RADIO'S FOREMOST MAGAZINE

RADIO NEWS and The SHORT-WAVE

25¢

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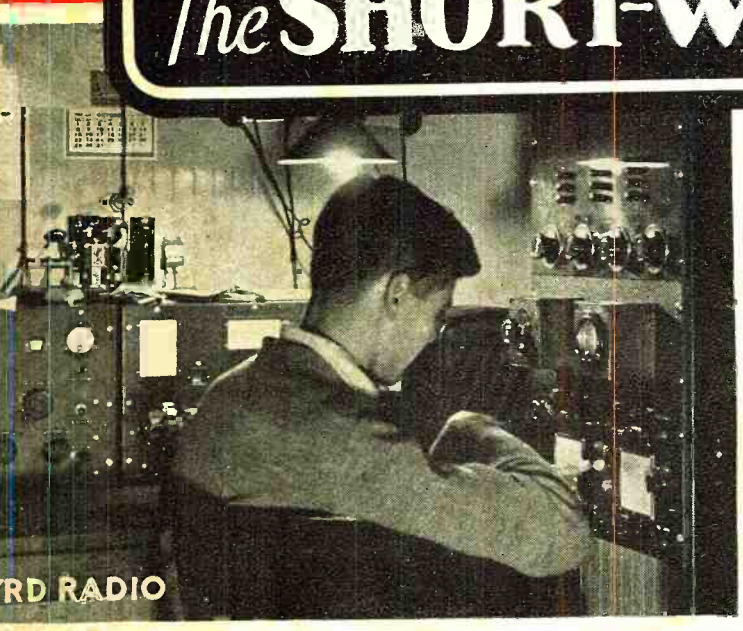

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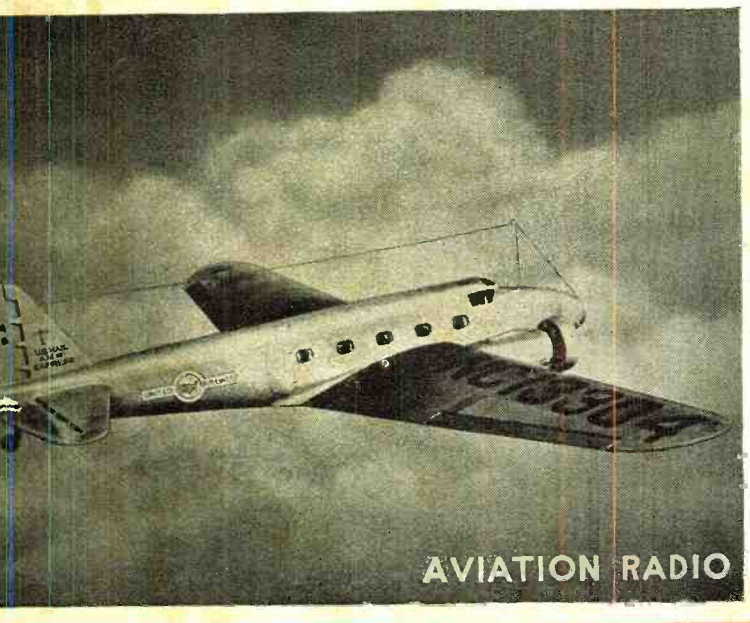


AVIATION RADIO

SHORT WAVES

IMPORTANT SERVICE DATA

A Publication Devoted to Progress and Development in Radio

Service Work
Engineering
Industrial Application
Experimental Research

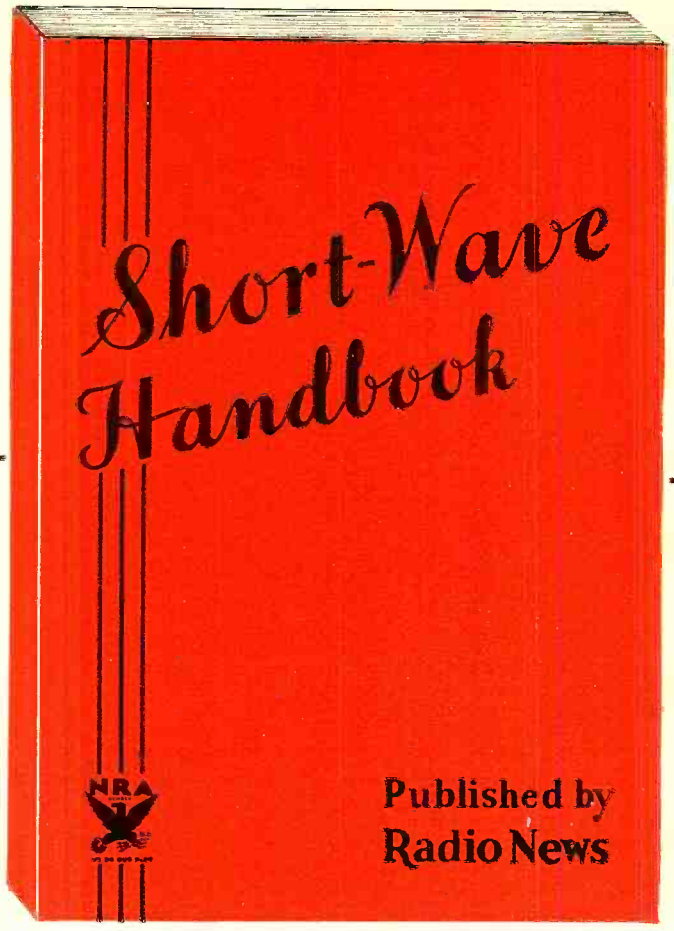
Short Waves
Broadcasting
Television
Electronics

