to feel that we are hearing it for the first time. It is to be hoped that another season the sponsors of this program will use more than a six-station hookup, as this feature would be gladly welcomed in any home where there is an appreciation of good music.

The Silvertown Cord Orchestra also can be rated almost as a pioneer in this class of entertainment, and since like the Eveready Hour it goes out over a lengthy hookup, it enjoys a widespread popularity. Here again, there was no experimenting with amateur or second rate talent. Joseph Knecht, long and favorably known as the leader of the Waldorf-Astoria Orchestra, has been its head since its inception, and last spring resigned his hotel position to devote all his time to his broadcasting duties. This feature illustrates the remarkable result of an idea, probably conceived by some bright young man at WEAf, for the mysterious singer introduced in this hour as the "Man in the Silver Mask" has possibly achieved a wider publicity than others who

(Please turn to page 44)

Radio Prophecies from Viewpoint of Prophesee

Seers Have Hard Time in Keeping Ahead of Radio

By
ARMSTRONG PERRY

RADIO prophets have tried hard to keep one jump ahead of the radio inventors.

Six or seven years ago, they were telling us that in another decade we would receive concerts, lectures and news, by radio, right in our own homes. If they had stopped prophesying long enough to listen in, they might have heard music in the air right then, for experimental broadcasts began just as soon as our government lifted the war-time ban from transmitting stations.

And now see what we have—so many broadcasts that we receive three or four programs at once, sometimes, in spite of all the selectivity in the radio advertisements.

As soon as broadcasting was on a firm foundation, the prophets talked about the increasing distances over which radio communication would be possible in another decade. Continent would speak to continent, and the islands of the sea would lose their isolation and be linked with the centers of population. That began to happen before most of the prophets were wise to it. In 1915, the Navy radio station at Arlington transmitted the voices of officials to the Eiffel Tower in Paris, and to a station in Hawaii, but it was too expensive to try every day. Five years later, a Boy Scout speaking from his amateur station in New Jersey was heard in Scotland. He used only 1,000 watts of power which, if I remember correctly, was one per cent of the rated power of the Arlington station. During the past year, stations have been heard across oceans so frequently that soon the public will be demanding something with more of a thrill in it.

When it comes to dot-and-

dash messages, fifteen-year-old boys are building sending and receiving sets in America that keep them in touch with Australia and other points on the opposite side of the earth. Even for the amateurs, radio is world-wide, and the commercial stations are handling millions of words of transoceanic traffic monthly, so reliably that American business men can transact in China, today, any business that could be handled by telegraph if China were as near as Canada.

The kick of newness has gone from the transmission and reception by radio of anything that can be heard. Now, the prophets have been busy for some time foretelling the day when we shall receive heat, light, power, motion pictures and intimate glimpses of the person at the other end of the conversation, by radio. The fellow who is in the habit of telephoning from his bath tub may be in hot water in more ways than one.

The actual accomplishments of radio are so marvelous that we are ready to believe almost anything. But, supposing there should be a doubting Thomas among the prophesees to whom the prophesiers are prophesying, what actual foundation in fact could be shown him for the hope that radio is to become a sort of general delivery wagon for everything but clothing, boots, shoes, hats, caps groceries and general merchandise? Prophets have a way of throwing out statements in a large and general way without going very much into detail as to the means by which their prophecies are coming to pass. Some of them

may know more than they tell, as in the case of an inventor who has his invention practically ready for the market and makes a prophecy merely for its publicity value. Others predict things that a mere layman, having only such information as can be found in books, finds it hard to believe.

Small Power Delivered

RADIO waves, it will be remembered, deliver very slight amounts of energy when brought into a receiving station. It costs one hundred dollars an hour to operate an average broadcasting station, but that is not all spent for power. A large proportion of it goes for salaries, rentals and expenses such as are incurred in other lines of business. The amount of energy radiated from the antenna seldom is more than five kilowatts. (An ordinary one-family house will use from ten to twenty kilowatt hours of current in a month, for lighting). Some scientist has figured out that only about three-trillionths of the energy from a broadcasting station is picked up by any one receiver. Somehow, after sawing and splitting the wood that is at the moment burning in my stove, and after considering the energy put forth by the sun and by the chemicals in the earth to produce the tree from which the wood came, I cannot see myself picking out of the ether enough energy so that I can junk the stove and save my back the wear and tear of cutting and carrying in fuel.

As to light, we are so accustomed to receiving a sufficient quantity of that from a distance, by the way of wires, that it is not so difficult to imagine eliminating the wires and gathering it from the ether.

(Please turn to page 42)

Plate Power Supply Uses the New Raytheon Tube

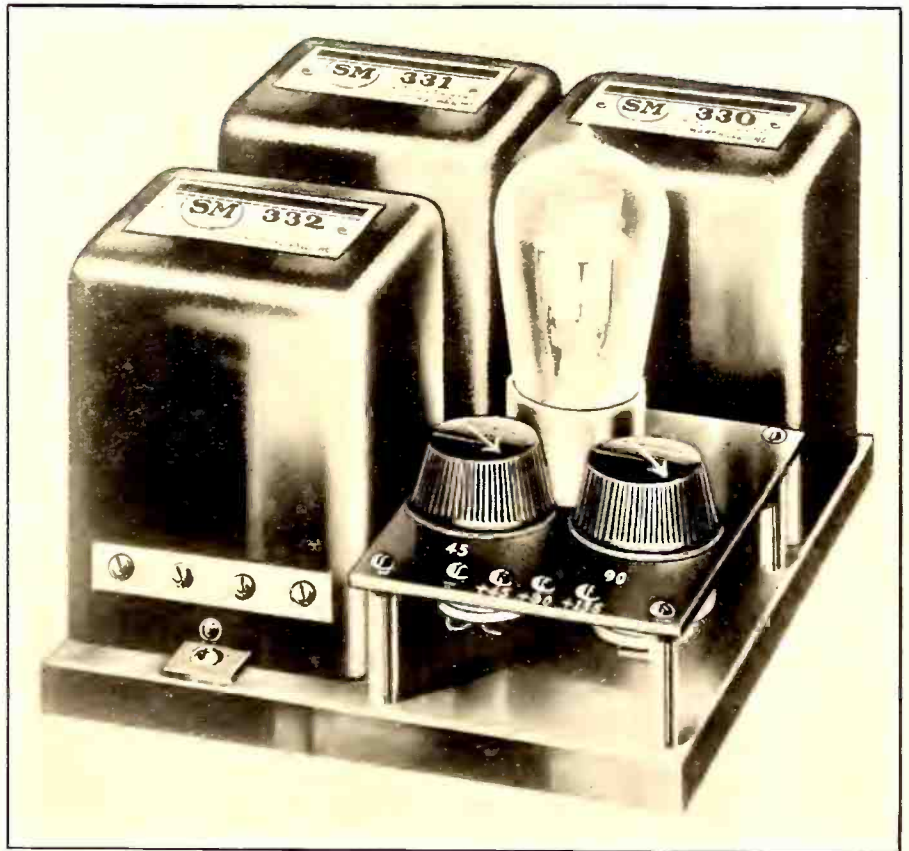
Clough Filter Seems Advance In Hum Elimination

By McMURDO SILVER

IT IS VERY interesting, indeed, to consider that of the entire myriad of B power supply sets and B battery eliminator designs which have made their appearance since the advent of the justly famous Raytheon and Rectron tubes which made them possible from the broadcast listener's point of view, an almost identical standard of design has been adhered to with practically uniform execution for every different type.

Basically, all supply systems designed to furnish power for the radio receiver from the house lighting mains consist of four units into which component parts may be very easily segregated.

The first section of every eliminator is the power transformer which serves to take the requisite power from the house lighting circuit to which it is connected and step it up to the value which will be required by the radio receiver, plus the additional amount necessary to overcome the losses inherent in the transformer itself, the rectifier device, and the filter system. Connected to the transformer is the second unit, the rectifying device—in the cases under consideration a Raytheon or, as an alternative, a Rectron tube. These tubes serve to convert the alternating current output of the transformer to a direct current of a comparatively uneven or pulsating nature. In such a state, this direct current could not be applied directly to the receiver without the same unpleasant hum drowning out all but the strongest signals which



The assembled unit is shown in the above photograph

would be present were the receiver to be connected directly to the lighting line.

Therefore, the third section, (the filter) is used to smooth out this pulsating direct current to a substantially smooth continuous direct current, the nature of which is similar to that of the current obtained from ordinary B batteries except that it does not diminish over a period of time as does the battery current as a result of chemical deterioration.

The voltage obtained from the system, so far, is consider-

ably in excess of that required for the operation of all receiver circuits excepting only the power amplifier, or audio amplifying tube, which requires from 135 to 300 volts. Therefore the fifth section (a voltage regulator) consisting of various resistances and condensers, is employed to cut down this high voltage, where necessary, to the requisite value for detector and radio frequency amplifier tubes. Such a power supply has a pronounced advantage in that the voltage is practically constant and the life almost unlimited

using the Raytheon tube which has no filament to burn out.

Only Two Types

THIS peculiar similarity of all current supply sets is probably due to the scarcity of rectifying devices available—the Raytheon and Rectron tubes being the only good ones in common use. Yet the real reason is the filtration problem, for in every single supply system commercially available or recommended in magazines, but one type of filter will be found—the so-called “brute-force” type, aptly named, as no selective effort is made in it to eliminate the undesired frequencies, but, rather, to choke down the entire group by a high value of inductance and capacity—large enough to cut down the fundamental hum, and far larger than is necessary to eliminate harmonics of the fundamental.

It is the purpose of this paper to describe a power supply

recently developed which is unique in that it presents for the first time in supply set design an absolutely new principle of filter construction—new not merely to supply-sets, but to the electrical art as a whole. While it is possibly premature to predict the future of this system, it seems safe to assume that the Clough filter, as it is known, will gradually revolutionize B sup-

ply design for thoroughly practical reasons, which will be evident after a consideration of the facts set forth in this paper.

Shown in Photo

THIS entire supply set is illustrated in the accompanying photo, and is seen to consist of three black enameled steel cases mounted on a rectangular steel sub-base which also carries a tube socket for the rectifier tube, a control panel equipped with voltage regulating resistances and output binding posts, and the necessary wiring.

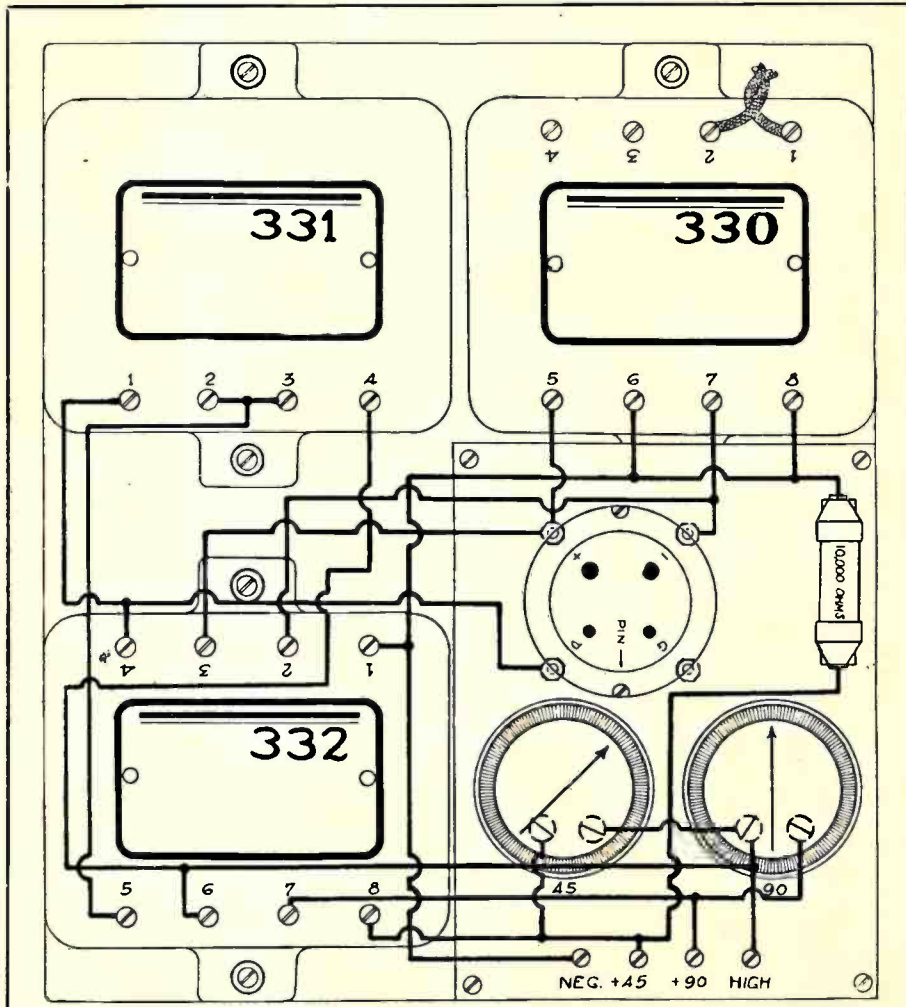
In the pictorial diagram appears the representation of the power transformer, provided with a primary winding terminating in a cord and plug to be inserted in a light socket or wall receptacle of any home or building supplied with 110 volt, 60 cycle alternating current. This transformer also contains a low voltage winding capable of supplying 7.5 volts at 1 ampere or more for filament lighting purposes. A high voltage secondary is provided to supply the rectifier tube, consisting of two 300 volt windings in series.

A special electrostatic shield is inserted between primary and secondary windings, thus eliminating much common line noise that would get through to the radio set with ordinary transformers. This shield also eliminates the antenna effect of the everyday lighting line, which tends to pick up radio signals, as well as carry undesired noises emanating from motors, flashers, X-ray machines, and other power equipment operated from it into the set.

The voltage regulation of the transformer is nearly perfect; that is, the voltage will remain constant regardless of the current drawn from it, over the ranges used in the largest receivers. One very interesting feature is the fact that if the supply set operated by this transformer is left permanently turned on, but without the radio receiver operating, the house current drawn will be less than one-fortieth of an ampere! Further, its normal rating is 85 milliamperes.

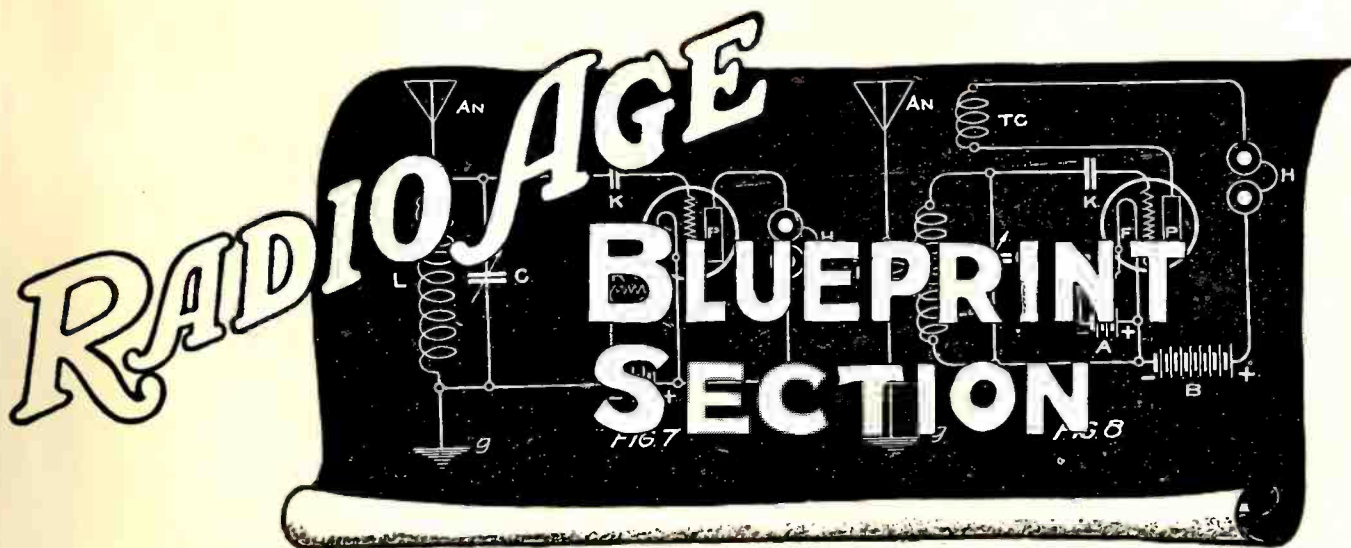
Parts Needed

- 1—S-M No. 330 power transformer
- 1—S-M No. 331 Unichoke
- 1—S-M No. 332 condenser bank
- 1—Raytheon BH tube
- 1—S-M No. 511 tube socket
- 2—Resistances
- 1—10,000 ohm resistance with clips
- 1—Bakelite terminal panel with four binding posts
- 1—Steel sub-base, 6½"x7½", with turned edges
- 1—Coil hook-up wire



This is a pictorial layout of the power supply device described.

(Please turn to page 40)



Power Amplification for Best Quality

Bass Notes Require More Energy Than Upper Register

By J. E. COOMBES

POWER amplification is the increase of the strength of radio reception, without distortion, through the use of larger capacity tubes, capable of handling many times the volume of the tubes ordinarily employed.

"But," you may say, "my set has plenty of volume as it is,—more, in fact, than I can listen to in comfort; and the quality is excellent."

Power amplification has a much more important function than merely to increase volume. It gives the set power to reproduce the heavier tones and overtones which cannot find release, even at moderate volume, through the customary method of amplification. Power amplification gives radio reproduction the fullness of a third dimension, reproducing every sound from the highest treble to the deepest bass of the broadcast program with almost unbelievable realism.

If driving a car were narrowed down to moving smoothly

along a level paved road at a speed of not more than thirty miles an hour we could get along with much less power than the average car possesses. But there are times when we need a good pick-up, there are occasional steep hills and mud holes or sand pits that require many times the power used in the normal run. We do not make a practice of traveling through traffic at 60 miles an hour, but there are times when we need that power.

If radio reception were put to no greater task than reproducing the music of the violin, power amplification would be unnecessary. There are times, however, when broadcast reproduction demands many times the power consumed in duplicating the music of the original violin.

More Energy

IT is not difficult to appreciate the fact that the beat of a

drum or the deep vibrations of the pedal diapason of the organ require a much greater expenditure of *mechanical* energy than does the bowing of a violin or the playing of a flute. Likewise it is easy to understand that the consumption of *electrical* energy must be proportionate to the mechanical energy expended. A radio tube with capacity just sufficient to amplify comfortably the music of a violin cannot be expected to do justice to the tones of the heavier bass instruments.