DX Reception
Set Building
Amateur Activity
Electrical Measurements

In Tune With Our Times

During the year 1934 short-wave radio is going to receive more and more attention. The ever-increasing public demand will force the radio industry to produce many all-wave and short-wave receivers. Therefore, RADIO NEWS, anticipating the trend, has published the *Short-Wave Handbook*. Here, in one compact, easy-reference volume, is presented all the necessary information, data and discussions that every radio man will need in dealing with short-wave radio.

Now is the time for every radio serviceman, dealer, experimenter and student to familiarize himself with the fundamentals of short waves. Use RADIO NEWS and the *Short-Wave Handbook* as your guides. You'll find them packed full of helpful information that means actual dollars and cents in your pocket. Prepare now for the all-wave radio field!



This Book Given Free!

You can get a copy of the *Short-Wave Handbook* absolutely free by subscribing for 11 issues of RADIO NEWS at the bargain price of $2. And, renewal subscriptions will be accepted! Act now! Mail the coupon with your remittance *at once!*

Partial Contents

Fundamental Principles

The *Short-Wave Handbook* begins with a discussion of the principles underlying short-wave communication — explaining the various theories, atmospheric effects, and peculiarities.

Helpful Short-Wave Data

Foreign announcements are explained—a time chart is included—a brief discussion on receivers follows—and hints on tuning are given.

Short-Wave Receivers

Having explained the fundamentals, the *Short-Wave Handbook* follows with full instructions, diagrams and circuits for building five simple short-wave receivers ranging from two to four tubes and two more-complicated receivers of five and six tubes.

Popular Commercial Apparatus

For the man who wants to buy his receiver ready-made, brief descriptions and circuit diagrams of popular commercially-built short-wave apparatus are printed.

Short-Wave Accessories

Various short-wave antenna systems and noise-control circuits are described—with constructional details where necessary.

Short-Wave Station Lists

The *Short-Wave Handbook* contains an up-to-date list of the world commercial short-wave stations from 5 to 80 meters.

Best Bets For DX

Chapter 8 contains a list of the short-wave stations now being received daily in the United States and reception reports by short-wave listeners.

Learning The Code

The complete International Morse Code is shown in Chapter 9 and simple instructions are given for learning it. Details for building various code practice sets are included.

Amateur Transmitters

Building instructions for several good amateur transmitters and valuable hints on R. F. amplifiers are presented in Chapter 10.

Ultra-Short Waves

For the ultra-short-wave fan, constructional data for 5 and 10 meter transmitters and receivers appear in Chapter 11. Simple methods for accurate 5 meter measurements are included.

RADIO NEWS, Dept. 341
222 W. 39th St., New York, N. Y.

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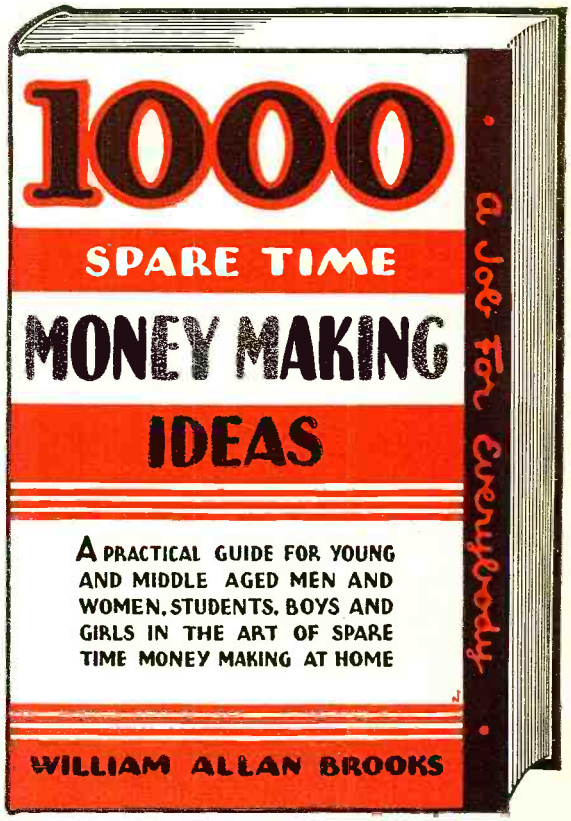

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( ) Amateur's Handibook @ 25c
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WORLD'S GREATEST RADIO VALUE

$49.50 with New Deluxe Auditorium Type SPEAKER

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Try this Midwest radio... in your own home... for thirty days before you decide. See for yourself the 40 new 1934 features that insure amazing performance. Other features include: Automatic Select-O-Band, Amplified Automatic Volume Control, 16 New Type Tubes, Balanced Unit Superheterodyne Circuit, Velvety Action Tuning, Super-Power Class "A" Amplifier, 29 Tuned Circuits, New Duplex-Diode-High Mu Pentode Tubes, No-Image Heterodynes, Full Rubber Floated Chassis, Variable Tone Blender, Centralized Tuning, 7 KC Selectivity, New Thermionic Rectifier, Automatic Tone Compensation, Auditorium Type Speaker, etc. These features are usually found only in sets selling from $100 to $150.

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AKRON, OHIO—My Midwest-16 is a real go-getter for distance. Received 205 stations on regular wave band... including U. S., Canadian, Mexican, Cuban and Hawaiian stations. Also many police, airport and "ham" stations from all over the country. Have logged England, France, Germany, Madrid, Rome, on 15-30 meter band. South American stations include Venezuela, Colombia, Brazil, Yucatan.—L. H. MOELLER, 793 N. South St.

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McMurdo Silver's

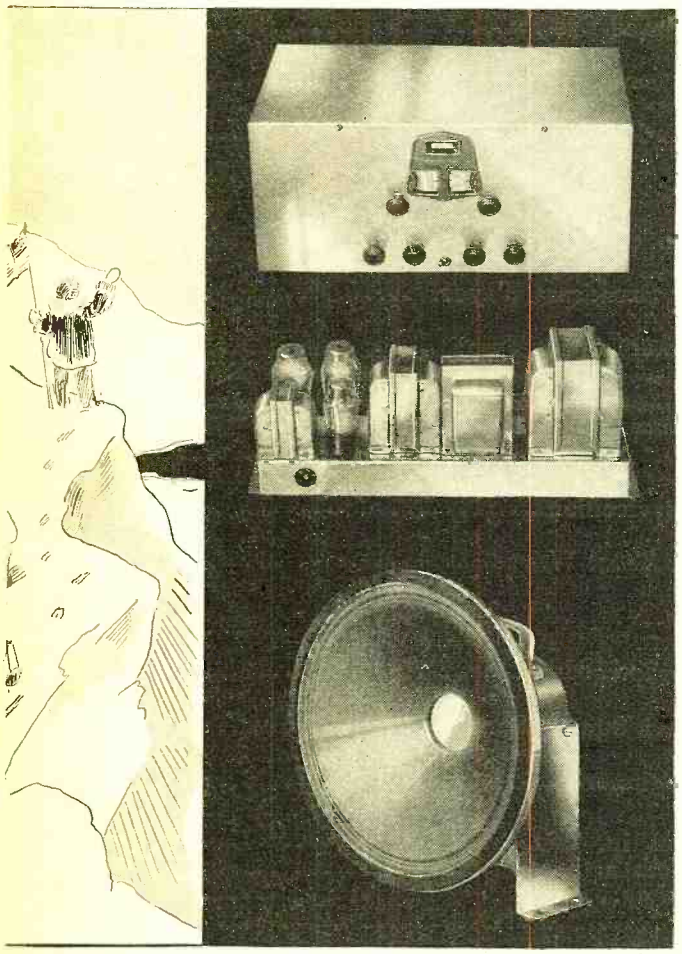
MASTERPIECE, II

Now in the Antarctic with Byrd

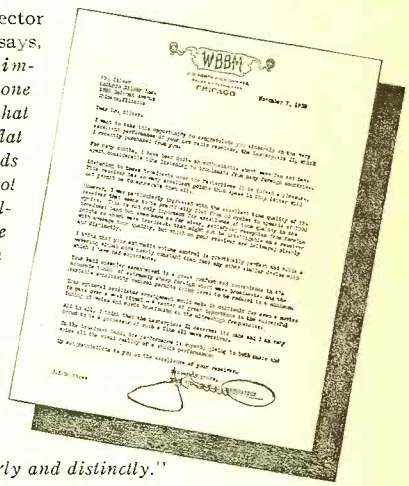
because two great eastern universities acclaimed it the most efficient all-wave receiver.