The development of the U. X. 210 and C. X. 310 power amplifying tubes has meant much in the advancement of quality reproduction. The standard amplifying tubes in common use today—the U. X. 201-A and C. X. 301-A—have a maximum undistorted power output of .015 watts when operated at the normal of 90 volts on the plate. The undistorted power output of the power tubes mentioned above is much greater,—measuring 1.54 watts, or *more than*

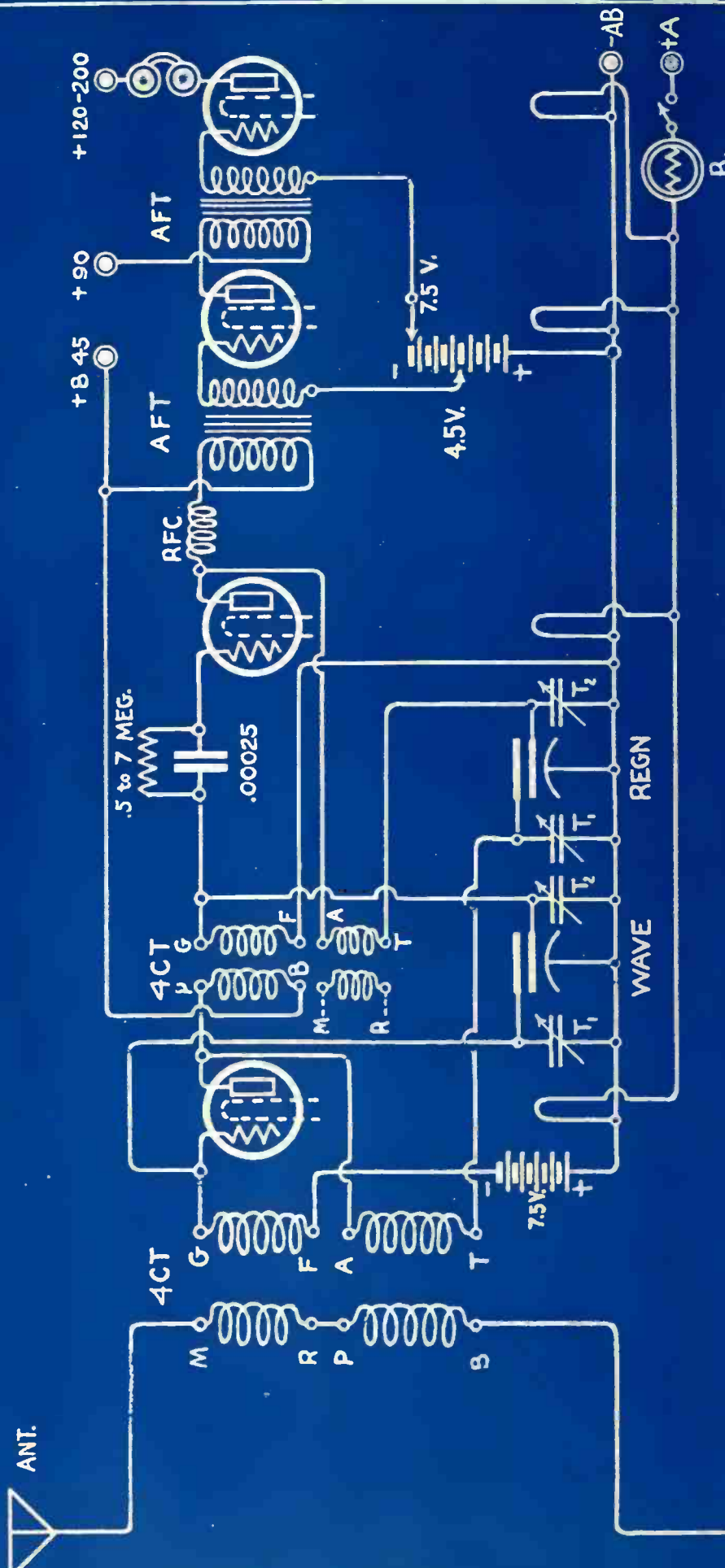
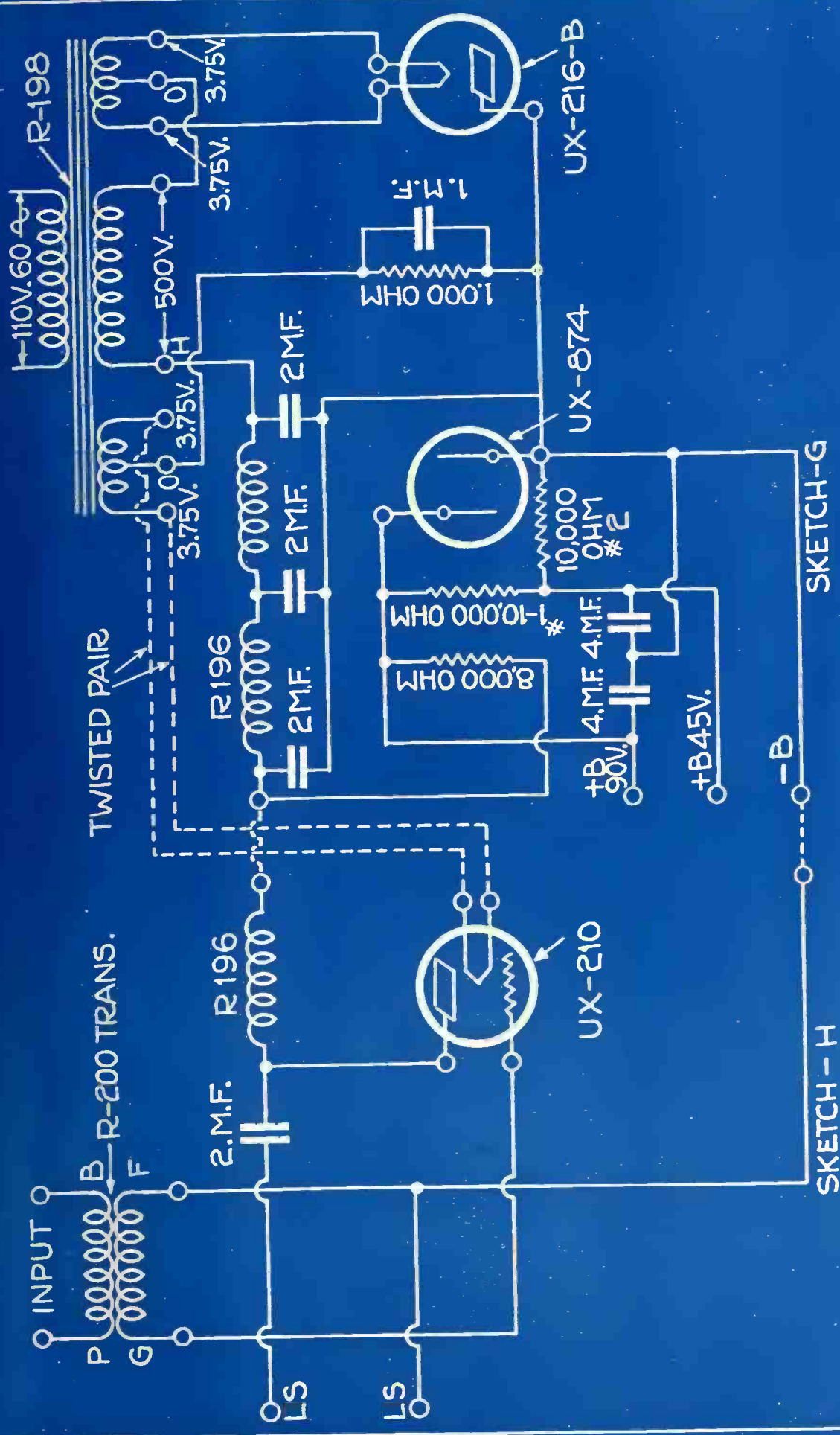
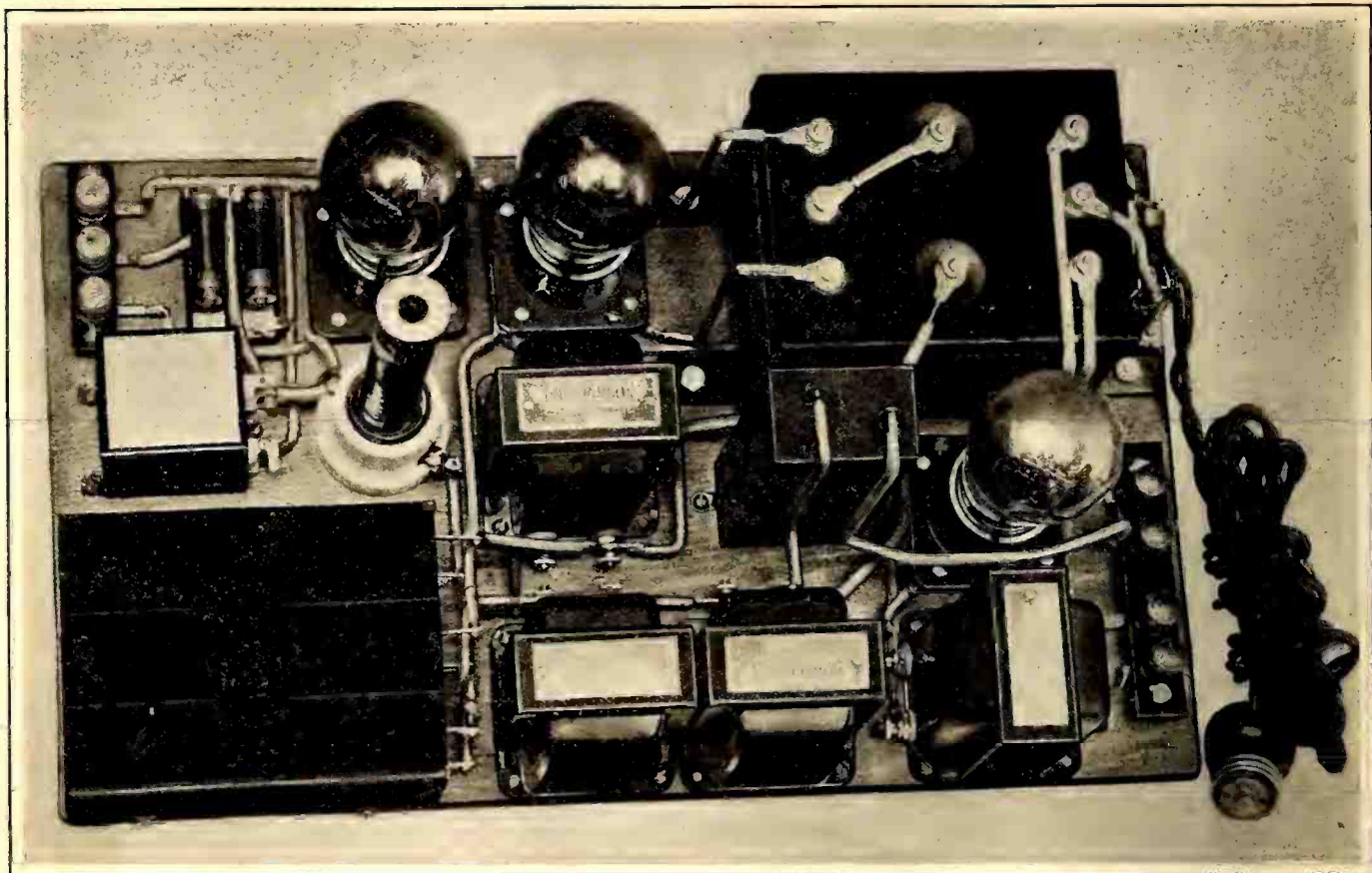


FIG. 1

**SCHEMATIC DIAGRAM
RADIO AGE GOLDEN RULE RECEIVER**





In this picture is shown the power amplifier described by Mr. Coombes.

100 times the output of the ordinary amplifying tube. This is sufficient to amplify the music of any broadcast program without tube distortion or sacrifice of bass notes.

Operates From Light Circuit

A TUBE producing so much more power necessitates the use of more power to operate it. These power tubes require the special voltages of $7\frac{1}{2}$ on the filament and 425 on the plate for maximum results. Batteries, to supply the current of proper values, would be so costly, inconvenient, and bulky as to make their use prohibitive. The Thordarson power supply transformer R-198 furnishes the proper values of current for both plate and filament of this power tube.

The current for the plate is rectified from A. C. to D. C. through the Radiotron U. X. 216-B tube designed for this purpose, after which it is "ironed out" through the usual filter circuit of condensers and chokes.

One very convenient feature of the Thordarson power amplifier is the use of the voltage

regulator tube, U. X. 874, which eliminates all controls, making manual voltage regulation unnecessary. This makes it possible to put the amplifier in the battery compartment, out of the way.

Receiver B Supply

IN ADDITION to serving as the supply for the power tube, the complete assembly shown in sketch (G) also provides the proper values of B-voltage to take care of the needs of the entire receiver, furnishing 45 volts for the plate of the detector tube and 90 volts for the stages of ordinary amplification. This B-elimination feature operates, as does the amplifier itself, with no internal hum or other noises. It would be well for the man contemplating the construction or purchase of a B-eliminator alone to bear in mind the great advantage of the combination of power amplification with B-elimination which this circuit affords him at but a slight increase in cost.

Installation

THE combined pictorial diagrams (G) and (H) illus-

trate a lay-out that can be followed by the most inexperienced novice in radio affairs.

Sketch (G) represents the power unit for the U. X. 210 tube and the B-supply for the entire receiver.

Sketch (H) represents the stage of power amplification (transformer coupled), which may be built either with the supply unit or installed in the receiver itself by converting the last audio stage to conform with this diagram.

CAUTION. Before laying out your apparatus or beginning your wiring remember that you are dealing with alternating current voltages up to 500,—strong enough to give a very uncomfortable shock to the unwary. Use rubber covered wire or bus bar wire covered with rubber tubing when connecting up the amplifier.

Mounting Condensers

WHERE space permits it is advisable to follow the layout of the accompanying sketches. If space for this arrangement is not available, much room may be saved by

mounting the condensers under the chokes. The three high voltage condensers of the power supply (Sketch G) may be placed side by side with their cases touching. If all four high voltage condensers are grouped together, or if the apparatus is mounted on a metal base plate, insulate the case of the condenser of the power amplifier, (sketch H) from the cases of the other high voltage condensers. The purpose of this is to prevent the 60 cycle hum of the light circuit from being inducted into the power amplifier itself.

To further prevent any inductive pick-up in the power amplification stage, it is advisable to twist the 7½ volt filament leads of the U. X. 210 and the U. X. 216-B tubes. These are the leads extending from either end of the transformer (R-198).

The 8,000 ohm resistor between the (power) B tap and the 90 volt B tap should always have a capacity of not less than 15 watts continuous duty rating. The Ward Leonard Company make such a resistor which mounts conveniently into a standard electric lamp socket.

The 10,000 ohm resistor, designated as No. 1, is of the proper value for supplying one tube (detector) with 45 volts on the plate. If 45 volts B-supply is desired for more than one tube, it is necessary to decrease the resistance with the increase in the number of tubes used. Some sets, particularly superheterodynes, use 45 volts as the B-supply for five and six tubes. In this case, a 2,000 ohm resistor should be used as No. 1.

Impedance Coupling

SKETCH (F) illustrates the method of installing power amplification with the Autoformer coupled amplifier. The step-up impedance coupling of the Autoformer gives equal attention to every note in the musical scale, and when this coupling method is used with tubes capable of carrying the bass notes, the resulting reproduction is nothing short of astounding.

CAUTION: It is always wise to bear in mind the high voltage of this instrument. Never at-

Parts Required

Sketch (G)

- 1 Thordarson power supply transformer (R-198)
- 2 Thordarson chokes, 30 henries, (R-196)
- 3 2-Mfd. Dubilier high voltage condensers. (Not less than 600 volts normal load and 1500 volts D. C. flash test.)
- 2 1-Mfd. condensers (standard by-pass type)
- 1 4-Mfd. condenser (standard by-pass type)
- 1 8000-ohm resistor (capacity to carry 40 milliamperes. Ward Leonard)
- 2 Allen Bradley 10,000 ohm resistors (grid leak type)
- 1 Allen Bradley 1000 ohm resistor (capacity to carry 25 M. A. current)
- 1 U. X. 216-B or C. X. 316-B rectifying tube
- 1 U. X. 874 or C. X. 374 voltage regulator tube.
- 2 Standard tube sockets.

Sketch (H)

- 1 Thordarson R-200 amplifying transformer.
- 1 Thordarson choke, 30 henries, (R-196).
- 1 2-Mfd. high voltage condenser (same specifications as above).
- 1 U. X. 210 or C. X. 310 power amplifying tube.
- 1 Standard tube socket.

tempt to make adjustments or touch the apparatus unless the light switch is turned off.

The assembly of this power amplifier and B-supply is simple. The only tools necessary are a soldering iron, a pair of pliers, a screw-driver and a small drill. Following the above instructions, and using quality apparatus, you will be able to build this amplifier in an evening's time,—and at last you will realize full reproduction.

Figure 1 shown in the blueprints is the Golden Rule receiver recently described in this magazine. It is shown with this article to show the conventional transformer coupled amplification. Any good power supply device can be used with this receiver, and if desired a UX 210 may be used in the last stage if proper change is made.

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DEALERS

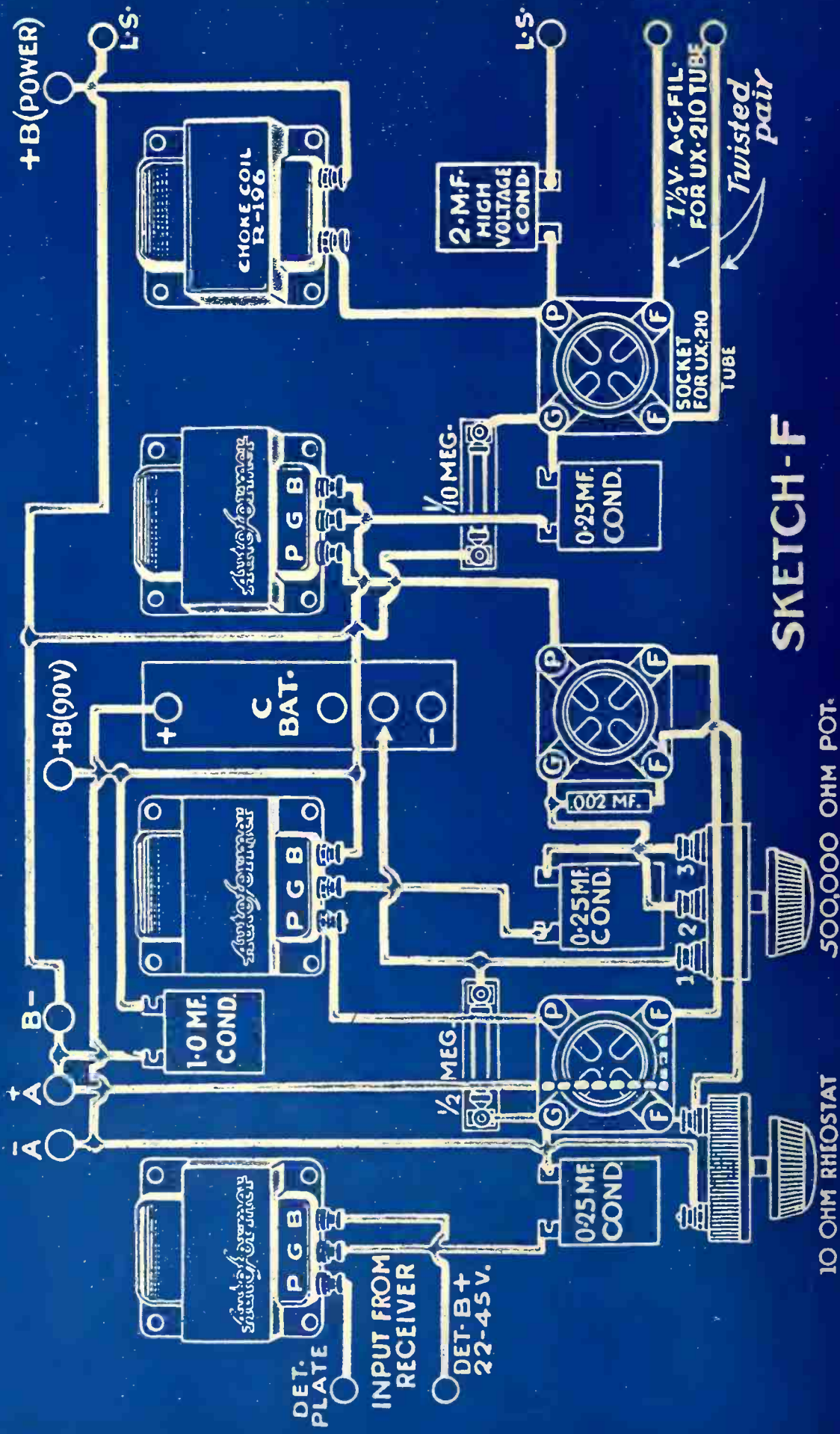
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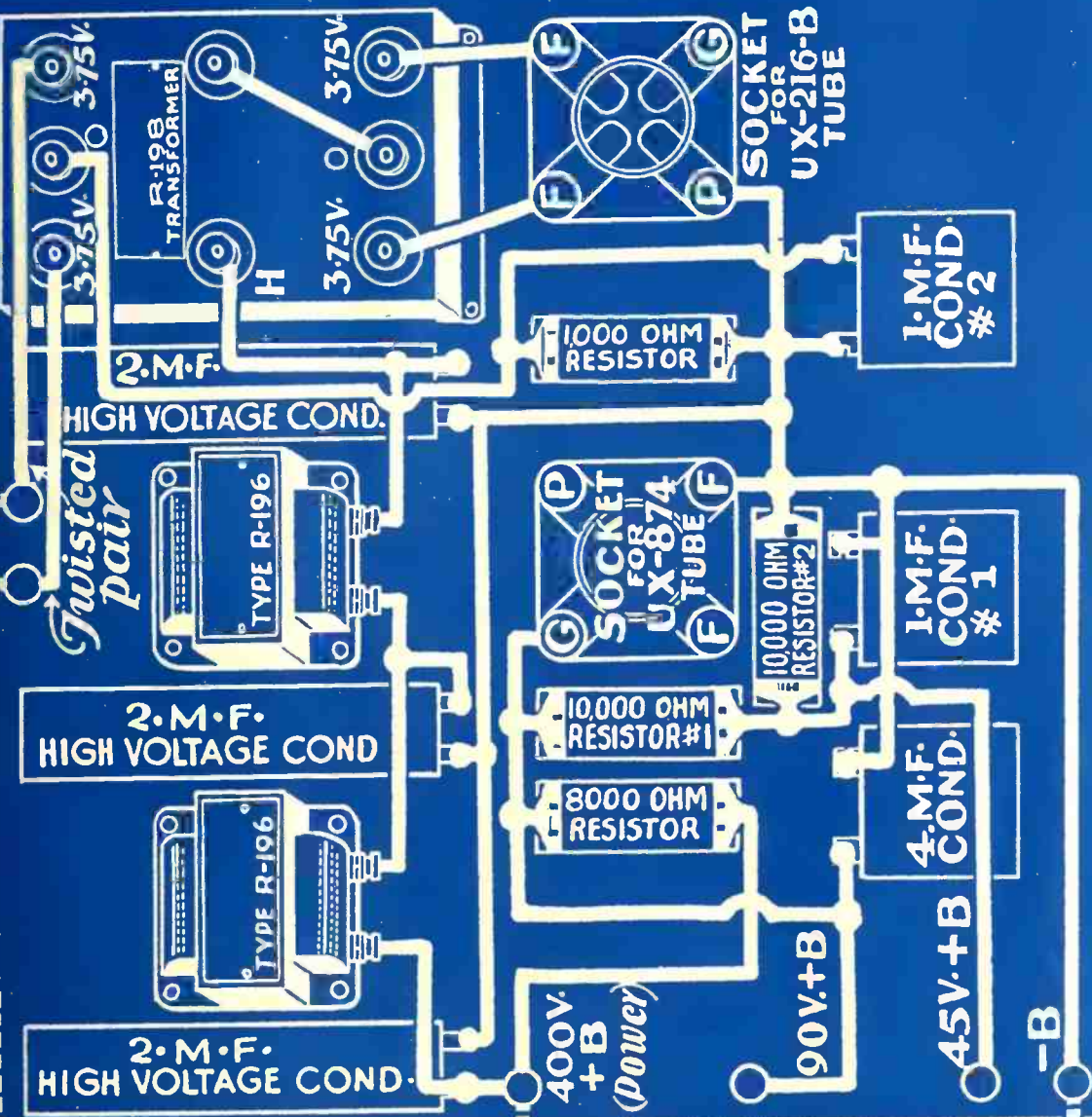
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SKETCH-F