Now the preference of Broadcast Executives

and technicians because, by their tests, it shows greater sensitivity and more perfect fidelity of tone on broadcast as well as foreign short wave reception.



Not only has my Masterpiece II been accorded the distinction and honor of serving Admiral Byrd in the Antarctic, but . . . it is also the preferred choice of Broadcast Executives and Technicians.



J. Kelley Smith, director of radio station WBBM says, *"I was particularly impressed with the excellent tone quality of the receiver that seems to be practically flat from 30 cycles to upwards of 5000 cycles. This is not only important for excellence of tone quality in the broadcast band but even more so for clear, satisfying reception from foreign points on short wave broadcasts that might not be intelligible on a receiver with average tone quality, but which on your receiver are delivered clearly and distinctly."*

And R. B. Stephenson, Western Sales Manager of WBBM, KMOX, WCCO, WJSU, WKRC, WBT and WPG says, *"As you know, I have been very enthusiastic about my present receiver, a very well known, custom-built, all-wave set. But, I must admit that in this comparative demonstration, you have entirely changed my mind. A surprising discovery also was the superb tone quality of your receiver. To my surprise, your receiver has much better definition, and a pure, liquid naturalness that makes all other receivers sound "boom-y" in comparison."*

So, why should you accept less dependability in world-wide reception than Admiral Byrd *demands?* Why should you be content with less tone quality than such competent authorities as J. Kelley Smith and R. B. Stephenson consider necessary?

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Wave length Range 10 to 570 meters or 520 to 30,000 kc. Four position wave change switch. (External unit extends range from 700 to 2000 meters.)

Tuned R.F. stage on both Broadcast and entire Short Wave range yet single dial tunes the receiver. Greatly improves signal-noise ratio on 12,000 mile reception.

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Send for a Masterpiece II. Try it 10 full days. If for any reason you want to return it, you can have your money back instantly, without argument. It's just as simple as that. But, first send the coupon for the full detailed story of this great receiver designed especially for Admiral Byrd . . . and for you who are entitled to just as much.

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Vol. XI
No. 7

RADIO NEWS

January, 1934

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THIS MONTH—

Future Trends

Electronics

Aviation Radio

Short Waves

Servicing

New Sets

Departments

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. . . . American Engineers Lead the World in the Technical Refinements of Radio . . . .

Lee de Forest

Dr. Lee de Forest, eminent radio inventor of the Audion, has just returned from a European trip of investigation of radio development and television progress. He also has been studying the various European methods under which broadcasting is being developed in various countries.

A NEW DEAL for SERVICEMEN

THE importance of the radio serviceman as a direct contact between the manufacturer and the consumer is rapidly becoming recognized by the radio industry. This is as true from the sales standpoint as it is from a service angle, as individual servicemen are the local experts in radio for their localities. They are technically trained men and they *know* radio and often combine the fields of sales and service in a manner so successful it is not equalled by any other agency. They not only sell radio merchandise, but they sell the *right* radio merchandise and they keep it sold by keeping it working properly. The radio listener has learned that he can trust the advice of the technically trained service-sales worker—a trust fully justified by experience.

RADIO NEWS has always been the leading magazine dealing with service work and service problems. It has consistently pointed the way for the serviceman to follow, to run his business on an economical and proficient plane. It has instructed him in the use of the proper tools and methods for conducting his business. It has done much to gain for servicemen their present recognition in the trade. All of these things, and more, it promises to do in the future. Listed below are some of the problems encountered in service work. In order to help RADIO NEWS help you as a serviceman, we are asking you to write us telling how *you* are solving, successfully, any of these problems. *You*, Mr. Serviceman, probably have other problems in service work that you have encountered and that you have *"licked."* Be sure that you write and tell us about your methods. It will swell the already great mass of facts we have collected and are now collecting in order to present a new and united fight on your behalf.

1. How do you go about increasing your clientele economically and successfully?

2. How do you establish contact with the manufacturer?

3. How do you learn the technical characteristics of any piece of radio merchandise so that you may pass this information along to your clients?

4. Do you belong to a radio service organization? And if so, what benefits do you receive from them?

5. Do you use a standard rate for doing service jobs of various kinds and how do you figure such rates?

6. What follow-up system do you use with your customers?

7. How do you proceed to obtain trade discounts from manufacturers or jobbers of radio merchandise?

8. How do you go about making sales of radio receivers in cities?

9. What type of radio receivers can you sell in rural districts where there are no power lines?

10. What testing apparatus do you find essential for conducting your business?

11. How much replacement stock do you find it necessary to carry?

12. What side lines do you push to augment your business?

13. What is the best advertising medium for the serviceman?

Write to RADIO NEWS, care of the Service Editor, and tell him your individual solutions to these problems. It will help us to help you!

Radio News

January, 1934

RURAL RADIO

The Editor—To You

Here is a new field for radio expansion. If you have a friend who is a radio serviceman or dealer be sure to tell him to read this page in RADIO NEWS. It will be like putting money in his pants' pockets

TEN million radio receivers wanted! That is the number of receivers that are needed in a like number of homes in the United States which are *unwired* and which *must depend on battery-powered equipment* if they are to enjoy radio at all. These are figures furnished by the United States Department of Commerce, based on the latest census and indicating the extensive market now awaiting a successful self-powered radio development. Most of these unwired homes are in rural districts in which the power companies have not felt the erection of power lines could be made to pay for themselves. Hundreds of thousands of farm homes are included in this category.

The old-style battery sets have been tried by a relatively small number of these potential radio listeners, but no success, in a large way, has accompanied these trials. The ordinary dry-cell "A" battery sets become a nuisance and the storage-battery-powered receivers are out of the question because of the "charging" difficulty in out-of-the-way places.

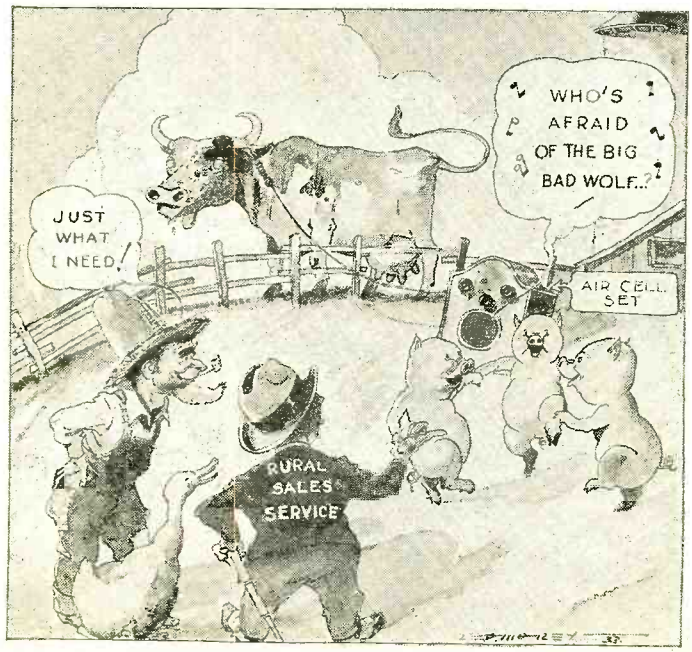
A new development perfected in actual usage during the last year or so, is now sweeping the rural districts like wildfire. It is the Air Cell Receiver utilizing a battery (for furnishing filament power to the tubes) that will last a whole year without charging or other care—a battery that draws its activating chemical element from the air. In the opinion of experts, this is the solution to the successful use of radio in the unwired home—the Air Cell Receiver.

The leading manufacturers are producing these new sets with as many as 6, 7, 8 and 9 tubes, employing the latest developments in circuits and giving operation that cannot only be relied upon but that is setting a new standard for radio reception. In fact, some experts are of the opinion that the Air Cell Receiver gives even better reception than a line-operated receiver. They base this claim on the fact that there cannot be any possibility of hum or power-line interference (man-made static) in the reception of this type of set, as there are no power lines to pick up such interference.

Here is a wonderful chance for the rural serviceman and dealer to increase his clientele and to serve these potential customers by introducing to them this new receiver. Go out into the unwired districts and bring a set with you in your car. Demonstrate it in the rural homes and you will have made a sale. The farmer needs radio for market reports, emergency farm news, etc., now being broadcast every day and forming so vital a part in the successful management of any farm. With the new Air Cell Receiver development, a radio set on the farm is no longer a luxury but a piece of business equipment that every progressive farmer must have. It is now placed in the category of the tractor, the milking machine and any other labor-saving tool. Demonstrate such a set and you make a sale!