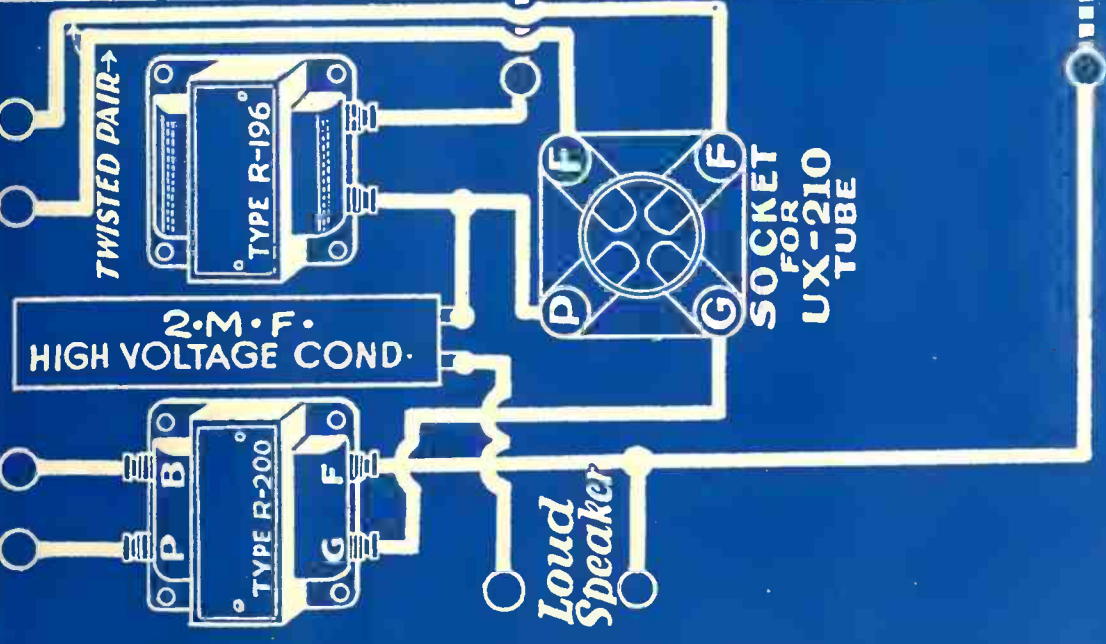
Plug in on 110 V.
60 Cycle
Supply

7 1/2 V.



SKETCH - G

Input from
Receiver



SKETCH - H

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RADIO AGE INC.

KYW First Crystal Control Set West of Pittsburgh

(Continued from page 14)

mental of the crystal which oscillates at 560 kc. This energy is led from the crystal oscillator through the successive power amplifier stages into the antenna system.

Direct current milliammeters for the plate circuits; radio frequency ameters for r. f. section of the plate circuits and the tank circuit meters are all laid out on the panels as shown in the photographs.

Although small power crystal operation is practically identical in operation, yet in the new KYW outfit it becomes quite necessary to insure against much greater stresses than are encountered in amateur or low power crystal operated transmitters. Condensers have to be generously spaced between plates; choke coils have to stand high voltages, and all apparatus designed to give a wide margin of safety in operation.

On account of the amplification at the fundamental it is necessary to neutralize between stages to prevent feedback. In this particular set tubes of the same size as those in the set are used as dummies to supply the necessary neutralization.

In the photograph at the top of page 27 is shown the front view of the crystal transmitter, starting with the 5 watt crystal stage at the extreme right, then the 7½ watter, then a 250 watt tube and on the left the 500 watt stage consisting of two quarter kilowatt tubes paralleled. Starting switches and tuning controls are mounted on the lower sections of the panel.

The lower photograph shows a rear view of the crystal operated set and gives an idea of the placement of the plate circuit inductances, chokes, condensers and resistances. At the present time the set is in operation from the crystal 5 watt stage as far as the 500 watt stage, but further installation work and developmental tests are yet to be made on the ten kilowatt stage before it is finally put on the air.

F. A. H.

A Shielded Short Wave Wavemeter

(Continued from page 13)

can calibrate your wave meter within less than ½ of 1%—it requires care to do it. For extreme accuracy, using this method, the wave meter should stop oscillation in the receiver with a change in the dial setting that is no greater than the width of the line that indicates the degree on the dial.

For use in checking your transmitter, a small flashlight lamp may be used with just one turn of wire (No. 16 for

mechanical strength), a b o u t three inches in diameter. (See page 38 August RADIO AGE Fig. 3-B). When the wave meter is in resonance with the transmitter the lamp will light. It should be held about two inches from the wave meter coil. Another way is to watch the milliammeter in the plate circuit of the transmitter. When resonance is obtained, the milliammeter will show a slight increase in plate current. The antenna ammeter is still another good indicator—when resonance is obtained the antenna ammeter will show a decrease in current.

Coil Winding Data (Karas)

| Coil No. | No. of turns | Wavelength range in meters |
|----------|--------------|-------------------------------|
| B-1 | 3 | 10 to 24 |
| B-2 | 7 | 21 to 49 |
| B-3 | 17 | 40 to 100 |

Coil Winding Data (Cardwell)

| Coil No. | No. of turns | Frequency range in kilocycles |
|----------|--------------|----------------------------------|
| A-1 | 3 | 10,500 to 28,300 |
| A-2 | 7 | 5,000 to 15,000 |
| A-3 | 16 | 2,500 to 7,500 |

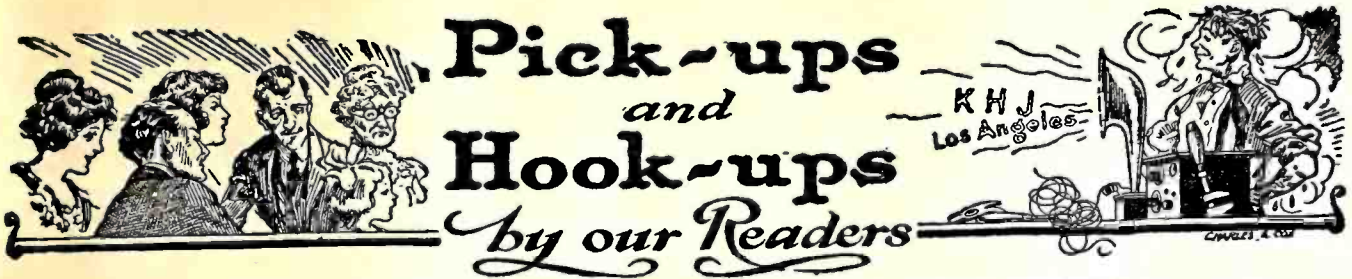
A Grid Meter Driver

(Continued from page 9)

the usual manner and adjust to zero beat. Set up the driver one or two rooms away from the receiver. This will be loud and can be heard on a loud speaker. Adjust the driver to zero beat with the receiver (the driver will have to be removed from the receiver until its energy is weak in order to prevent the receiver tube from blocking) couple a wavemeter to the driver, loosely, and find resonance by the dip of the grid meter. This setting of the wavemeter will be the setting for the standard frequency being received. With the grid dip meter included in the driver circuit, a wavemeter or other tuned circuit may easily be calibrated without having any form of resonance indicator in the circuit under measurement. Due to this fact the driver is especially adapted for the measurement of the natural period of choke coils or other forms of inductances. The coil may be sus-

ended free from the hand or other objects on a dry thread. When coupled to the driver coil the fundamental and the harmonic frequencies of oscillation will be clearly shown if tuned across by adjusting the driver condenser.

Where direct coupling cannot be made to a coil or circuit to be measured, such as sometimes is found within a cabinet or surrounded by other apparatus, the coupling may be obtained by use of a link circuit. The link circuit may consist simply of a closed loop of insulated wire having two or three turns at each end with the intermediate portion formed into a twisted pair. The coil at one end is coupled to the driver, while the coil at the other end is coupled to the circuit to be measured. The total length of the link coupling conductor should not exceed ½ wavelength. Resonance will be indicated in the same manner as though direct coupling were used.



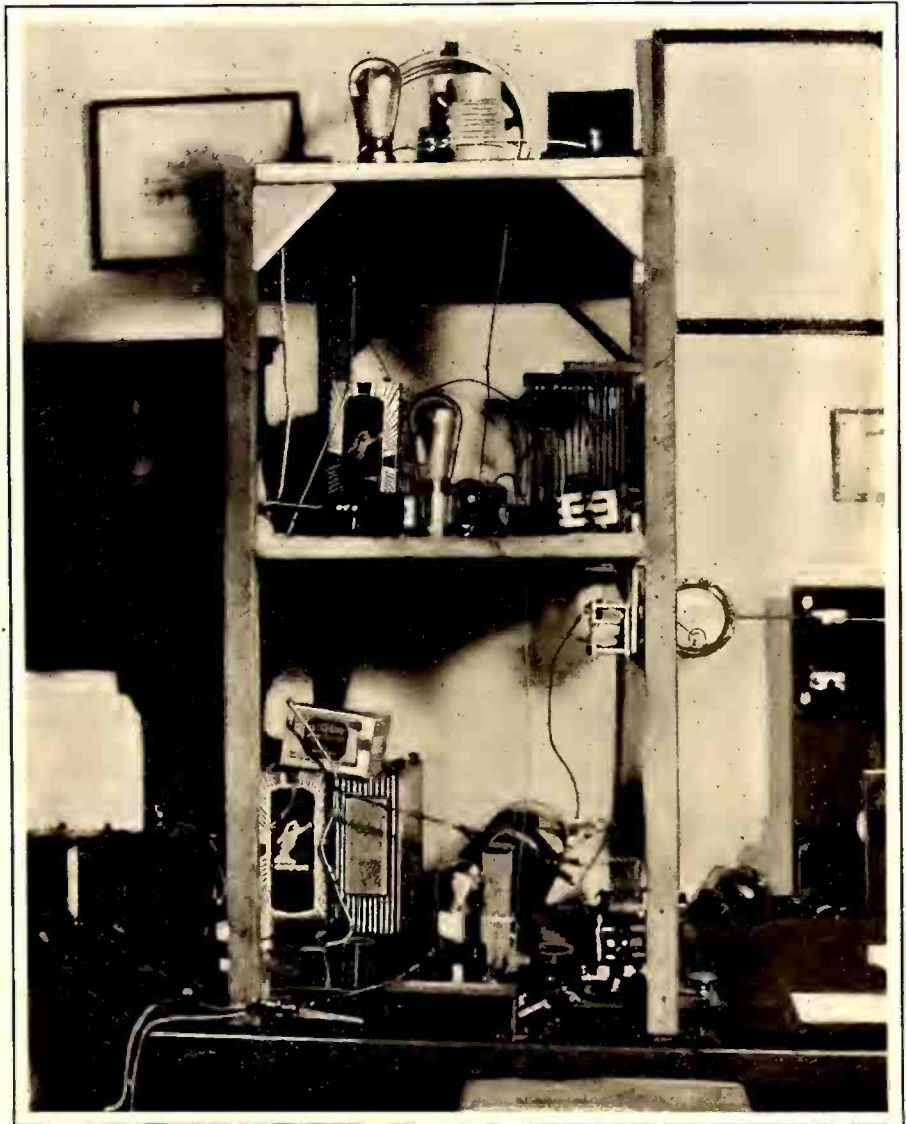
Pick-ups and Hook-ups by our Readers

THE material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

POWER supply devices have certainly taken a strong hold on the popular mind. Despite this none of the battery companies are figuring on going out of business. There is a vast and yet undeveloped field for dry cell operation out in the areas where electricity is not available and while the dry cell interests may lose on their metropolitan they will gain in their rural business. Many of the amateurs living in regions remote from current lines have done remarkable work on transmission with dry cell B batteries; the transmitter in the August issue of RADIO AGE is an example of what could be done with a low power set. In the October issue we expect to have a full story on the conversion of 9BHX to crystal control with a small increase in power.

JOHN N. CANEPA, Radio 4IY,
P. O. Box 359, Jacksonville,
writes an interesting letter which
we are quoting:—

"After reading your August issue of RADIO AGE and the article on short wave sets which said 9BHX was tuned around FW, I proceeded to fish around for the station and was surprised to hear a little peep peep. Being that I am not such a fast ham on the code could not read what you were sending as you were going pretty fast. There was considerable QRM an QRN but heard you sign three different times. Your note is very steady and would be easy to copy but for interference. I am using a Reinartz with two tubes and have my transmitter all finished and my license too, but I have no power supply yet. In fact the only thing that keeps me off the air is the mazuma and



Above is shown the crystal controlled transmitter of George P. Rankin, Jr., amateur station 4BK, at Macon, Ga., who is doing consistent DX work with a steady tone and pure dc note. In the photograph the oscillator is on the top shelf, the doubler is on the second shelf, and the 40 meter amplifier on the table. Rankin tells us there is nothing like crystal control for the ham who wants his signal to stay put

the YL's. Soon as I get on the air would like to work you."

WITH the tendency of broadcasters to shift wavelengths it looks as if the Dial Twisters will get nervous prostration trying to keep up with the procession. If the broadcast-

ers take wavelengths which are standard, that is in 10 kilocycle separation between stations, the log-a-wave chart which we print every month will come in handy. If they take the non-standard ones then the Dial Twister will have to make up his own log.

WHY GAMBLE!

It's not worth it!



Price
\$49.50
 Complete with
 Raytheon Tube

In every industry certain names stand out as guideposts for the buyer who would receive fair value for his money.

The familiar B-T signature has been a guide for careful buyers since broadcasting began.

Now a B-Power Unit-- without any guess-work about its operation. There are no knobs to turn. Fixed resistances enable the user to know at all times the exact voltage delivered.

There is no radio product in which the user must trust more to the ability and sincerity of the manufacturer than B-Eliminators.

There is not an element in the construction of the B-T Unit for which a cheaper substitute could not be used—nor is there a step in the process of manufacture which could not be done more cheaply if price were the principal consideration.

This B-Power Unit was designed primarily to insure satisfactory operation of B-T Counterphase Receivers. That in itself is about our strongest argument. It can be used of course with all ordinary receivers.

Write for circulars describing this product in detail.

If you wish to read a more complete discussion of B-Eliminators, you will find it in "Better Tuning" 10th edition.

Anyone considering spending the price of a B-Eliminator will be amply repaid for reading the discussion on the subject in "Better Tuning." Other late developments in Radio are covered in this new issue.

Send 10c for your copy today.



Manufacturing Co.
 520 So. Canal St., Chicago, Ill

NAVAL officials are said to be negotiating with the B. G. Corporation of New York for the use of a device said to eliminate motor ignition noises in airplane radio receivers. During a number of tests, the apparatus appeared to eliminate the interference ordinarily caused by airplane motor ignition systems, especially in high-frequency and radio-compass work. This should make for improved short-wave work in aircraft, Naval experts predict.

RADIOMAN M. D. CLARK, a communication reser v ist from Jacksonville, Fla., won the recent radio code test in the Seventh Naval District by copying 30 words per minute perfectly. The prize was \$10 in gold.

9BH_X Transmission

Operators at Station 9BHX located in the Radio Age Laboratory, using a low power crystal controlled transmitter on 42.09 and 40.64 meters, report having worked the following stations during the month of July:

- | | |
|------|------------------|
| 9QZ | 2BUJ |
| 4BY | 6CUA |
| 6JP | 5HZ |
| 1CIB | 6AOD |
| 2MU | 7AIB |
| 8DIA | 8PL |
| 4BK | 2TY |
| 9MO | 4JK |
| 9AOT | 2PF |
| 2CMU | 6KG |
| 1AOF | 9BW _X |
| 6OR | 9ATV |
| 4PF | 9AMB |



Remember . . .
 on your present set, or the one you're building, you can't sacrifice the added convenience, neatness and mechanical superiority of the

**Jones
 MULTI-PLUG**
 THE STANDARD SET CONNECTOR

Ask Your Dealer
HOWARD B. JONES
 618 S. Canal St. Chicago, Ill.

The McQuiddy Press announces the publication of **"HOWDY JUDGE"**

a volume of dialect stories in character—brimful of wholesome humor,

By
GEORGE D. HAY
"The Solemn Old Judge"

Orders are being received by
THE MCQUIDDY PRESS
 110 Seventh Avenue North, Nashville, Tennessee. \$1.25 per copy. First issue out August 20.

Subscribe to Radio Age.