So get busy immediately, you servicemen, and demonstrate these sets in rural districts and do your bit for the rural home owner. You can be the first in the field. Give him the chance he really deserves for cashing in on radio broadcasting. The production of these new Air Cell Sets is being stepped up continuously and ambitious merchandising plans are now in formation. Industrial leaders are organizing distribution channels in order to handle the great volume of this new business, giving new life to the radio industry. Radio dealers and servicemen—if you do not know where these sets can be procured, write immediately to the Editor and we will put you in touch with the proper agencies.

A NEW CUSTOMER IN EVERY FARMYARD



WHAT CAN WE EXPECT FROM RADIO IN 1934?

What will the coming year offer in radio development? Will higher prices inspire new researches to improve radio equipment? What about television? Will radio listening include international broadcasts?

POWEL CROSLEY, JR.

H. B. RICHMOND

ERNEST AMY

R. H. MANSON

PROGRESS in radio development will accelerate during 1934 and the radio industry will feel a marked recovery from the industrial depression. One of the important trends will be the greater use of all-wave high quality receivers. More faithful reproduction over the entire sonic frequency range will be obtained with twin or multiple speaker sets. Further conquest of man-made static will be made, especially insofar as the all-wave sets are concerned. **Ernest V. Amy,** President, Amy, Aceves & King, Inc.

PRESIDENT ROOSEVELT'S masterly use of the radio should indicate to teachers and educators all over the country how this modern means of communication can be employed most effectively. Broadcasting is intimate and informal. Programs go right into the home and reach the heart of the family gathered around the fireside. No one would deliberately walk into such a circle and deliver an oration on any subject, no matter how important. So those most concerned in following up the possibilities of radio as an instrumentality in education have come to realize that the traditional class-room lecture methods are ineffective over the radio. The trend is definitely in the direction of organizing "educational" programs, thoroughly sound as to content, yet informal, conversational and, above all, interesting and not oratorical. **Levering Tyson,** Director, National Advisory Council on Radio in Education.

NO radical change in trans-oceanic radio communication is anticipated during the coming year. Over shorter distances, the ultra-short waves extending down to the centimeter waves will doubtless find increasing use.

Airplane radio will assume increasing importance, and in particular in relation to methods for the radio guiding of airplanes in flight with special reference to safety of life in the air.

In the broadcasting field, direct short-wave long-distance reception of international programs will be possible with equipment which is being made available to the public.

Television research proceeds apace, but no specific date can yet be set for the commercial introduction of this new art on a wide scale. **Dr. Alfred N. Goldsmith.**

MARKED improvement in tone quality, appearance and, from the standpoint of the manufacturer and the trade, higher price are three very definite mile stones of radio progress for the year 1934. The all-season popularity of automotive radio and a pronounced increase in console sales are other fundamental improvements in the radio industrial picture which began early last summer and are continuing with increased momentum. **Bond Geddes,** Executive Vice President, Radio Manufacturers Association.

Broadcasting in 1934

STILL further extension of the use of radio by national leaders, so strikingly evidenced by the direct personal addresses to the nation such as are being made so successfully by President Roosevelt, undoubtedly will be one of the major trends of broadcasting in the future. Other advances will be continued improvement in transmission technique, sustained progress in the planning of better programs, and greater attention to international broadcasting, which has been given a strong impetus by the development of a transoceanic program transmission service available to networks and stations in the United States. **David Sarnoff,** President, Radio Corporation of America.

IT is my belief that there will be two definite future trends in radio. The first will be the establishment of definite standards for the broadcasting industry to apply jointly to the broadcasting end and to receiving set manufacturers with the purpose of solving respective problems with ultimate results, rather than working separately. The second trend will be the greater attention and increased use of directional antennas so that maximum signal results may be obtained without interfering with other stations. **Edwin K. Cohan,** Technical Director, Columbia Broadcasting System.

I BELIEVE that the 1934 trend of radio broadcasting will be in the direction of a further development of harmonious balance—balance both in individual programs and in the broadcasting schedule as a whole. Radio has incorporated practically all the branches of the entertainment world into its fold; it has brought the stars of Broadway and the concert field alike to the microphone; it has developed numerous stars of its own; it has made the scientific, religious, cultural, and educational fields its province; and it has given them all an international means of dissemination. **William S. Paley,** President, Columbia Broadcasting System.

TO my mind, the future trends in the development of radiocasting will proceed with cumulative vigor and success in 1934 along three lines:—the first technical, the second psychological and the third educational. While the public expects more and gets more from each new receiving set, it is no secret that in the research departments of the manufacturer and the broadcaster we are only beginning a stage of development which may encompass television and certainly will include a wider cycle of reception and audibility. Entertainment is the first function of radio and always will be, whether presented through a majestic polyphonic ensemble or through a lone artist whose talent grips millions by a single word. **Ed Wynn,** Famous Radio Entertainer.