Please mention Radio Age when writing to advertisers

Do Not Throw Away B Batteries Too Soon

MANY RADIO users seem to labor under the delusion that after a set of B batteries has been in service several months, it is time to expect poorer results from them. A night or two of poor reception due to atmospheric conditions frequently confirms the set owner's preconceived idea that his batteries are about done for, and out they go.

An amusing incident of this nature recently came to light in a mid-western city. A prominent physician was the proud possessor of a "superhet," made especially for him by a local radio expert. He powered it with heavy duty B batteries, which, under normal conditions of use, should have run that particular receiver about nine months. After he had used the set six months, he began to imagine it wasn't working as well as it used to, so he called his friend on the telephone and tried to explain the trouble. When the expert learned that he was still using the original "B" batteries, he immediately told the physician that he needed new ones.

This physician has a friend who is connected with a large battery manufacturer in that city, and who had furnished the original B batteries for the "super-het." The battery friend was told of the supposed death of his batteries and was requested to come around with a new set. Knowing the tendency of the average set owner to throw his B batteries away too soon, the battery man tried to convince his friend that his batteries were not at fault, but to no avail. The "expert" had diagnosed the trouble—by telephone—and the remedy was clearly indicated.

The battery man was still unconvinced, and to prove his point, he worked a sleight-of-hand trick on his friend. Instead of connecting the new batteries to the set, he re-connected the old ones, and then asked the doctor to tune in and see how the set worked. He was delighted with the performance.



*Radically new Circuit
greatly increases Power
and enhances tone Quality*

The Chelsea Truphonic Six utilizes an entirely new and different system of audio amplification—a system as far in advance of that heretofore employed as the orthophonic principle in talking machines is superior to former phonograph reproduction. A power tube may be used in the last stage, thus obtaining tremendous amplification. Tone quality is stabilized while the whole tone range is increased to its full limits, enabling you to enjoy the maximum capabilities of the best loudspeaker.

Ask Your Dealer To Demonstrate or Write Us Direct.

CHELSEA RADIO CO., Chelsea, Mass.

Other Chelsea Sets \$26.00 and \$50.00—each a leader in its class. Send for details.



The new CHELSEA Truphonic Six

All the "trouble" had been cleared up.

The physician was left under the impression that he was using new B batteries, and his satisfaction was complete. Not until three months afterward was he obliged to get new ones. When the hoax was explained to him, he was cured. Hereafter he will not blame all his trouble indiscriminately on his "B" batteries.

Another case illustrating the fact that broadcast listeners are

prone to throw their B batteries away too soon, is that of a young amateur in central Michigan who recently built a battery operated transmitter. His meagre funds were exhausted by the purchase of the parts, leaving nothing for the B battery to run the set. He accumulated a supply from batteries discarded by his friends who owned receivers, and with these supposedly "dead" batteries, he established communication with a fellow amateur in California.

WITH THE MANUFACTURERS



Wired Radio is to Offer Competition

EVERYBODY is speculating these days as to just what is going to happen in the now established radio broadcasting industry, which is assured of a permanent future due to its great following and its commercial adaptations. Will it have a competitor or become a monopoly?

One thing appears certain, there is little likelihood of a radio broadcast monopoly; too many independent interests are already established.

To be sure the Radio Corporation now owns three broadcasting stations, and the General Electric and Westinghouse Companies operate several more, but since the other five hundred odd stations are independent, it is difficult to see how a monopoly could be affected.

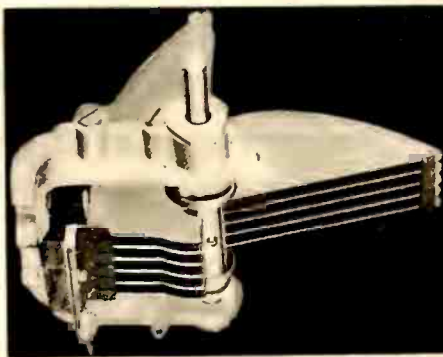
The Bell system has practically withdrawn from radio broadcasting; it has sold WEAf to the Radio Corporation and closed Washington's WCAP, which was operated by the Chesapeake and Potomac Telephone Co., a company related closely to the American Telephone and Telegraph Company. Why the telephone company did this is still somewhat of a mystery, although it is understood that it will still lease its telephone lines to connect the

Radio Corporation and other stations in chains for their mutual cooperation. One reason why the telephone company might have seen fit to stop broadcasting, is found in the Dill and White radio bills, which prohibit combinations of wire, radio and cable interests into what might be considered a communication monopoly.

Another reason, is because the telephone company is exceedingly interested in the possibility of broadcasting over the wires of its great telephone net with its millions of subscribers throughout the country.

Great possibilities have been seen in wired wireless ever since General Squier demonstrated the practicability in his Signal Corps laboratory about four years ago. Wired Radio Inc., is one of the leaders in work along this line as far as power lines are concerned.

Hammarlund Condenser For Short Waves



The Hammarlund Mfg. Co. low wave receiving condenser shown above is built to overcome the difficulties in the reception of wave lengths below 100 meters. The plates are two and one-half times as far apart as in most receiving condensers.

An insulated pig tail connection between the rotor and the frame is provided.

Full ball bearing at one end of the rotor and a ball bearing end thrust at the other provides smoothness of movement. An external brake holds the rotor firmly in position and at the same time permits of easy turning. The wide range of capacity between the minimum and the maximum allows for tuning over a broad band of frequencies, while the straight frequency line characteristic of the plates gives greater dial visibility. The maximum capacity is 100 mmfd. and minimum is 3 mmfd.

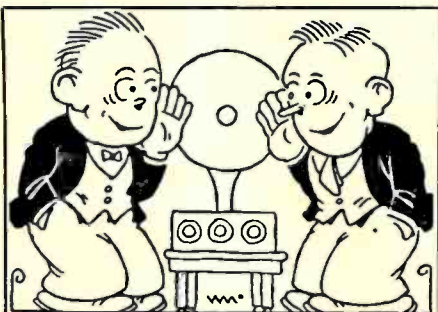
Counterphase Eight



AMONG the many new features found in the new Bremer Tully Counterphase set models are: Visual indicator for wave length reading of stations—individual calibration of each receiver—one station selector and ultra-selectivity.

The Counterphase circuit is used with one rejector stage, three tuned radio frequency stages, a detector and three audio stages with power tube output. Individual shielding of radio frequency and detector stages. It operates on short indoor antenna. Small panel conceals controls when set is not in use and forms hand rest when tuning.

The Counterphase Six is the same in general design as the "Eight" except for one less radio frequency stage and one less audio stage.



"Radio is still an infant."
"No doubt that is why there are so few silent nights."

Test Shows Dielectric Factor of Halowax

IN A RECENT issue of RADIO AGE, in an advertisement of the Zenith Radio Corporation, an erroneous statement was made regarding the insulating properties of Halowax as used in paper and tinfoil condensers.

On investigation this magazine finds the statement to have been in error and is glad to make this correction in the interest of justice to the Halowax Corporation of New York, manufacturers of chlorine substitution products sold under the trade name Halowax.

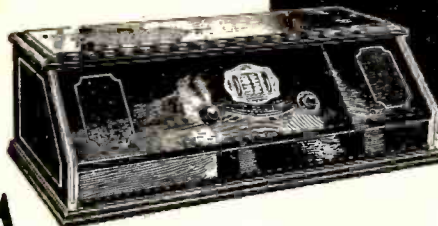
E. R. Hansen, chemical engineer, attached to that corporation, was a recent visitor in Chicago and explained the process by which Halowax is made. When naphthalene is chlorinated to a certain stage a synthetic wax is produced which investigation has proved to have twice the dielectric constant of paraffin, that of Halowax being 4 while that of paraffin is 2. This waxlike substance was named halo-wax, the first part because halo-wax, the first part from the chlorine is one of the halo-gens.

Patented processes for the derivation and application of this product are held by the Halowax Corporation of New York and licenses issued to manufacturers. Among a number of those licenses are the Wireless Specialty Co., the Federal Telephone and Telegraph Co., American Bosch Company, Atwater-Kent, Grigsby, Gruno Hinds, and the Aerovox Corp.

Halowax has been used in condensers for over ten years many million condensers having been made with it which are functioning with absolute satisfaction to the user. Life tests employing the continuous application of high voltage over periods of many months have indicated no change in the electrical properties of the wax.

Pittsburgh Show

The Pittsburgh Radio Show given under the auspices of the Pittsburgh Radio Association will be held at Duquesne Gardens, Oct. 4 to 9, inclusive.



Acceptance...
thru Expert Judgement

Those who know radio, either as broadcast listeners or experienced technicians, accept Bosworth.

They accept it because of the care and correctness of its construction, and the dependability of its performance.

Those who have yet to enjoy their first set may find guidance in the fact that the experienced fan, who is qualified to pass judgment, consistently recommends Bosworth.

Two Bosworth models, a six tube set at \$155, and a five tube set at \$115. West of Rockies add \$10.00. Write for booklet C, "The Spirits of Entertainment". Address The Bosworth Electric Mfg. Co., 3748 Montgomery Rd., Cincinnati, Ohio.

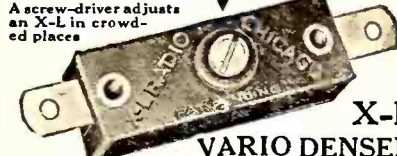
BOSWORTH RADIO

Sweden to Have a New Broadcaster

SWEDEN is to have a modern 50-KW, radio broadcaster at Motala, for which the government has just appropriated \$287,500, the Department of Commerce is advised. This will bring the total broadcasters up to 17, of which seven are relay stations.

The new station is said to be a replica of the famous Daventry station in England, the Marconi Wireless Company having the order. The station will presumably go on the air early next spring.

See That Screw



RESULTS in easier tuning, more distance, volume and clarity—greater stability. Indorsed by leading radio authorities.

Model "H"
A slight turn obtains correct tube oscillation on all tuned radio frequency circuits. Neutrodyne, Roberts two tube, Browning-Drake, McMurdo Silver's Knockout, etc., capacity range 1.8 to 20 micro-micro farads. Price \$1.00

Model "G"
With grid clips obtains the proper grid capacity on Cockaday circuits, filter and intermediate frequency tuning in heterodyne and positive grid bias in all sets.
Capacity range: Model G-1 .00002 to .0001 MFD. Model G-5 .0001 to .0005 MFD. Model G-10 .0003 to .001 MFD. Price \$1.50

X-L Flush Post
Push it down with your thumb, insert wire, remove pressure and wire is firmly held. Releases instantly. Price 15c. Also furnished seven to a strip. Nicely marked in white with seven standard markings. Price \$1.50.



Information on Request
X-L RADIO LABORATORIES
2424 N. Lincoln Ave. Chicago, Ill.

Dellinger Says Better

Reception in 1928

WORDS of cheer to all radio fans may help tide over the present period of poor reception and the threatened chaos in the other.

From 1928 to 1933 radio reception conditions should improve, reaching their best in the latter year, according to the sunspot interference theory, Dr. J. H. Dellinger, radio savant of the Bureau of Standards states.

We must then, be patient for a year or two, and await better times, rather than struggle and strive for distance, at the expense of batteries and loss of sleep. Explaining one of the theories of radio interference developed recently, Dr. Dellinger says: "There seems to be some affect of sunspots on radio reception. Sunspots throw out enormous eruptions of electrons and other electrical particles some of which reach the earth's atmosphere. When the sunspots are particularly intense, radio reception is apt to be disturbed and poor. This has not been conclusively proved, but seems to be indicated by such observations as have been made. The sunspot cycle is 11 years, that is, there is an minimum of spots on the sun for a time, after which, they gradually increase and pass through a maximum and return to a minimum, the whole occupying a cycle of 11 years. The last sunspot minimum was in 1922 and it would be inferred, therefore, that radio reception at its best in 1922, should be progressively worse to 1928, and that in succeeding years reception conditions should improve and be at their best again in 1933."



Silent "B" Power with World Radio Storage "B" Battery
Lasts Indefinitely—Pays for Itself
Dependable. Quiet "B" power, clear without "hum." Economy you have never before thought possible. Convenience. Outstanding performance. Recharged for almost nothing. Solid rubber case insures against leakage or acid. Extra heavy glass jars. Heavy rugged plates. Approved and listed as standard by Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc. and other Radio authorities.

Extra Offer: 4 Batteries in series (96 Volts) \$10.50.
SEND NO MONEY! just state number of batteries wanted and we will ship same day order is received. Pay expressman after examining batteries. 5 per cent discount for cash with order. Send your order today—NOW!

WORLD BATTERY COMPANY
123 So. Wabash Ave. Dept. 81 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$10.50; 120 Amp. \$12.50; 140 Amp. \$13.25.
All equipped with Solid Rubber Case.

World STORAGE BATTERIES
Set your Radio Dial for the new 1000-watt World Storage Battery Station, WSBG, Chicago. Always something interesting.
KDKA - WEAZ - WGN - WJZ - KHJ - KGO - KFAX - WJY - KOP

PATENTS

To the Man with an Idea

I offer a comprehensive, experienced efficient service for his prompt, legal protection and the development of his proposition. Send sketch of model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge. My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense. Booklet of valuable information and form for properly disclosing your idea free on request. Write today.

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Free 60-page Reference Book

POLK'S REFERENCE BOOK FOR DIRECT MAIL ADVERTISERS

Shows how to increase your business by the use of Direct Mail Advertising. 60 pages full of vital business facts and figures. Who, where and how many prospects you have. Over 8,000 lines of business covered. Write for your FREE copy.

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599 POLK DIRECTORY BUILDING
Branches in principal cities of U. S.

"Outsell, Because They Excel"

Empire All Types

Including NEW Detector (EX-200) High MU and Power Amplifier

Dealers and Jobbers Write for Prices and Folder "L"

EMPIRE ELECTRICAL PRODUCTS COMPANY
Laboratories & Factory—Kearny, N. J.
Sales Office—132-134 Greene St., New York
Also Mfrs. of Empire Cone & Loud Speakers.

SM

220 & 221 AUDIO TRANSFORMERS

The S-M 220 transformer compensates for the shortcomings of modern broadcasting—it provides a rising low note characteristic. Thus, it compensates for conditions of a reverse nature in loud speakers and will improve reception on any set. It is big and husky—built to do a power job—and do it well, yet the price is but \$6.00—for the finest of audio amplifying devices.

The 221 is an output transformer for use between the last audio stage and the loud speaker, requiring no additional tubes or batteries. It will improve the tone quality of any receiver—especially low note reproduction—and will increase the speaker capacity for handling strong signals without distortion. Price \$6.00.

For "B" Eliminator and Power-Pack Assemblies

| | |
|---------------------------|--------|
| S-M 330 Power Transformer | \$6.00 |
| S-M 331 Unichoke | 6.00 |
| S-M 332 Condenser Bank | 10.00 |

SILVER-MARSHALL, INC.
850 W. Jackson Blvd.
Chicago, U. S. A.

BECOME A RADIO EXPERT

in 3 MONTHS STUDY AT HOME

Our unique home-study course in practical radio engineering makes you an expert quickly. You devote spare-time hours to fascinating study of world's greatest science. We show you how to start as you learn. Get into this big-pay field on the ground floor. Full equipment furnished free, including Superdon Twin radio set. Our training is superior for you learn to make money from the start. **LEARN HOW TO GET THIS COURSE FREE**

Our unusual plan shows you how you can get the course free, with good people besides. Whether you know radio now or not, we can teach you better. If you can read this ad you can study our easy, simple, illustrated lessons and get a diploma as a radio engineer. Thousands of positions with good money open to you. Here is the field that will make you rich if you make good. Get our book, "Millions Untouched." It is free. Write me today and learn how to make \$50 to \$250 a week. L. J. Mandala, AMERICAN RADIO ENGINEER, Dept. 510, Howard Square, Chicago, U. S. A.

FREE—Our 64-Page Catalogue. Filled With Radio Bargains. Write Today!

RANDOLPH RADIO CORP.
159N. UNION AV. Dept. 4, CHICAGO, ILL

Australian Beauty to Radio World's Fair

MISS BERYL MILLS, selected in Australia's national beauty contest, has accepted an invitation to be a guest of honor at the opening of the Radio World's Fair in New Madison Square Garden, September 13. There is tremendous interest in broadcasting and amateur wireless in Australia and New Zealand, and Miss Mills, who is a recent college graduate, frequently listens in. Miss Mills will be present at the Atlantic City beauty pageant. She sailed from Sydney July 28.

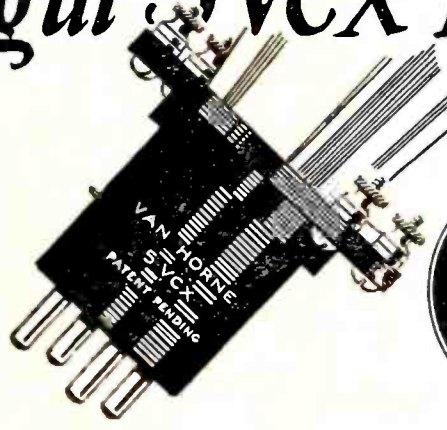
The official invitation was conveyed from the Radio World's Fair through A. W. Watt, editor of the Wireless Weekly, in Sydney, by cable and by amateur radio, through Stations 2 EV, J. B. Kilpatrick, New York City, and relays by "hams" in the Middle West and the Pacific Coast.

Radio Weather Maps

A new and practical application of radio-photography is the broadcasting of weather charts. Instead of receiving the weather data and plotting it on an outline map of the surrounding region, this new method, brings in the map complete.

The U. S. Navy is planning to try out this system.

*No Change in Wiring
~ with the adapted
Mogul 5VCX Power
Tube*



Here is a power tube that requires no change in set wiring. When you put one on your set you will immediately note an unusual improvement—a general increase in volume, a roundness of tone and clear cut reproduction in voice and music that is unobtainable when ordinary tubes are used.

VAN HORNE CUSHION BASE 5 VAX



To further improve the tonal quality of your set, equip it throughout with Van Horne Cushion Base Tubes, the soft sponge rubber cushion completely checks vibration.



Set users who are not satisfied with ordinary reception are equipping their sets throughout with Van Horne Tubes. They are made in a number of types for all receiving purposes, every tube being unconditionally guaranteed. Ask your dealer about Van Horne Tubes or write for descriptive matter.

THE VAN HORNE CO., INC.

Center Street

Franklin, Ohio

Cardwell Condensers

OVER THE POLE!
WHERE the failure of a single instrument might mean disaster, unusual care is exercised. So Cardwell Condensers were used in all the Radio apparatus built especially for Commander R. E. Byrd.

Straight frequency! Concentric! Compact! Rugged!

The Taper Plate Type "E"

Modified Straight Wave Length Type "C" forming long wave separation

| | | | |
|------|------|------|--------|
| 173C | 1942 | 0005 | \$1.00 |
| 173C | 1942 | 0005 | \$4.75 |
| 170C | 1942 | 0003 | \$1.25 |
| 1942 | 1942 | 0008 | \$4.00 |

Eric Allen D. Cardwell Manufacturing Corp.
81 Prospect Street - Boston, U. S. A.

"THE STANDARD OF COMPARISON"

Jefferson Announces New Tube Charger

EXPERIENCE has shown that all radio tubes should be charged at least once a month to keep them at highest efficiency. The Jefferson Electric Mfg. Co., 501-511 South Green Street, Chicago, has just announced a new radio tube charger which will reactivate or rejuvenate all the tubes in a set at one time without removing them from the set.

6-Volt Storage Radio "A" Battery

Most amazing battery value ever offered! A genuine World 6-Volt Radio "A" Battery with 25 ampere capacity for only \$5.00! Just the thing for Trickle Charger. Famous World Quality assured. Equipped with **Solid Rubber Case** an assurance against acid and leakage. Order Now. We ship same day—by express C. O. D. subject to your examination on arrival. Extra Offer: 6% discount for cash in full with order. ACT TODAY!