Short-Wave Development Hailed

THE development of short-wave transmission and reception has progressed to the point where in 1934 it will be a

H. A. HUTCHINS

ROY DAVEY

LEVERING TYSON

H. W. HOUCK

C. J. PANNIL

E. A. NICHOLAS

EXPERTS PREDICT THESE DEVELOPMENTS IN 1934

The authoritative survey presented herewith gives the reader the viewpoints of leading American experts on the progress in the various radio fields of future development. Read these statements!

V. K. ZWORYKIN

BOND GEDDES

DAVID SARNOFF

WM. S. PALEY

matter of refinements. By this I mean more highly concentrated directional transmissions, improvements in receiving antenna and equipment to overcome some of the inherent characteristics of short-wave transmissions, such as selective sideband fading, general fading, etc. A great deal has been done by the use of diversity antenna but improvements may be expected all along the line. **C. W. Horn**, General Engineer, National Broadcasting Company.

RADIO has been developed to the point where it provides the most economical and satisfying entertainment for the home. The services of radio are destined to evolve to an even more perfect state and occupy an even more important place in our daily lives. But for the year 1934 several significant trends are discernable. One trend takes us back in some respects to the DX hunting thrills of the early radio days, but with a new, broadened field of operation. I believe that the all-wave type of receiver capable of picking up the multitude of entertainment and communications services not only in our own country, but from other continents, will attain a cumulative popularity of large proportions. Another is the further evolution of cabinet design to more convenient and practical forms and a new simplicity and modernity of line. **E. A. Nicholas**, Vice-President, R. C. A. Victor Company.

THE receiver of today and the future must have the following qualifications: Ability to tune foreign broadcast with local volume and readibility. Must be housed in modern furniture foreign to the present console. Reproduction must be taken out of the present radio class and put in the musical instrument class. Last year I predicted the public were leaning toward the better radio and better furniture. This prediction has become an established fact; with the advancement of better times, the higher priced equipments are finding a ready market. **W. H. Hollister**, President, Lincoln Radio.

IN terms of new receiver engineering design trends, 1934 will witness the perfection of at least two important features, of almost equal importance. The first is the further perfection of short-wave reception. The second trend is to dual channel audio amplifiers, possibly coupled with semi-resonant air columns, the effect of which is to make available reproduction which may only be described as more real than life itself. **McMurdo Silver**, President, McMurdo Silver, Inc.

THE apparent ease with which European stations are now being received on the latest all-wave receivers accounts for their widespread and increasing popularity and much development work is constantly being done to improve the short-wave portion of the sets for 1934. **A. G. Hoffman**, President, Midwest Radio Corporation.

THE public is learning all over again that "you can't get something for nothing" and in radio this means increasing interest in better performing receivers. Further improvements in audio quality are sure to come in the best sets during 1934. Some of the new receivers already announced for 1934 have mechanical preselection tuning which greatly simplifies the process of selecting a favorite station and makes possible blindfold operation. Simplified remote control radios will be featured in 1934. There are no radical changes in sight at this time. While well built small receivers will continue to be sold in large quantities, these sets are definitely "speech radios" as compared to the larger and better sets which can truthfully qualify as adequate reproducers of music, as well as speech programs. **Ray H. Manson**, Vice President and Chief Engineer, Stromberg-Carlson Telephone Manufacturing Co.

INTENSIVE high-frequency research is opening an ever-increasing field for short-waves, both for thoroughly reliable communication and for home entertainment. The development of the Lamb single-signal circuit and recent improvements in stability and general efficiency have revealed short-waves as the most promising medium for flexible and efficient long distance commercial work, while modern easily-handled sets are proving of unmistakable interest to the broadcast listener. We feel that the future of high-frequency radio has never been brighter, and we are enthusiastically continuing the vigorous research program that has been so prolific in the past. **James Millen**, Vice President, The National Company.

DEPENDING on the continued success of the National Recovery Act and the continuation of radio sets at the present price or even at higher levels, the coming season will see the majority of sets being sold in console cabinets. These sets will be of very high quality, having good sensitivity, good selectivity, but most important of all, a very high fidelity and large volume output. A large majority of these sets will probably include short wave down to 13 meters as more and more of the European short-wave stations are being added and many of these can be reliably heard in this country. Also, many sets will include the long-wave band to 2000 meters for domestic sale. **V. C. MacNabb**, Rudolph Wurlitzer Mfg. Co.