\$5.00 C. O. D. Send No Money

World BATTERY CO.
Dept. 136
1219S. Wabash Ave., Chicago

KDKA - WEAZ - WGN - WJS - KRL - KGO - KFAP - WJY - KOP

WRITTEN 2-YEAR GUARANTEE

ARROW BATTERY

Battery Prices SMASHED!

To Consumers Only

Here is a real battery quality, guaranteed to you at prices that will astound the entire battery-buying public. Order Direct From Factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a *Written 2-Year Guarantee*. Here is your protection! No need to take a chance. Our battery is right—and the price is lowest ever made. Convince yourself. Read the prices!

| Auto Batteries | | Radio Batteries | |
|--------------------------|-------------------------|--------------------------|--|
| 6 Volt, 11 Plate, \$8.50 | 6 Volt, 100 Amp. \$8.50 | 6 Volt, 120 Amp. \$10.25 | |
| 12 Volt, 7 Plate, 11.75 | 6 Volt, 140 Amp. 11.75 | | |

Buy Direct—Send No Money

We ask no deposit. Simply send name and address and style wanted. Battery will be shipped same day we receive your order Express C.O.D. subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Send your order today—NOW!

ARROW BATTERY CO.
Dept. 12. 1215 So. Wabash Ave., Chicago



Plate Power Supply Uses the New Raytheon Tube

(Continued from page 24)

Uses Raytheon

THE new type BH 85-milampere, full-wave Raytheon tube is utilized for rectification since its voltage regulation is excellent, its life extremely long, and its operation more than satisfactory. However, the single-wave or double-wave Rectron tubes may be used, but will require the use of the filament lighting winding of the power transformer.

The filter, the most interesting part of the entire outfit, rather than depending upon brute-force action to eliminate the 120 cycle fundamental hum which is very strong at the rectifier output, uses a selective section, plus brute-force action, to eliminate this frequency, and for the weaker 240, 480, and 960 cycle harmonics, depends upon brute-force action.

The filter is made up of a special unichoke and condenser bank, in identical steel cases. The condenser bank also contains the 1/10 mfd. buffer condensers required across the elements of the Raytheon tube, which really serve as radio frequency drains and by-pass condensers, as well as the voltage regulator condensers in addition to the filter capacities proper.

The choke coil consists of two windings, one large and one small, wound in opposition upon a common core. Upon the exact characteristics of these windings depends the entire effectiveness of the filter. The input to the filter from the rectifier is shunted by a 2. mfd. condenser which serves to supply starting voltage for the rectifier tube, and to aid in filtration. Connected from the joint of the opposed inductances in the unichoke to ground is another 2. mfd. condenser. This capacity, plus the mutual inductance of the opposed coils, provides a resonant circuit of extremely low resistance which effectively eliminates the 120 cycle hum. The actual resonance curve is sufficiently broad to take care of

commercial lighting line variations.

Harmonics In Supply

SINCE the 240, 480, and 960 cycles harmonics are quite weak—the 960 one being almost negligible, a brute-force effect is used, provided by the unusually high inductance of one winding of the unichoke and the capacities. Across the output of the filter is a 4 mfd. condenser, which, in addition to aiding the filtering action, serves to reduce distortion in the receiver due to poor voltage regulation—a practically unnecessary precaution. This is because of the very low direct current resistance of the unichoke, Raytheon tube and transformer. Thus, the voltage regulation curve of the entire supply set is practically a descending straight line.

In order that the maximum output voltage can be properly cut down, one fixed, and two adjustable resistances as well as two 1. mfd. condensers are used, thus permitting voltages of from 20 up, to be obtained for ordinary receivers. The full voltage of the supply set is only used on power amplifier tubes such as UX112, UX171, or UX210 types.

Construction Simple

CONSTRUCTION of the eliminator is astonishingly simple, since all parts as below can be procured all ready mounted upon the metal base, so that it is merely necessary to cut a few wires to length, scrape their ends, and fasten them under the terminal screws of the various instruments. It is then ready for operation. Even should the parts not be available all ready mounted, it is a simple matter

NOTICE

The KISSEL-CARMAN manufacturers of radio coils will be known hereafter as the:

KISSEL KOIL KO.

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MARVELOUS NEW AUDIO TRANSFORMER adds a musical quality to any set far beyond anything you ever heard before. **KARAS HARMONIK** Amplifies low, middle and high tones—all to the same big volume, thus eliminating distortion. Brings out the vital harmonics and overtones of music. Price \$7.00. Write Karas Electric Co., Dept. 1096, 4012 N. Rockwell St., Chicago



POSITIVELY ELIMINATE ALL BATTERIES

Run ANY set, ANY number of ANY type tubes from 110 volt A. C. Positively no hum. Easily done with **NEW TYPE ELIMINATOR** quickly made for few dollars from **STANDARD**. No liquids. No salts. **NO TRICKLE CHARGER!** No battery of any kind. Gives perfect "A" and "B" current in any quantity. Nothing like it. Dollar bill brings detailed blue prints and instructions that assure perfect results.

J. M. MULLEN, Consulting Engineer, 6549 N. Wazhelenaw Av., Chicago

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Just hot off the press—1927 Radio Catalog & Guide brimful of latest ideas, newest hookups—all free. Shows savings as high as 50% on standard guaranteed radio parts, sets, kits. Be sure to get this thrifty book before you buy. It puts money in your pocket. Unusual! You'll say so when you get it. Also please send name of radio friend. Write today.

THE BARAWIK COMPANY
12-126 S. Canal St., Chicago, U. S. A.

to screw them down as desired, after which they can easily be connected up following the pictorial diagram, though they can be arranged in practically any manner to fit a given space.

Once the eliminator has been set in operation, it may be connected to a receiver and put in operation. Several precautions should be observed, however, inasmuch as the supply set is a power device, and must be carefully handled. The detector voltage should be obtained from the binding post marked "+45," while the amplifier voltage is taken from the "+90" post. Before starting, both resistances should be well unscrewed, and in turning them in, it must be remembered that on an average receiver, the voltage obtained when they are all in will be on the order of several hundred. If a power tube operating on 135 volts is to be used, then an extra resistor must be employed in series with the "HIGH" binding post, as well as an extra 1. mfd. condenser connected across the 135 volt and negative B binding posts of the receiver.

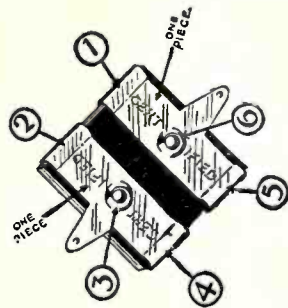
This, however, is an arrangement which wastes much of the supply set power, and does not give anywhere near the maximum quality and volume that might be easily obtained. The ideal way to take advantage of the supply set power is to use a UX112, UX171, or UX210 power tube as the last audio amplifier ALWAYS. Even where dry cell tubes are used in the receiver itself, it is entirely simple to use a power tube in the last audio stage, lighting its filament from the 3-4 winding of the power transformer. Assuming a UX-210 tube to be used, the following procedure may be advantageously followed:

Using Power Tubes

FILAMENT connections from the last audio tube socket
(Please turn to page 47)

Free Mailing Lists
Will help you increase sales
Send for FREE catalog giving counts
and prices on thousands of classified
names of your best prospective customers—
Retail, Wholesale, State and Local—Individuals,
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give clearer reception with greater signal strength. No carbon, paper, varnish or fiber. The metallic resistance element is fused to the inside of a glass tube. Noiseless, accurate, non-inductive, non-hygroscopic. Uniform in all weathers and working conditions. Capped with the exclusive Electrad ferrule. Impregnated under high vacuum. Great current-carrying capacity without overheating or change of resistance. 60c—in Canada, 85c.



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Note these points: Triple-ply insulation full 10 inches long, covered with waterproof webbing. One-piece copper strip, heavily tinned to prevent corrosion. Fahnestock clips, all connections riveted and soldered. Fits under locked doors and windows—bends to any shape. 40c—in Canada, 60c.



For perfect control of tone and volume use the Electrad 500,000-ohm Compensator. For free hookup write 428 Broadway, New York City



ELECTRAD Inc.

Radio Prophecies From View-point of Prophesee

(Continued from page 22)

But, how much light did you ever see produced directly by radio waves? Once, when I was operating a receiver four miles from a 100-kilowatt government radio station, I discovered faint sparks at the terminal of a fixed condenser. They were produced directly by the energy from the transmitting station, apparently. I have seen the end of a cat-whisker fused with the galena of a crystal detector when a powerful transmitting station was sending over my head to some ship a thousand miles off shore. A Canadian priest who is an expert in radio showed me apparatus of his invention that would cause gas in a specially constructed tube to glow when it was within ten feet of a powerful Tesla coil. He said he believed that, if he could find the right gas, he could produce light from radio energy at a distance of ten miles. But, even in the face of such evidence, I cannot imagine anyone reading and working, hour after hour, in a room illumined by energy transmitted without wires from a plant a hundred miles away. If energy can be received from a radio transmitting station in sufficient quantity to illuminate a room as well as it can be lighted by electric systems now in use, it should be just as easy to use the energy in the form of power for operating machinery. When I see a Ford climbing a hill, without running either on its engine or its reputation, with just an aerial up in front and a radio receiver under the hood, I will be ready to believe the prophecies concerning the distribution of power by radio.

The transmission and reception of pictures by radio is a different proposition. I have examined the Jenkins apparatus by which that is done. That is merely a matter of radio control, like the transmission and reception of sounds. Neither sound nor light is actually transmitted by radio. The radio wave, as propagated at the transmitting aerial, is composed of an electro-

magnetic and an electro-static field. These fields can be projected far and wide. A powerful station encompasses the earth with its waves and sends them an unknown distance into space. Wherever they pass a conductor of electricity, they tend to set up a flow of current. This current, even though it may be exceedingly weak, can be turned into the grid of an electron tube and used to impress certain characteristics of the radio waves upon stronger currents flowing in circuits connected with that tube. The output current of the tube, bearing the characteristics imposed upon it by the current caught from the ether, can be amplified to an enormous degree. The local current can be changed into various forms of energy, such as heat, light or motion, and can be made to do a great variety of work.

Radio as Control

IN THIS manner, radio can be used to control the movements of airplanes, torpedoes, boats, ships and trains; it can control the light used in reproducing the pictures "transmitted" by radio; it may, in time, be used to open the drafts in the stove, call the hired girl and let down the hay for the horses. It was used several years ago to ring bells on radio receivers in Germany and call the members of the household to listen in. But if it is actually going to furnish the heat, the light and the power, and if it is correct that the amount of energy a single radio receiver can pick up is but three-trillionths of the amount radiated from the transmitting aerial, somebody will have to manufacture a terrible amount of juice at the central power station.

Of course, there is the beam system of radio transmission. It transmits the energy all in one direction instead of spreading it broadcast. This effects an enormous saving. But how could a radio heat, light and power company induce all its customers to live in one row?

There are three very impor-

tant things that the radio prophets have left out of such predictions as I have encountered: the transmission of odors, and of those characteristics that enter our consciousness through the sense of touch and the sense of taste. Why do the radio prophets withhold from us the hope of lying abed in a New York or Chicago apartment and smelling the exquisite fragrance of the new mown hay that some early-rising farmer is raking? (Yes, farmers, I know that hay has to be dried before it is raked, but there is plenty of time for that before a lot of city folks are up.) And, if we are going to be able to see the circus without going to it, why can't they fix it so we can taste the peanuts and the pink lemonade? Likewise, if we are to see the smiling visages of the friend who is talking to us by radio, why can't we get the feel of the handclasp?

Seems Possible

RADIO prophets may not be stretching the truth. Probably everything they say is within the bounds of possibility. Any genius who could pick up three-trillionths of the energy of the sun, or harness three-trillionths of the strength of the ocean, or bring up three-trillionths of the heat that is believed to be imprisoned in the bowels of the earth, or turn into useful channels three-trillionths of the energy of the mosquitoes of the world, could heat and light a city and furnish the power for all its machinery. Some inventor may show the world how to radiate safely a trillion times the amount of energy that goes out from the most powerful radio transmitter today, or how to increase the amount of energy that may be picked up by a radio receiver. But will not some prophet who is practical as well as prophetic please tell us, soon, just how these weak impulses that we now catch from the radio waves are to be increased so that we can start the flivver by merely tuning in on any station that we do not owe for power previously consumed?

Making Use of A Hertz Multi-Wave Transmission

(Continued from page 10)

denser. Tune the driver to get maximum output in antenna, or until the bulb in the center of the antenna glows the brightest and the bulb in the feeder wire is just barely red, if any light at all. Then we know the antenna and the counterpoise are oscillating at their frequency and not the feeder wires. This is as it should be.

"I have given the exact measurements in Figures 1 and 2, so it will save all the bother trying to find the exact spot on the antenna and counterpoise to hook the feeder wires. After the antenna system is once adjusted remove all bulbs and lock it, for it never has to be changed for any of the different bands. Its fundamental will be about 39 meters. The series condenser in the antenna does not tune the secondary circuit but by its adjustment keeps the feeder wire out of mischief, or from oscillating at a frequency other than the one we are working on.

"The use of a single wire antenna, with no counterpoise, and the feeder clipped onto the primary, regardless of the setting of the condenser, raised an awful bunch of QRM among the local BCL's but after changing to the inductive coupling as at present, all the interference stopped."

Phillips tells us he is on the air on 37.5 meters every night from 6 to 8 E. S. T. and will be glad to handle any questions regarding this particular type of antenna system.

Shunt For Power

The bulbs in the antenna circuit can be in series for low powers, but for high power the bulbs should be shunted across the center of the antenna by means of small wires. You can make up the wires in the form of hooks so you can just hang the bulb on the antenna at the center. You will probably have to do a little experimenting with the proper length of the bulb leads to get best results as far as brilliancy is concerned. If the leads are too short, you will have no glow, and if they are

PROVED!

17 Sewall St., Framingham, Mass., April 12, 1926.

Ferbend Electric Co.
Dear Sirs—I have tried the "B" battery Eliminator which I purchased some time ago and find it works satisfactorily in every way. I have recommended this to several radio friends in this locality. I have had it on three different sets of five tubes each. Two of these sets are the tuned radio frequency and the other is a straight Fred-Eismann set, fully neutralized. (Signed) Edw. A. Browning.

246 Florence Ave., Highland Park, Mich., April 25, 1926.

Ferbend Electric Co.
Gentlemen—My reception is easily enhanced at least 60% since the installation of the Ferbend Eliminator, and, naturally I am a very enthusiastic "Satisfied Customer." Performance is far in excess of excellence that I have ever before experienced with the use of batteries. I am using a five-tube R. F. (Freshman Circuit), employing a "C" battery and am at a loss to know how I can at all improve it since using your Eliminator. In fact, I am so pleased that I solicit inquiries from such as may be your prospects. I have compared the performance of the "Maxim" with others of far greater price and find that you produce the clarity of reception as does your instrument. (Signed) Wilson E. Rogers.

San Francisco, April 20, 1926.

Ferbend Electric Co.
Dear Sirs—I have been using my "B" Eliminator steadily since I received it, and must say that it lives up to all the claims you make for it. This letter, I feel is the least I could do to thank you. (Signed) Philip A. Reilly, 1167 Valencia St.



\$12.50

COMPLETE nothing else to buy Replaces "B" Batteries. Operates Direct from Electric Light Socket, A. C. Power.

FERBEND "B" ELIMINATOR

Many careful buyers choose to adopt a policy of "watchful waiting." This is often true in the purchase of an apparently better, but yet-to-be-proved, automobile. The same holds good for many other commodities. And Radio. With the original announcement of the good Ferbend "B" Eliminator and its amazing low price of \$12.50, many there were who chose to wait. They wanted to be convinced. True, thousands bought at the start and they are the ones who now tell you what to expect. Lack of space alone prevents us from publishing the hundreds of fine testimonials from satisfied users. They are all in our files open to public inspection at any time. A few reproduced here.

The Ferbend "B" Eliminator successfully passed the rigid Laboratory tests of Radio News, Popular Radio and Radio Broadcast. It is a Proved Radio necessity, and a great one.

Ask Your Dealer—or Send Direct

If you prefer, we will make shipment direct to you upon receipt of price, or C. O. D., if desired. Use for 10 days to convince yourself—if unsatisfactory, write us within that time and purchase price will be refunded. Use the coupon now.

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too long, you will have too much brilliance.

We would be glad to hear from other amateurs as to their experience with this form of a Hertz antenna. F. A. H.

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25 Church St. New York, N. Y.

Who Pays Our Pipers

(Continued from page 21)

have spent years on the concert stage. As a result of the mystery worked up about him by the indefatigable Mr. Carlin, WEAf has received thousands of letters concerning his identity, which is surely sufficient to prove to the company footing the bill that people are listening to their offering. And the fact that his voice is a pleasing one, as tenors go, makes him a popular entertainer with many listeners who don't care if he is John McCormack or the Prince of Wales.

For those who prefer their radio with a vaudeville or minstrel flavor, with popular songs and chatter, there are those two sterling teams of entertainers, Goldy and Dusty; and Billy Jones and Ernest Hare, the Happiness Boys. The sincerest test of the popularity of these features is the fact that there is scarcely a radio station in the country that hasn't a couple of bright boys trying to imitate them. All of these artists had years of professional experience behind them before they went on the air through WEAf's microphone, and their cheery half-hours each week add not a little to the lighter side of our radio entertainment.

Dance Music

NOWADAYS, with pick-ups from every hotel and cafe of note throughout the land, the radio public has become somewhat of a discriminating judge of dance music, and the advertiser who would devote his hour to this class of music knows that it must be good. To our way of thinking the large orchestra, under the leadership of S. E. Lanin, which broadcasts under the name of the Ipana Troubadours has few equals on the air in the line of syncopated melody, and the interruption of the program with concert numbers is a feature much to be commended. Another cheery group, conducted by that expert banjoist, Harry Reser, who is always broadcasting somewhere, is the Cliquot Esquimo organization, which also has on its roster a rousing vocal

quartette. Their programs have a zip and a dash, which seems particularly appropriate to the product they are engaged to make popular. These two features naturally have the widest appeal to the younger element, or at least that portion of the radio audience with dancing feet.

One wonders who was responsible for putting the excellent singing quintette and instrumental trio, which made its appearance last spring, on the air with the awful appellation, the "Grand Prize Eurekas"; but it is doubtless a case of a rose by any other name, and as they are all artists of established reputation, they probably don't care what they are called. They have done some fine ensemble singing, and when you know that they include Franklyn Bauer, Lewis James, and Wilfred Glenn, with Ed Smalle as accompanist, and are assisted from time to time by Rudy Wiedoeft and the omnipresent Harry Reser, it isn't surprising that this half-hour has been one of the high-lights among the newcomers on the hookup.

An attempt to fully cover this phase of WEAf's activities would be like cataloging the attractions of a variety theatre; and we understand, that even at this date the whole feature is still regarded as more or less of an experiment by the American Telephone and Telegraph Company, although the testimony of thousands of listeners would seem to take it out of the experimental class. There is one more feature, however, that should be mentioned, since it appealed to an element that possibly otherwise had not been especially concerned with radio; and that was the broadcasting last winter of the bridge lessons, under the supervision of those well-known wizards of the game, Messrs. Whitehead and Work. Our observation is that there could scarcely have been a devotee of auction throughout the land who did not contrive by fair means or foul to get in on these lessons, and the fact that those who took the trouble to write to the corporation sponsoring the half-hours received a detailed account of the game as played, procured for this com-

pany and the publishers of the Bridge Bulletin a mailing-list comprising a large percentage of all the bridge players on the continent. The United States Playing Card company received 70,000 requests for reprints of the games, the letters coming from all parts of the United States, as well as England, France, Spain, Italy, Alaska, Russia, China, Australia and South Africa. These figures should remove any doubt that may exist as to the success of radio as a publicity medium, and the results have been so gratifying to the originators of these programs that another series of lessons will be broadcast this fall on a more extensive scale. So widespread was the interest aroused that stations in Johannesburg, South Africa and Sydney, Australia, have arranged to broadcast the entire series.

Those of us who have been listeners long enough to feel that our judgment in broadcasting affairs is almost mature, are with few exceptions confirmed addicts to the entertainment furnished by WEAf and its satellites, and if you are coming into the fold for the first time this fall, our best wish for you is that you may be so fortunately situated geographically as to hear several nights a week the familiar chant,

"Ladies and gentlemen: this is WEAf, New York; WEEI, Boston; WCAP, Washington; WJAR, Providence; WGR, Buffalo; WCAE, Pittsburgh; WSAI Cincinnati; WWJ, Detroit; WOC, Davenport; WCCO, Minneapolis and St. Paul; WGN, Chicago; WTAM, Cleveland; WTAG, Worcester; WOO, Philadelphia and KSD, St. Louis. Please stand by!"

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Men Wanted Everywhere-Now

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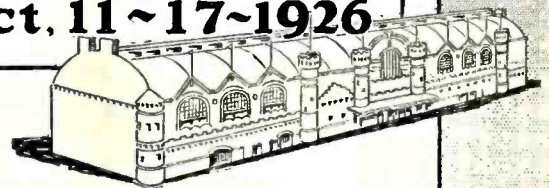
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Coliseum
Chicago
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The World's Foremost Radio Exhibitions

Four years ago, outside of a limited circle of scientists, radio was unknown. Today a radio set is a necessity in every home, for to be without one is to be like Robinson Crusoe, stranded on a desert island. With its almost daily new distance records, radio is destined to link the world, bringing all nations into one big family. Whether or not you are a radio fan, you should keep abreast of the latest developments in this marvelous new industry.

At the New York & Chicago Shows every representative radio manufacturer will display his new products—a complete showing of everything new in radio. If you own a radio, you will want to see what's new. If you do not own one, go to the show and see the latest models. There are all kinds of shows, but this is the show you can't afford to miss.

“Go to the Radio Show”

Zenith Considers Business Expansion

THE Zenith Radio Corporation of Chicago held a special directors meeting on July 20 for the purpose of considering an expansion of their business to take care of their newly perfected railway control devices. A report was presented by E. F. McDonald, Jr., President of the Corporation, showing the very successful result of the demonstration made on July 8th, on a freight train of 115 cars between Elkhart, Ind., and Chicago, under the auspices of the American Railway Association and witnessed by 33 executives from all of the principal railroads in the country.

A survey was presented of the manufacturing program for the present year showing complete parts, cabinets and materials in the factory to take care of the proposed shipments for the months of August, September and October. Orders on hand

were shown to be more than twice as large as the same date the preceding year, or amounting to \$2,200,000 worth of products.

The stockholders and directors present were unanimously in favor of expanding the operations of the corporation and thereupon subscribed and paid for unissued treasury stock to an amount more than sufficient to carry out the new activities of the corporation.

The following officers were elected: E. F. McDonald, Jr., President; Paul B. Klugh, Vice-President and General Manager; T. M. Pletcher, Vice-President; N. A. Fegen, Secretary and Sales Manager; H. Robertson, Treasurer.

The above statement repudiates unfounded rumors regarding the consolidation of Zenith with two large competitors. The Zenith Radio Corporation states it will continue as an outstanding, independent, manufacturer of high grade radio devices.



FULL VOLTAGE

Under Any Load
with

Burns

“B” BATTERY ELIMINATOR

Smooth constant plate current with ample reserve powers for set of any number of tubes. Operates from house lighting system, using Raytheon tube. First cost the only expense.

Write for full description.

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Makers of Burns Loud Speakers

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| KDKA Westinghouse Electric & Mfg. Co. East Pittsburgh, Pa. | 309 | KFQP G. S. Carson, Jr. | Iowa City, Ia. | 224 |
| KDLR Radio Electric Co. | Devils Lake, N. D. | 231 | KFQU W. Riker | Holy City, Calif. 217 |
| KDYL Newhouse Hotel | Salt Lake City, Utah | 246 | KFQW C. F. Knierim | North Bend, Wash. 216 |
| KFAB Nebraska Buick Auto Co. | Lincoln, Neb. | 343 | KFQZ Taft Products Co. | Hollywood, Calif. 225 |
| KFAD McArthur Bros. Mercantile Co. | Phoenix, Ariz. | 271 | KFRB Hall Bros. | Beeville, Texas 248 |
| KFAF A. E. Fowler | San Jose, Calif. | 217 | KFRD City of Paris Dry Goods Co. | San Francisco, Calif. 268 |
| KFAU Independent School Dist. | Boise, Idaho | 280 | KFRU Stephens College | Columbia, Mo. 500 |
| KFBB F. A. Buttrey & Co. | Havre, Mont. | 275 | KFRW G. & G. Radio Shop | Olympia, Wash. 219 |
| KFBC W. K. Azbill | San Diego, Calif. | 216 | KFSD Airfan Radio Corp. | San Diego, Calif. 246 |
| KFBK Kimball-Upson Co. | Sacramento, Calif. | 248 | KFSG Echo Park Evan. Assn. | Los Angeles, Calif. 275 |
| KFBL Leese Bros. | Everett, Wash. | 224 | KFUL Thomas Grogan & Bros. Music Co. | Galveston, Texas 258 |
| KFBS School District No. One | Trinidad, Colo. | 238 | KFUM W. D. Corley | Colorado Springs, Colo. 239 |
| KFBU Bishop N. S. Thomas | Laramie, Wyo. | 270 | KFUO Concordia Seminary | St. Louis, Mo. 545 |
| KFCB Nielson Radio Supply Co. | Phoenix, Ariz. | 238 | KFUP Fitzsimmons General Hospital | Denver, Colo. 234 |
| KFDD St. Michaels Cathedral | Boise, Idaho | 278 | KFUR Peery Bldg. Co. | Ogden, Utah 224 |
| KFDM Magnolia Petroleum Co. | Beaumont, Texas | 316 | KFUS Louis L. Sherman | Oakland, Calif. 256 |
| KFDX First Baptist Church | Shreveport, La. | 250 | KFUT University of Utah | Salt Lake City, Utah 261 |
| KFDY South Dakota State College | Brookings, S. D. | 273 | KFUU Colburn Radio Labs. | Oakland, Calif. 220 |
| KFDZ Harry O. Iverson | Minneapolis, Minn. | 231 | KFVD McWhinnie Electric Co. | San Pedro, Calif. 205 |
| KFEC Meier & Frank Co. | Portland, Ore. | 248 | KFVE Film Corporation of America | St. Louis, Mo. 240 |
| KFEL Winner Radio Corp. | Denver, Colo. | 254 | KFVG First M. E. Church | Independence, Kans. 236 |
| KFEQ J. L. Scroggin | Oak, Neb. | 268 | KFVI Headquarters Troop, 56th Cavalry | Houston, Texas 240 |
| KFEY Bunker Hill & Sullivan Min. & Con. Co. | Kellogg, Idaho | 233 | KFVN Carl E. Bagley | Fairmont, Minn. 227 |
| KFFP First Baptist Church | Moberly, Mo. | 242 | KFVS Hirsch Battery and Radio Co. | Cape Girardeau, Mo. 224 |
| KFGQ Crary Hardware Co. | Boone, Iowa | 226 | KFVY Radio Supply Co. | Albuquerque, N. M. 250 |
| KFH Hotel Lassen | Wichita, Kans. | 268 | KFWA Browning Bros. Co. | Ogden, Utah. 261 |
| KFHA Western State College of Colo. | Gunnison, Colo. | 252 | KFWB Warner Bros. | Hollywood, Calif. 252 |
| KFHL Penn. College | Oskaloosa, Iowa | 240 | KFWC L. E. Wall | San Bernardino, Calif. 211 |
| KFI E. C. Anthony, Inc. | Los Angeles, Calif. | 468 | KFWF St. Louis Truth Center | St. Louis, Mo. 214 |
| KFIF Benson Polytechnic Institute | Portland, Ore. | 248 | KFWH F. Wellington Morse, Jr. | Chico, Calif. 254 |
| KFIO North Central High School | Spokane, Wash. | 265 | KFWI Radio Entertainments, Inc. | South San Francisco, Calif. 226 |
| KFIQ First Methodist Church | Yakima, Wash. | 256 | KFWM Oakland Educational Society | Oakland, Calif. 207 |
| KFIU Alaska Electric Light & Power Co. | Juneau, Alaska | 226 | KFWO Lawrence Mott | Avalon, Calif. 211 |
| KFIZ Daily Commonwealth | Fond du Lac, Wis. | 273 | KFWU Louisiana College | Pineville, La. 238 |
| KFJB Marshall Electrical Co. | Marshalltown, Iowa | 248 | KFWV Wilbur Jerman | Portland, Ore. 213 |
| KFJC R. B. Fegan (Episcopal Church) | Junction City, Kans. | 219 | KFXB Bertram O. Heller | Big Bear Lake, Calif. 203 |
| KFJF National Radio Manf. Co. | Oklahoma City, Okla. | 261 | KFXD Service Radio Co. | Logan, Utah 205 |
| KFJI Liberty Theatre (E. E. Marsh) | Astoria, Ore. | 246 | KFXE Pike's Peak Broadcasting Co. | Colorado Springs, Colo. 250 |
| KFJM University of North Dakota | Grand Forks, N. D. | 278 | KFXH Bledsoe Radio Company | El Paso, Texas 242 |
| KFJR Ashley C. Dixon & Son | Portland, Ore. | 263 | KFXJ Mt. States Radio Dist. Inc. | Denver, Colo. 216 |
| KFJY Tunwall Radio Co. | Fort Dodge, Iowa | 246 | KFXR Classen Film Finishing Co. | Oklahoma City, Okla. 214 |
| KFJZ W. E. Branch | Ft. Worth, Tex. | 254 | KFXZ Mary M. Costigan | Flagstaff, Ariz. 205 |
| KFKA Colo. State Teachers College | Greeley, Colo. | 273 | KFYF Carl's Radio Den. | Oxnard, Calif. 205 |
| KFKU The University of Kansas | Lawrence, Kans. | 275 | KFYO Chronicle Publishing Co. | Houston, Texas 238 |
| KFKX Westinghouse Elec. & Mfg. Co. | Hastings, Neb. | 288 | KFYQ Buchanan-Vaughan Co. | Texarkana, Tex. 210 |
| KFKZ Chamber of Commerce | Kirkville, Mo. | 226 | KFYR Hoskens-Meyers, Inc. | Bismarck, N. Dak. 248 |
| KFLR University of New Mexico | Albuquerque, N. M. | 254 | KGAR Tuscon Citizen | Tuscon, Ariz. 244 |
| KFLU San Benito Radio Club | San Benito, Texas | 236 | KGBS A. C. Dailey | Seattle, Wash. 210 |
| KFLV Swedish Evangelical Church | Rockford, Ill. | 229 | KGBU R. R. Thornton | Ketchikan, Alaska 229 |
| KFLX George Roy Clough | Galveston, Texas | 240 | KGO General Electric Co. | Oakland, Calif. 361 |
| KFLZ Atlantic Automobile Co. | Anita, Ia. | 273 | KGTT Glad Tidings Tabernacle | San Francisco, Calif. 207 |
| KFMR Morningside College | Sioux City, Iowa | 261 | KGU Marion A. Mulrony | Honolulu, Hawaii. 270 |
| KFMX Carleton College | Northfield, Minn. | 337 | KGW Portland Morning Oregonian | Portland, Ore. 491 |
| KFNF Henry Field Seed Co. | Shenandoah, Iowa | 263 | KGY St. Martins College | Lacy, Wash. 246 |
| KFOA Rhodes Department Store | Seattle, Wash. | 454 | KHJ Times-Mirror Co. | Los Angeles, Calif. 405 |
| KFOB Chamber of Commerce | Burlingame, Calif. | 226 | KHO Louis Wasmer | Seattle, Wash. 394 |
| KFON Echophone Radio Shop | Long Beach, Calif. | 233 | KJBS J. Brunton & Sons | San Francisco, Calif. 220 |
| KFOO Latter Day Saints' University | Salt Lake City, Utah | 236 | KJR Northwest Radio Service Co. | Seattle, Wash. 384 |
| KFOR David City Tire & Electric Co. | David City, Neb. | 226 | KLDS Reorganized Church | Independence, Mo. 441 |
| KFOT College Hill Radio Club | Wichita, Kans. | 231 | KLS Warner Brothers Radio Supplies Co. | Oakland, Calif. 250 |
| KFOX Board of Education, Tech. High School | Omaha, Nebr. | 248 | KLX Tribune Publishing Co. | Oakland, Calif. 508 |
| KFOY Beacon Radio Service | St. Paul, Minn. | 252 | KLZ Reynolds Radio Co. | Denver, Colo. 266 |
| KFPL C. C. Baxter | Dublin, Texas. | 252 | KMA May Seed & Nursery Co. | Shenandoah, Iowa 252 |
| KFPM The New Furniture Co. | Greenville, Texas. | 242 | KMJ Fresno Bee | Fresno, Calif. 234 |
| KFPR Los Angeles County Forestry Dept. | Los Angeles, Calif. | 231 | KMMJ M. M. Johnson Co. | Clay Center, Nebr. 229 |
| KFPW St. Johns M. E. Church | Cartersville, Mo. | 258 | KMO Love Electric Co. | Tacoma, Wash. 250 |
| KFPY Symons Investment Co. | Spokane, Wash. | 266 | KMOX Voice of St. Louis | St. Louis, Mo. 280 |
| KFQA The Principia | St. Louis, Mo. | 261 | KMTR Turner Radio Corp. | Los Angeles, Calif. 238 |
| KFQB The Searchlight Publishin Co | Fort Worth, Texas | 263 | KNRC C. B. Juneau | Los Angeles, Calif. 208 |
| KFQD Chovin Supply Co. | Anchorage, Alaska | 227 | | |

Plate Power Supply Uses the New Raytheon Tube

(Continued from page 41)

in the receiver are disconnected entirely from the set wiring, and, instead, connected to terminals 3-4 of the No. 330 power transformer by means of a pair of rubber-covered wires which should be twisted. If a UX171 or UX112 tube were to be used, then a fixed 5 ohm resistance would have to be connected in series with one wire. Next, direct at the tube socket terminals should be mounted a 100 ohm fixed resistance with one end connected to each of the filament posts of the socket. To the center tap of this resistance will be connected the C and B- leads as well as the negative filament lead of the other tubes in the set. The receiver is then connected to the supply set with a 1500 ohm adjustable resistance in the common negative lead to the eliminator. The set end of this resistor connects to the center of the 100 ohm resistance shunting the power tube filament, and the C- lead of the power stage connects to an adjustable contact on the 1500 ohm resistor.

The receiver is now put in operation with the tap on the 1500 ohm resistance at the end farthest from the filament resistance connection. With a signal coming in, the position of this tap is adjusted for best quality. The most satisfactory way to make this adjustment is to connect a millimeter in the plate circuit of the last tube, and adjust the resistance tap until a signal does not cause the meter reading to vary at all, which is the correct adjustment.

If a power tube is used, operating on the full voltage of the supply set, an output transformer really should be used between the speaker and the power tube for insulation purposes. Further, such a transformer will improve low note quality very much, if properly designed, as is the S-M No. 220 output transformer, for this purpose. It will also, by keeping the direct current out of the loud-speaker, increase the speaker's handling

capacity several times, in most cases.

Under certain circumstances, it may be well to connect a 1 to 4 mfd. condenser from the center tap of the 100 ohm resistance to the "F" post of the secondary of the audio transformer in the power stage. Frequently, stability will also be improved if two 1/10th mfd. condensers, with their joint grounded directly to the set ground, have their other terminals connected to the "F" posts of the Raytheon tube socket. In this case, connecting terminal 8 of the power transformer (the noise shield) directly to the set ground may also diminish noise if troublesome. These suggestions apply only when the 1500 ohm series resistance in the negative B supply lead is used to obtain power amplifier C voltage.

The supply set may be connected to the lighting circuit and disconnected at will by means of the separable attachment plug, which serves excellently as a switch. If left connected for several days at a time, no damage will be done as the tube itself has a practically indefinite life.

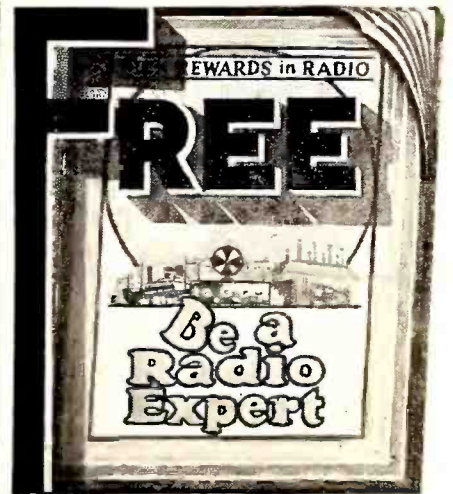
New "A" Power Unit



An excellent "A" power unit for radio has been developed by Westinghouse and is being marketed by the Westinghouse Union Battery Company. It is known as the "A" Autopower and is a combination of battery and trickle charger.

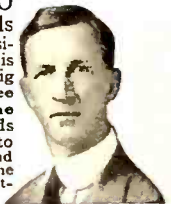
A feature is that the rate of charging can be varied from 1/10 ampere to 1/2 ampere, with two intermediate steps, by simply changing the position of a connecting link.

The charging unit is made on an entirely new principle.



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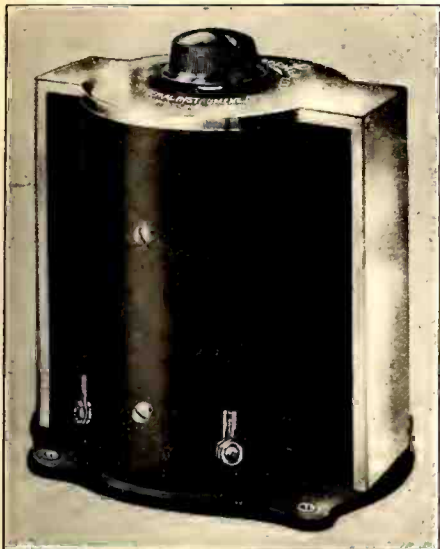
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 - (5) Practice set and buzzer outfit.

| | |
|--|--|
| KNX Los Angeles Evening Express.....Los Angeles, Calif. 337 | WBAL Consolidated Gas & Elec. Co.....Glen Morris, Md. 246 |
| KOA General Electric Co.....Denver, Colo. 322 | WBAO James Millikan University.....Decatur, Ill. 270 |
| KOAC Oregon Agricultural College.....Corvallis, Ore. 280 | WBAP Wortham-Carter Pub.(Star Telegram).....Ft. Worth, Texas 476 |
| KOB N. Mex. College Ag. & Me. Arts.State College, N. Mex. 349 | WBAW Braid Elec., & Waldrum Drug Co.....Nashville, Tenn. 236 |
| KOCH Central High School.....Omaha, Neb. 258 | WBAX John H. Stenger, Jr.....Wilkes-Barre, Pa. 256 |
| KOCW Oklahoma College for Women.....Chickasha, Okla. 252 | WBBL Grace Covenant Presbyterian Church.....Richmond, Va. 229 |
| KOIL Monarch Manufacturing Co.....Council Bluffs, Iowa 278 | WBMM Atlas Investment Co.....Chicago, Ill. 226 |
| KOIN H. B. Read.....Portland, Ore. 319 | WBBP Petoskey High School.....Petoskey, Mich. 238 |
| KOMO Bert F. Fisher.....Seattle, Wash. 306 | WBBR People's Pulpit Assoc.....Rossville, N. Y. 273 |
| KOWW Blue Mt. Radio Assn.....Walla Walla, Wash. 256 | WBBS First Baptist Church.....New Orleans, La. 252 |
| KPO Hale Bros.....San Francisco, Calif. 428 | WBBW Ruffner Junior High School.....Norfolk, Va. 222 |
| KPPC Pasadena Presbyterian Church.....Pasadena, Calif. 229 | WBBY Washington Light Inf.Co."B" 118th inf,Charleston,S.C. 268 |
| KPRC Houston Post Dispatch.....Houston, Texas 297 | WBZZ C. L. Carrell.....Chicago, Ill. 216 |
| KPSN Star-News Publishing Co.....Pasadena, Calif. 316 | WBCN Foster & McDonnell.....Chicago, Ill. 266 |
| KQV Doubleday-Hill Electric Co.....Pittsburgh, Pa. 275 | WBDC Baxter Laundry Co.....Grand Rapids, Mich. 256 |
| KQW Charles D. Herrold.....San Jose, Calif. 231 | WBES Bliss Electrical School.....Takoma Park, Md. 222 |
| KRE Berkeley Daily Gazette.....Berkeley, Calif. 256 | WBNO B. A. Ruhome Corp.....New York, N. Y. 322 |
| KSAC Kansas State Agricultural College.....Manhattan, Kans. 341 | WBOQ A. H. Grebe & Co., Inc.....Richmond Hill, N. Y. 236 |
| KSD Pulitzer Printing Co.....St. Louis, Mo. 545 | WBPI I. R. Nelson.....Newark, N. J. 263 |
| KSL Radio Service Corp. of Utah.....Salt Lake City, Utah 300 | WBRC Bell Radio Corporation.....Birmingham, Ala 248 |
| KSMR Santa Maria Valley Railroad Co.....Santa Maria, Calif. 210 | WBRE Baltimore Radio Exchange.....Wilkes-Barre, Pa. 231 |
| KSO A. A. Berry Seed Co.....Clarinda, Iowa 242 | WBT Charlotte Chamber of Commerce.....Charlotte, N. C. 275 |
| KTAB Associated Broadcasters.....Oakland, Calif. 240 | WBZ Westinghouse Elect. & Mfg. Co.....Springfield, Mass. 331 |
| KTBI Bible Institute.....Los Angeles, Calif. 294 | WBZA Westinghouse Elect. & Mfg. Co.....Boston, Mass. 242 |
| KTBR Brown's Radio Shop.....Portland, Ore. 263 | WCAC Connecticut Agricultural College.....Mansfield, Conn. 275 |
| KTHS New Arlington Hotel Co.....Hot Springs, Ark. 375 | WCAD St. Lawrence University.....Canton, N. Y. 263 |
| KTNT N. Baker.....Muscatine, Iowa 256 | WCAE Kaufmann & Baer Co. & The Pitts. Pr.....Pittsburgh, Pa. 461 |
| KTW First Presbyterian Church.....Seattle, Wash. 454 | WCAJ Nebraska Wesleyan University.....University Place, Nebr. 254 |
| KUOA University of Arkansas.....Fayetteville, Ark. 300 | WCAL St. Olaf College.....Northfield, Minn. 337 |
| KUOM State University of Montana.....Missoula, Mont. 244 | WCAM City of Camden.....Camden, N. J. 236 |
| KUSD University of South Dakota.....Vermillion, S. D. 278 | WCAO A. A. and A. S. Brager.....Baltimore, Md. 275 |
| KUT University of Texas.....Austin, Texas 231 | WCAP Chesapeake & Potomac Tel. Co.....Washington, D. C. 468 |
| KVOO The Voice of Oklahoma.....Bristow, Okla. 375 | WCAR Southern Radio Corp. of Texas.....San Antonio, Texas 263 |
| KWCR H. F. Paar.....Cedar Rapids, Iowa 278 | WCAT State College of Mines.....Rapid City, S. Dak. 240 |
| KWG Portable Wireless Telephone Co.....Stockton, Calif. 248 | WCAU Universal Broadcasting Co.....Philadelphia, Pa. 278 |
| KWKC Wilson Duncan Studios.....Kansas City, Mo. 236 | WCAX University of Vermont.....Burlington, Vt. 250 |
| KWKH Henderson Iron Works.....Shreveport, La. 312 | WCBA Charles W. Heimbach.....Allentown, Pa. 254 |
| KWSC State College.....Pullman, Wash. 349 | WCBD Wilbur C. Voliva.....Zion, Ill. 345 |
| KWUC Western Union College.....Le Mars, Iowa 252 | WCBE Uhalt Radio Co.....New Orleans, La. 263 |
| KWWG City of Brownsville.....Brownsville, Texas 278 | WCBH University of Mississippi.....Oxford, Miss. 242 |
| KYW Westinghouse Electric & Mfg. Co.....Chicago, Ill. 535 | WCBM Charles Swarz.....Baltimore, Md. 229 |
| KZIB I. Beck.....Manila, P. I. 250 | WCBR C. H. Mester.....Providence, R. I. 210 |
| KZKZ Electrical Supply Co.....Manila, P. I. 270 | WCCO Washburn-Crosby Co.....Anoka, Minn. 416 |
| KZM Preston D. Allen.....Oakland, Calif. 240 | WCFT Knights of Pythias.....Tullahoma, Tenn. 252 |
| KZRQ Far Eastern Radio.....Manila, P. I. 222 | WCLO C. E. Whitmore.....Camp Lake, Wis. 231 |
| KZUY F. J. Elser.....Manila, P. I. 360 | WCLS H. M. Couch.....Joliet, Ill. 214 |
| NAA U. S. Navy Dept.Arlington, Va. 434 | WCMA Culver Military Academy.....Culver, Ind. 222 |
| WAAD Ohio Mechanics Institute.....Cincinnati, Ohio 258 | WCOA City of Pensacola.....Pensacola, Fla. 222 |
| WAAF Chicago Daily Drivers Journal.....Chicago, Ill. 278 | WCSS Henry P. Rines.....Portland, Maine 256 |
| WAAW Omaha Grain Exchange.....Omaha, Nebr. 278 | WCSSO Wittenberg College.....Springfield, Ohio 248 |
| WABB Harrisburg Radio Co.....Harrisburg, Pa. 204 | WCWS Chas. W. Selene (Portable).....Providence, R. I. 210 |
| WABC Asheville Battery Co., Inc.....Asheville, N. C. 254 | WCX Free Press and Jewett R. & P. Co.....Detroit, Mich. 517 |
| WABI 1st Universalist Church.....Bangor, Me. 240 | WDAD Dad's Auto Accessories, Inc.....Nashville, Tenn. 226 |
| WABO Lake Avenue Baptist Church.....Rochester, N. Y. 278 | WDAE Tampa Daily Times.....Tampa, Fla. 273 |
| WABQ Haverford College, Radio Club.....Haverford, Pa. 261 | WDAF Kansas City Star.....Kansas City, Mo. 366 |
| WABR Scott High School.....Toledo, Ohio 263 | WDAG J. Laurence Martin.....Amarillo, Texas 263 |
| WABW College of Wooster.....Wooster, Ohio 207 | WDAH Trinity Methodist Church.....El Paso, Texas 268 |
| WABX Henry B. Joy.....Mt. Clemens, Mich. 246 | WDAY Radio Equipment Corp.....Fargo, N. Dak. 261 |
| WABY John Magaldi, Jr.....Philadelphia, Pa. 242 | WDBE Gilham-Schoen Elec. Co.....Atlanta, Ga. 270 |
| WABZ Coliseum Place Baptist Church.....New Orleans, La. 275 | WDBJ Richardson Wayland Elec. Corp.....Roanoke, Va. 229 |
| WADC Allen T. Simmons (Allen Theatre).....Akron, Ohio 258 | WDPK M. F. Broz.....Cleveland, Ohio. 227 |
| WAFD Albert B. Parfet Co.....Port Huron, Mich. 275 | WDBO Rolins College, Inc.....Winter Park, Fla. 240 |
| WAGM R. L. Miller.....Royal Oak, Mich. 225 | WDBZ Kingston Radio Club.....Kingston, N. Y. 233 |
| WAHG A. H. Grebe & Co.....Richmond Hill, N. Y. 316 | WDEL Wilmington Elec. Specialty Co.....Wilmington, Del. 266 |
| WAIT A. H. Waite Co.....Taunton, Mass. 229 | WDGY Dr. George W. Young.....Minneapolis, Minn. 263 |
| WAIU American Insurance Union.....Columbus, Ohio 294 | WDOD Chattanooga Radio Co., Inc.....Chattanooga, Tenn. 256 |
| WAMD Radisson Radio Corp.....Minneapolis, Minn. 244 | WDRG Doolittle Radio Corp.....New Haven, Conn. 268 |
| WAPI Alabama Polytechnic Institute.....Auburn, Ala. 248 | WDWF Dutee Wilcox Flint, Inc.....Cranston, R. I. 441 |
| WARC American Radio & Research Corp.....Medford, Mass. 261 | WDZ J. L. Bush.....Tuscola, Ill. 278 |
| WATT Edison Electric.....Boston, Mass. 244 | WEAF Broadcasting Co. of America.....New York, N. Y. 491 |
| WBAA Purdue University.....W. Lafayette, Ind. 273 | WEAI Cornell University.....Ithaca, N. Y. 254 |
| WBAK Pennsylvania State Police.....Harrisburg, Pa. 275 | WEAM Bor. of N. Plainfield.....North Plainfield, N. J. 261 |

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IMPROVING audio frequency amplifiers has been a serious problem confronting every radio set user. The use of more tubes in inefficient amplifying systems does not appeal to every one in their pursuit of quality. A new variable audio transformer solves the problem of getting perfect reproduction from a transformer coupled amplifier.

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Experiments with 250-watt short-wave transmitters at land stations and on some destroyers have proven very successful for long-range work. The Denver, while at Africa, communicated successfully with the Finch which was on Asiatic station, and was also heard in New Zealand. The Memphis and Pittsburgh have been authorized to conduct special communication tests on 10 and 35 meters with amateurs while cruising across the Atlantic. Destroyers now going abroad to relieve ships in European waters are being fitted out with short-wave receivers.



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International Radio Notes

From H. de A. Donisthorpe
23 Gledhow Gardens, London, S. W. 5

A NUMBER of the countries in Europe are employing small relay broadcasting stations to work in conjunction with their larger stations. Norway is the next country to follow this example and relay stations are being erected at the following: Rjukan (100 watts), Porsgrund 700 watts, and Nottoden (50 watt).

JUGO-SLAVIA is the next country to erect a high power broadcasting station. This new station is to be installed by the State. A site for the station has been chosen near Agram.

This station will serve the whole of this little country for the present. Radio broadcasting in Jugo-Slavia is still very much in its infancy, there being only 700 listeners in their capital city of Belgrade.

THE PRESENT government in Spain is taking an active interest in broadcasting and is contemplating the erection of a station at Prado del Rey, near Madrid, for their own use. This station will send out musical programs as well as educational talks. A long wave has been suggested for this station and 3800 meters has been mentioned in this connection.

A NEW high power broadcasting station is to be erected at Langenberg, near Cologne. It is intended that this station shall take the place of two relay stations which previously covered the area that this new station will serve. In this manner there will be a conservation of wavelengths, which is most essential in Europe at the present time with all the new stations which are springing up every day in all the different countries on that continent. It is reported that this station has been designed to work with a power of some 60

kilowatts, so that it is quite likely that this new station will be heard in the eastern States of America during good climatic conditions.

THE WORLD'S greatest horse race has come and gone once more in England and the Derby is over. The British Broadcasting Company as usual in accordance with the terms of their agreement with the government, were unable to broadcast a description of the race whilst it was in progress, and only comments and noises associated with the race were "put over the air." This continued restriction has brought a shower of complaints from the listeners in England, who owing to the very bad weather on Derby day were annoyed that they were not allowed to "see" the race from their homes by the aid of their radio receivers. America's example in allowing this kind of broadcast has been brought to the notice of the powers that be and it is hoped that there will be some radical changes in the policy of British broadcasting.

Life Story of Steinmetz to Go on Air

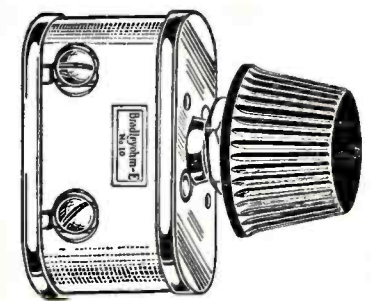
THE HIGHLY dramatic and interesting story of Charles Proteus Steinmetz, scientist and mathematician, and for many years, consulting engineer of the General Electric Company, will be told from WGY in a series of weekly talks which began Tuesday night, July 20.

John Winthrop Hammond, biographer of Dr. Steinmetz, has prepared the talks which will follow chronologically the career of the young German refugee who fled to America to escape persecution by the reactionary forces then in control in his native land.

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| 6-Volt, 120-Amperes \$12.50 | | 6 - Volt, 13 - Plate \$12.50 |
| 6-Volt, 140-Amperes \$13.25 | | 12 - Volt, 7 - Plate \$15.25 |

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Approved and Listed as Standard by Leading Authorities

including Radio Inventions, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories, Radio In The Home, and Lefax, Inc.

KDKA WSBC WEAf KYW

| | |
|--|--|
| WLTS Lane Technical High School.....Chicago, Ill. 258 | WQAO Calvary Baptist Church.....New York, N. Y. 360 |
| WLW Crosley Mfg. Co.....Cincinnati, Ohio 422 | WQJ Calumet Rainbo Broadcasting Co.....Chicago, Ill. 447 |
| WLWL Miss. Society of St. Paul the Apostle.....New York, N. Y. 288 | WRAF The Radio Club (Inc.).....LaPorte, Ind. 224 |
| WMAC C. B. Meredith.....Casenovia, N. Y. 275 | WRAC Economy Light Co.....Escanaba, Mich. 256 |
| WMAF Round Hills Radio Corp.....Dartmouth, Mass. 441 | WRAM Lombard College.....Galesburg, Ill. 244 |
| WMAK Norton Laboratories.....Lockport, N. Y. 266 | WRAV Antioch College.....Yellow Springs, Ohio 263 |
| WMAL M. A. Lesse Optical Co.....Washington, D. C. 213 | WRAW Horace D. Good.....Reading, Pa. 238 |
| WMAN First Baptist Church.....Columbus, Ohio 278 | WRAX Berachah Church.....Philadelphia, Pa. 268 |
| WMAQ Chicago Daily News.....Chicago, Ill. 447 | WRBC Immanuel Lutheran Church.....Valparaiso, Ind. 278 |
| WMAY Kingshighway Presbyterian Church.....St. Louis, Mo. 248 | WRC Radio Corp. of America.....Washington, D. C. 468 |
| WMAZ Mercer University.....Macon, Ga. 261 | WRCO Wynne Radio Co.....Raleigh, N. C. 252 |
| WMBB American Bond & Mortgage Co.....Chicago, Ill. 250 | WREC Wooten's Radio & Electric Co.....Coldwater, Miss. 254 |
| WMBBC Michigan Broadcasting Co.....Detroit, Mich. 256 | WREO Reo Motor Car Co.....Lansing, Mich. 285 |
| WMBF Miami Beach Hotel.....Miami Beach, Fla. 384 | WRHF Radio Hospital Fund.....Washington, D. C. 256 |
| WMBI Moody Bible Institute.....Chicago, Ill. 288 | WRHM Rosedale Hospital, Inc.....Minneapolis, Minn. 252 |
| WMC Commercial Appeal.....Memphis, Tenn. 500 | WRK Doron Bros.....Hamilton, Ohio 270 |
| WMRJ Peter J. Prinz.....Jamaica, N. Y. 227 | WRM University of Illinois.....Urbana, Ill. 273 |
| WMCA Hotel McAlpin (Greenley Sq. Hotel Co.).....New York, N. Y. 341 | WRMU A. H. Grebe & Co., Inc., M. Y. "MU-1".....New York, N. Y. 236 |
| WNAB Shepard Stores.....Boston, Mass. 280 | WRNY Experimenter Publishing Co.....New York, N. Y. 375 |
| WNAC Shepard Stores.....Boston, Mass. 430 | WRR Municipal Station.....Dallas, Tex. 246 |
| WNAD University of Oklahoma.....Norman, Okla. 254 | WRST Radiotel Mfg. Co., Inc.....Bay Shore, N. Y. 216 |
| WNAL Omaha Central High School.....Omaha, Nebr. 258 | WRVA Larus & Brother Co., Inc.....Richmond, Va. 256 |
| WNAT Lenning Bros. Co. (Frederick Lenning).....Philadelphia, Pa. 250 | WRW Peoples Broadcasting Corp.....Tarrytown, N. Y. 273 |
| WNAX Dakota Radio Apparatus Co.....Yankton, S. Dak. 244 | WSAI United States Playing Card Co.....Cincinnati, Ohio 326 |
| WNBH New Bedford Hotel.....New Bedford, Mass. 248 | WSAJ Grove City College.....Grove City, Pa. 229 |
| WNJ Radio Shop.....Newark, N. J. 252 | WSAN Allentown Call Publisher Co.....Allentown, Pa. 229 |
| WNOX Peoples Tel. & Tel. Co.....Knoxville, Tenn. 268 | WSAR Daughty & Welch Electrical Co.....Fall River, Mass. 254 |
| WNRG W. B. Nelson.....Greensboro, N. C. 224 | WSAU Camp Marien.....Chesham, N. H. 229 |
| WNYC Dept. of Plant & Structures.....New York, N. Y. 526 | WSAX Zenith Radio Corp. (Portable).....Chicago, Ill. 268 |
| WOAI Southern Equipment Co.....San Antonio, Texas 394 | WSAZ Chase Electric Shop.....Pomeroy, Ohio 244 |
| WOAN Vaughn Con. of Music.....Lawrenceburg, Tenn. 283 | WSB Atlanta Journal.....Atlanta, Ga. 428 |
| WOAW Woodman of the World.....Omaha, Nebr. 526 | WSBC World Battery Co.....Chicago, Ill. 210 |
| WOAX Franklyn J. Wolf.....Trenton, N. J. 240 | WSBF Stix-Baer-Fuller D. G. Co.....St. Louis, Mo. 273 |
| WOC Palmer School of Chiropractic.....Davenport, Iowa 484 | WSBT South Bend Tribune.....South Bend, Ind. 275 |
| WOCL A. E. Newton.....Jamestown, N. Y. 275 | WSDA Seventh Day Adventist Church.....New York, N. Y. 263 |
| WODA James K. O'Dea.....Paterson, N. J. 224 | WSKC World's Star Knitting Co.....Bay City, Mich. 261 |
| WOI Iowa State College.....Ames, Iowa 270 | WSM Nashville Life & Accident Ins. Co.....Nashville, Tenn. 283 |
| WOK Neutrowound Radio Mfg. Co.....Homewood, Ill. 217 | WSMB Saenger Amuse. Co. & Maison B. Co.....New Orleans, La. 319 |
| WOKO Harold E. Smith.....Peekskill N. Y. 233 | WSMH Shattuck Music House.....Owosso, Mich. 240 |
| WOO John Wanamaker.....Philadelphia, Pa. 508 | WSMK S. M. K. Radio Corp.....Dayton, Ohio 275 |
| WOOD Grand Rapids Radio Co.....Grand Rapids, Mich. 242 | WSOE School of Engineering.....Milwaukee, Wis. 246 |
| WOQ Unity School of Christianity.....Kansas City, Mo. 278 | WSRO Radio Company.....Hamilton, Ohio 252 |
| WOR L. Bamberger and Co.....Newark, N. J. 405 | WSSH Tremont Temple Bap. Church.....Boston, Mass. 261 |
| WORD People's Pulpit Assn.....Batavia, Ill. 275 | WSUI State University of Iowa.....Iowa City, Iowa 484 |
| WOS State Market Bureau.....Jefferson City, Mo. 441 | WSVS Seneca Vocational School.....Buffalo, N. Y. 219 |
| WOWO Main Auto Supply Co.....Fort Wayne, Ind. 227 | WSWS Illinois Broadcasting Corp.....Wooddale, Ill. 275 |
| WPAK N. D. Ag. College.....Agricultural College, N. D. 275 | WTAB Fall River Daily Herald Publishing Co.....Fall River, Mass. 266 |
| WPCC North Shore Cong. Church.....Chicago, Ill. 258 | WTAD Robt. E. Compton.....Carthage, Ill. 236 |
| WPDQ H. L. Turner.....Buffalo, N. Y. 205 | WTAG Telegram Pub. Co.....Worcester, Mass. 545 |
| WPG The Municipality of Atlantic City.....Atlantic City, N. J. 300 | WTAL Toledo Radio & Electric Co.....Toledo, Ohio 252 |
| WPRC Wilson Printing & Radio Co.....Harrisburg, Pa. 216 | WTAM Williard Storage Battery Co.....Cleveland, Ohio 389 |
| WPSC Pennsylvania State College.....State College, Pa. 261 | WTAP Cambridge Radio & Electric Co.....Cambridge, Ill. 242 |
| WQAA Horace A. Beale, Jr.....Parkersburg, Pa. 220 | WTAQ C. S. Van Gordon.....Eau Claire, Wis. 254 |
| WQAC Gish Radio Service.....Amarillo, Tex. 234 | WTAR Reliance Electric Co.....Norfolk, Va. 261 |
| WQAE Moore Radio News Station.....Springfield, Vt. 246 | WTAW Agricultural & Mech. Col. of Texas College Sta., Texas 270 |
| WQAM Electrical Equipment Co.....Miami, Fla. 263 | WTAX Williams Hardware Co.....Streator, Ill. 231 |
| WQAN Scranton Times.....Scranton, Pa. 250 | |

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(9-26)

Use the
Log-a-Wave
Chart
on Page 56

Radio Beacons to Guide Planes Across Continent

(Continued from page 15)

along a safe course as long as the two signals were heard with equal intensity.

Equi-Signal Method

MORE recently this equi-signal system has been modified and the new method of guiding airplanes put into practice by the Air Service and the United States Post Office Department. The former maintains a radio beacon tower at Wilbur Wright Field, Dayton, Ohio. The Engineering Division of the Air Service describes the new radio beacon, which will be used in guiding mail-carrying airplanes and commercial craft, as follows:

"The former system by which this was accomplished was known as the equi-signal system. The present system, which has been in experimental use for something more than a year, is an outgrowth of the old equi-signal system and is known as the interlocking signal system. That is, the pilot trying to keep his course in the direction of the transmitting beacon hears certain signals. To the right and left of the course, these signals have somewhat the character of the Continental 'N' — and 'A'. —, respectively. On the course, where these two interlocking signals are of the same intensity, a third signal is formed, such as the letter 'T' —, which is a continuous and unbroken sound. Hearing this constant sound, the pilot knows he is on his course. If the sound becomes broken into either of the two signals before mentioned, he knows he is to the right or the left of the course and must try for correction by resetting the nose of his plane until he hears the constant signal once more. One difficulty with the system has been that the flyer has had to depend entirely upon his hearing, involving considerable concentration and possibility of personal error. To correct this difficulty a visual indicator has been devised.

Visual Indicator

THIS consists mainly of three small lights, mounted

on the instrument board and connected with the receiving set, which flash constantly. The unbroken signal obtained by the interlocking of the two separate signals at a point of equal intensity causes a relay to operate a telephone selector which in turn causes a white light to flash. While the white light is flashing, the pilot knows he is on his course. To either side of the course, the component signals operate relays which in turn cause the selector to close the circuit, lighting a green or red light to the right or the left of the course, respectively. For economy of space, these light bulbs are of small, Christmas tree size."

When perfected by the Bureau of Standards, the radio beacon is bound to be of inestimable value.

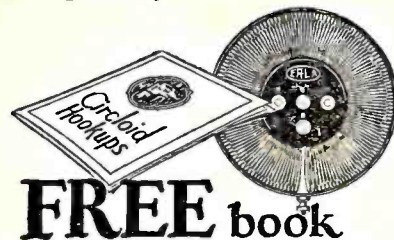
Only Two-Fisted Radiomen Wanted

ONLY "two-fisted" radio-men are desired by the Army and Naval radio service. This is because, when in transmitting, the operator's right hand is busy on the key and the use of his left hand for numbering and timing radiograms, as fast as they are sent, is desirable.

It is also necessary for modern radio operators to be able to typewrite, since several clear copies of the messages received are desired, and hand written messages have to be typed.

Commenting on time-saving methods in the service, an old timer in the Signal Corps says that, just as in modern telegraph offices, a radio operator must be able to tick off a message with one hand and mark off the number and time sent with the other. Radio operators as well as telegraphers who cannot thus become ambidextrous find themselves hopelessly behind time, if not lost entirely when handling a large number of messages.

An operator may have a "lightning fist" and a keen ear, he puts it, meaning that the man can send and receive with good speed, but he is still in the "lid" class, unless he has learned to use both hands.



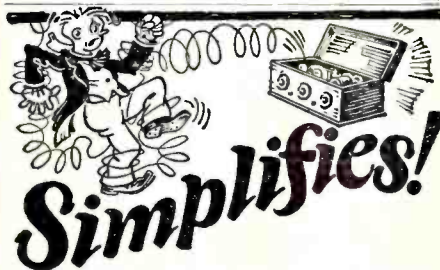
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|----------------------------------|-------------------------|----------------------------------|--------------------------|
| WTAZ Thomas J. McGuire..... | Lambertville, N. J. 261 | WWGL Radio Engineering Corp..... | Richmond Hill, N. Y. 213 |
| WTIC Travelers Insurance Co..... | Hartford, Conn. 476 | WWJ Detroit News..... | Detroit, Mich. 353 |
| WWAE Electric Park..... | Plainfield, Ill. 242 | WWL Loyola University..... | New Orleans, La. 275 |

Dominion of Canada

| | | | |
|---|------------------------|---|----------------------|
| CFAC Calgary Herald..... | Calgary, Alta. 434 | CJCL A. Couture..... | Montreal, Que. 279 |
| CFCA Toronto Star Pub. & Prtg. Co..... | Toronto, Ont. 356 | CJGC London Free Press..... | London, Ont. 329 |
| CFCF Marconi Wireless Teleg Co., (Ltd.) Can. Montreal, Que. | 411 | CKAC La Presse..... | Montreal, Que. 411 |
| CFCH Abitibi Power & Paper Co. (Ltd.)..Iroquois Falls, Ont. | 500 | CKCD Vancouver Daily Province..... | Vancouver, B. C. 397 |
| CFCK Radio Supply Co..... | Edmonton, Alta. 517 | CKCK Leader Pub. Co..... | Regina, Sask. 476 |
| CFCN W. W. Grant (Ltd.)..... | Calgary, Alta. 434 | CKCL Dominion Battery Co..... | Toronto. 357 |
| CFCR Laurentide Air Service..... | Sudbury, Ont. 410 | CKCO Ottawa Radio Association..... | Ottawa, Ont. 434 |
| CFCT Victoria City Temple..... | Victoria, B. C. 329 | CKCX P. Burns & Co. (Ltd.)..... | Calgary, Alta. 434 |
| CFCU The Jack Elliott (Ltd.)..... | Hamilton, Ont. 341 | CKFC First Congregational Church..... | Vancouver, B. C. 411 |
| CFHC Henry Birks & Sons..... | Calgary, Alta. 434 | CKLC Wilkinson Electric Co. (Ltd.)..... | Calgary, Alta. 434 |
| CFKC Thorold Radio Supply..... | Thorold, Ont. 248 | CKNC Canadian National Carbon Co..... | Toronto, Ont. 357 |
| CFQC The Electric Shop (Ltd.)..... | Saskatoon, Sask. 329 | CKOC Wentworth Radio Supply Co..... | Hamilton, Ont. 341 |
| CFRC Queens University..... | Kingston, Ont. 450 | CKY Manitoba Tel. System..... | Winnipeg, Man. 384 |
| CFXC Westminster Trust Co..... | Westminster, B. C. 291 | CNRA Canadian National Railways..... | Moncton, N. B. 312 |
| CFYC Commercial Radio (Ltd.)..... | Vancouver, B. C. 411 | CNRC Canadian National Railways..... | Calgary, Alta. 436 |
| CHBC The Calgary Albertan..... | Calgary, Alta. 434 | CNRE Canadian National Railways..... | Edmonton, Alta. 517 |
| CHCM Riley & McCormack (Ltd.)..... | Calgary, Alta. 434 | CNRM Canadian National Railways..... | Montreal, Que. 411 |
| CHCS The Hamilton Spectator..... | Hamilton, Ont. 341 | CNRO Canadian National Railways..... | Ottawa, Ont. 435 |
| CHIC Northern Electric Co..... | Toronto, Ont. 357 | CNRR Canadian National Railways..... | Regina, Sask. 476 |
| CHNC Toronto Radio Research Society..... | Toronto, Ont. 357 | CNRS Canadian National Railways..... | Saskatoon, Sask. 329 |
| CHUC International Bible Ass'n..... | Saskatoon, Sask. 329 | CNRT Canadian National Railways..... | Toronto, Ont. 357 |
| CHXC R. Booth, Jr..... | Ottawa, Ont. 434 | CNRV Canadian National Railways..... | Vancouver, B. C. 291 |
| CHYC Northern Electric Co..... | Montreal, Que. 411 | CNRW Canadian National Railways..... | Winnipeg, Man. 384 |
| CJCA Edmonton Journal..... | Edmonton, Alta. 511 | | |

Republic of Mexico

| | | | | | |
|----------------------|-----|----------------------|-----|----------------------|-----|
| CYB Mexico City..... | 380 | CYL Mexico City..... | 400 | CZE Mexico City..... | 350 |
|----------------------|-----|----------------------|-----|----------------------|-----|

Republic of Cuba

| | | | | | |
|-----------------------------|------------|-------------------------|----------------|----------------------|----------------------|
| PWX Cuban Telephone Co..... | Havana 400 | 2OL Oscar Collado..... | Havana 257 | 6KW F. H. Jones..... | Tuinucu 272 |
| 2BY F. W. Borton..... | Havana 260 | 5DW R. S. Calderon..... | Matanzas 200 | 7SR S. Rionda..... | Central Elia 350 |
| 2OK M. G. Velez..... | Havana 360 | 6VY Jose Ganduxe..... | Cienfuegos 260 | 8BY A. Ravelo..... | Santiago de Cuba 250 |
| | | 6JK F. H. Jones..... | Tuinucu 340 | | |

Great Britain

| | | | | | |
|---------------------|-----|----------------------|------|--------------------|-----|
| 2LO London..... | 365 | 5XX Daventry..... | 1600 | 5NO Newcastle..... | 404 |
| 5IT Birmingham..... | 479 | 2RN Dublin..... | 390 | 5SC Glasgow..... | 422 |
| 5WA Cardiff..... | 353 | 6BM Bournemouth..... | 386 | 2BD Aberdeen..... | 495 |
| 2BE Belfast..... | 440 | 2ZY Manchester..... | 378 | | |

France

| | | | |
|------------------------------|-------|----------------|-------|
| YN Lyons..... | 550 | 8AJ Paris..... | 1,780 |
| FL Paris (Eiffel Tower)..... | 2,650 | ESP Paris..... | 458 |

Short Wave Phone Broadcasting

| | | KC | Meters |
|------|---------------------|------|--------|
| 2XK | Schenectady, N. Y.* | 4600 | 65.16 |
| KDKA | Pittsburgh, Pa.* | 4760 | 63.00 |
| KDKA | Pittsburgh, Pa.* | 5100 | 58.79 |
| 2XAF | Schenectady, N. Y.* | 9143 | 32.79 |

*Crystal Control

Press Building is Radio Equipped

THE National Press Building at Washington will probably be better equipped for radio reception and also for transmission than any building in the world.

A special committee on radio is working out a plan which will combine the latest and most practical radio applications on the market. This may include interior wiring so that any office may plug in a pair of phones and listen in to major broadcast events. It is believed that the use of loud-speakers would be objectionable. This idea is not solely to provide radio entertainment but is based upon the fact that radio will be utilized more and more to cover news events in the Nation's Capital, where practically everything of importance is broadcast. Thus it is seen that a busy correspondent might stay at his desk in his office and yet cover a speech which his paper desired reported, simply by listening in. Radio reporting in this manner has already been practiced on several occasions.

Facilities in the Press Club quarters on the top two floors will include the installation of three or four broadcast receivers, connected through a central switch board so they can be operated independently and plugged in so as to serve any of the several rooms. At a dance loud speakers in the dining room and the auditorium might be run from two sets tuned to a single station or two loudspeakers could be operated from one powerful receiver. In the meantime, if members in a private dining room want a different program, the operator at the board can tune in a station on a third set and plug it in for them. These sets will not be operated by members but monitored by experts.

In the auditorium it is expected to have installed the necessary wires and microphones, for connecting with local broadcast stations so that entertainments may be broadcast from the club quarters at almost a moment's notice.

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What do you want to purchase in the radio line? Let RADIO AGE save you time and money by sending in the coupon below. Enter the number of the article you would like to know more about in the spaces provided in the coupon:

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|----------------------------|----------------------------|
| 1 "A" Batteries, all kinds | 45 Jacks |
| 2 Aerials | 46 Jars, battery |
| (a) Loop | 47 Keys, transmitting |
| (b) Outdoor | 48 Knobs |
| 3 Ammeters | 49 Laboratories, testing |
| 4 Amplifiers | 50 Lightning arresters |
| 5 "B" batteries, all kinds | 51 Loud speakers |
| 6 Batteries (A and B) | 52 Lugs, battery |
| (a) Dry | 53 Meters, all types |
| (b) Wet | 54 Mica |
| 7 Battery chargers | 55 Mountings |
| 8 Battery substitutes | 56 Nuts |
| (a) "A" battery | 57 Panels |
| (b) "B" battery | 58 Paste, soldering |
| 9 Battery supplies | 59 Patent attorneys |
| 10 Bezels | 60 Phone connectors |
| 11 Binding posts | 61 Phonograph adapters |
| 12 Books on radio | 62 Plugs |
| 13 Broadcasting equipment | 63 Pointers |
| 14 Buzzers | 64 Potentiometers |
| 15 "C" batteries | 65 Rectifiers |
| 16 Cabinets | 66 Resistances, fixed |
| 17 Code practice sets | 67 Rheostats |
| 18 Coils, all forms | 68 Scrapers, wire |
| 19 Condensers, fixed | 69 Screw drivers |
| 20 Condensers, variable | 70 Screws |
| 21 Contact points | 71 Schools, radio |
| 22 Cords, headset, etc. | 72 Sets, transmitting |
| 23 Couplers, vario, etc. | 73 Sets, receiving |
| 24 Crystals | (a) Factory Built (b) kits |
| 25 Desks | 1 Crystal |
| 26 Detector (crystals) | 2 Radio Frequency |
| 27 Detector tubes | 3 Reflex |
| 28 Detector units | 4 Regenerative |
| 29 Dials | 5 Super-heterodyne |
| 30 Dies | 74 Shellac |
| 31 Drills | 75 Sockets |
| 32 Electrolyte | 76 Solder |
| 33 Fibre | 77 Supports, aerial |
| 34 Filters | 78 Switches |
| 35 Fuses, tube | 79 Transformers, a. f. |
| 36 Grid leaks | 80 Transformers, r. f. |
| 37 Ground clamps | 81 Transformers, sending |
| 38 Head phones | 82 Tubes, all types |
| 39 Horns, all types | 83 Variometers |
| 40 Hydrometers | 84 Wave meters |
| 41 Inductances | 85 Wave traps |
| 42 Insulation | 86 Wire, all kinds |
| 43 Insulators, all types | |
| 44 Irons, soldering | |

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I am a— Dealer Jobber Mfgs.' Rep. Manufacturer

Firm (If identified with Radio industry).....

My Occupation

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Address

City State

| KC | Meters | STATIONS | DIALS | | |
|------|--------|----------|-------|---|---|
| | | | 1 | 2 | 3 |
| 1480 | 202.6 | | | | |
| 1470 | 204.0 | | | | |
| 1460 | 205.4 | | | | |
| 1450 | 206.8 | | | | |
| 1440 | 208.2 | | | | |
| 1430 | 209.7 | | | | |
| 1420 | 211.1 | | | | |
| 1410 | 212.6 | | | | |
| 1400 | 214.2 | | | | |
| 1390 | 215.7 | | | | |
| 1380 | 217.3 | | | | |
| 1370 | 218.8 | | | | |
| 1360 | 220.4 | | | | |
| 1350 | 222.1 | | | | |
| 1340 | 223.7 | | | | |
| 1330 | 225.4 | | | | |
| 1320 | 227.1 | | | | |
| 1310 | 228.9 | | | | |
| 1300 | 230.6 | | | | |
| 1290 | 232.4 | | | | |
| 1280 | 234.2 | | | | |
| 1270 | 236.1 | | | | |
| 1260 | 238.0 | | | | |
| 1250 | 239.9 | | | | |
| 1240 | 241.8 | | | | |
| 1230 | 243.8 | | | | |
| 1220 | 245.8 | | | | |
| 1210 | 247.8 | | | | |
| 1200 | 249.9 | | | | |
| 1190 | 252.0 | | | | |
| 1180 | 254.1 | | | | |
| 1170 | 256.3 | | | | |
| 1160 | 258.5 | | | | |
| 1150 | 260.7 | | | | |
| 1140 | 263.0 | | | | |
| 1130 | 265.3 | | | | |
| 1120 | 267.7 | | | | |
| 1110 | 270.1 | | | | |
| 1100 | 272.6 | | | | |
| 1090 | 275.1 | | | | |
| 1080 | 277.6 | | | | |
| 1070 | 280.2 | | | | |
| 1060 | 282.8 | | | | |
| 1050 | 285.5 | | | | |
| 1040 | 288.3 | | | | |
| 1030 | 291.1 | | | | |
| 1020 | 293.9 | | | | |

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| KC | Meters | STATIONS | DIALS | | |
|------|--------|----------|-------|---|---|
| | | | 1 | 2 | 3 |
| 1010 | 296.9 | | | | |
| 1000 | 299.8 | | | | |
| 990 | 302.8 | | | | |
| 980 | 305.9 | | | | |
| 970 | 309.1 | | | | |
| 960 | 312.3 | | | | |
| 950 | 315.6 | | | | |
| 940 | 319.0 | | | | |
| 930 | 322.4 | | | | |
| 920 | 325.9 | | | | |
| 910 | 329.5 | | | | |
| 900 | 333.1 | | | | |
| 890 | 336.9 | | | | |
| 880 | 340.7 | | | | |
| 870 | 344.6 | | | | |
| 860 | 348.6 | | | | |
| 850 | 352.7 | | | | |
| 840 | 356.9 | | | | |
| 830 | 361.2 | | | | |
| 820 | 365.6 | | | | |
| 810 | 370.2 | | | | |
| 800 | 374.8 | | | | |
| 790 | 379.5 | | | | |
| 780 | 384.4 | | | | |
| 770 | 389.4 | | | | |
| 760 | 394.5 | | | | |
| 750 | 399.8 | | | | |
| 740 | 405.2 | | | | |
| 730 | 410.7 | | | | |
| 720 | 416.4 | | | | |
| 710 | 422.3 | | | | |
| 700 | 428.3 | | | | |
| 690 | 434.5 | | | | |
| 680 | 440.9 | | | | |
| 670 | 447.5 | | | | |
| 660 | 454.3 | | | | |
| 650 | 461.3 | | | | |
| 640 | 468.5 | | | | |
| 630 | 475.9 | | | | |
| 620 | 483.6 | | | | |
| 610 | 491.5 | | | | |
| 600 | 499.7 | | | | |
| 590 | 508.2 | | | | |
| 580 | 516.9 | | | | |
| 570 | 526.0 | | | | |
| 560 | 535.4 | | | | |
| 550 | 545.1 | | | | |

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The classified advertising rates are but five cents per word for a single insertion. Liberal discounts are allowed on three, six and twelve-time insertions, making rate of 4 1-2, 4 and 3 cents a word per insertion respectively. Unless placed through an accredited advertising agency, cash should accompany all orders. Name and address must be included at foregoing rates. Minimum contract charge \$1.00.

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