THE compact, portable, universal set has definitely established a permanent place for itself in the radio industry. As a second or third set in the home, it fills a definite requirement and opens up a market of infinite possibilities for 1934. Constant improvements in cabinet design and tone quality have been appreciated by the buying public who have responded by buying this type set in huge quantities. We feel that the coming year will bring further tremendous increase in the sale of the universal, compact type radio. **Ralph B.**

C. W. HORN

A. G. MOHAUPT

A. N. GOLDSMITH

GEORGE LEWIS

H. L. OLESON

E. K. COHAN

J. E. SMITH

W. H. HOLLISTER

D. H. WRIGHT

JAMES MILLEN

ERNEST SEARING

R. B. AUSTRIAN

Austrian, General Sales Mgr., Emerson Radio and Phonograph Corp.

NINETEEN THIRTY-THREE has shown a decided trend toward the modernistic in the design of many products ranging from small cartons to massive office buildings. This trend coincided with the Century of Progress and its ultra-modern buildings, and decorations, so it is possible that this great exposition had a large part in forming this trend. Early this year, when we were shaping up the present line of Crosley radio models, we were impressed by this trend and incorporated the modern tone in the design of our cabinets. Later developments have shown that we gauged public desires correctly. We look for a continuation of this trend in 1934. Certainly, soundly modern design will be popular for some time to come. There is always a tendency to go too far, to develop cabinets that are "freakish" in the use of the ultra-modern. We will avoid this, but we will continue to express the true modern note in our cabinets. ***Powel Crosley, Jr.,*** Pres., Crosley Radio Corp.

IT is obvious that the modern lines have found their way into new radio cabinet designs for 1934. Those designs most meeting popular favor are the modified *moderne*. The use of burls and crotched pattern woods strike the general fancy, whereas straight-grain spectacular woods do not. The new designs must blend into the living-room furniture to create a note of newness instead of so directly contrasting with everything else that they are out of place. Over 10,000 selections made actually in the home, in a survey conducted from coast to coast, has been the basis of success for our 1934 models. **Roy Davey,** Sales Mgr., American Bosch Corp.

Radio Tubes—Today and Tomorrow

UNDER the theoretical guise of new and useful development, many new tubes practically swamped our industry during the past year, many of which in practice did not meet their heralded advantages. Not only did this deluge confuse the picture for manufacturers of tubes and receivers, but created a problem for the various distributing channels—servicemen, dealers and jobbers. In line with the spirit of the National Recovery Act, whose secret, according to President Roosevelt, is *co-operation,* there has been a sudden and effective termination to this promiscuous announcement of new tubes having slight and doubtful improvements to recommend their existence. Instead, tube manufacturers will henceforth as a co-operative group weigh new tubes carefully and sanely, considering the economic as well as the scientific value of the proposed addition to the tube family. New developments will unquestionably take place and become accepted by the industry as a whole with the knowledge that such developments are real advances in the art. **George Lewis,** Arcturus Radio Tube Company.

THE past two years have witnessed a tremendous increase in new types of tubes for receiving set use. At one time, in fact, this hysteria was so pronounced that set engineers did not seem to be able to design a new model unless entirely new and different tube types were used. Undoubtedly the general advances in tube designs have helped the radio industry. In fact, tube designs at present seem more than adequate for set requirements for some time to come. Of course, in some types the promise of improvement was not achieved in actual operating conditions, and this year is witnessing an increasing return to some of the more familiar type numbers. Present events indicate that the trend of tube developments in the immediate future will take the course of improvements both mechanically and electrically in present designs rather than engineering entirely new types. **H. A. Hutchins,** General Sales Manager, National Union Radio Corp.

WE see nothing radical in the way of new tubes for the year 1934. In fact, tube manufacturers as a whole are primarily occupied with production problems occasioned by the remarkable present demand. The present situation is probably more sound than it has been in some time. Prior to 1929, progress of set manufacturers was somewhat impeded and the radio art was held back by delay in the issuance and development of new tubes. Concurrently with the wider use of superheterodyne circuits, this situation changed and the number of new tubes issued not only caught up to, but passed the demand, so that the full possibilities of the tubes already made available have not yet been realized. Also, it is not likely that the industry will ever again see the hectic condition caused by the issuance of slightly varying types by a number of manufacturers which existed until a few months ago. **B. G. Erskine,** President, Hygrade Sylvania Corporation.

Improvements in Amplifiers, Parts and Accessories

IT is reasonable to expect that the trend of amplifier design in 1934 will be along lines that increase the utility of the equipment. Reduction of the number of component parts by incorporation into a single unit of such devices as input transformers, control units, matching transformers, microphone current supply, have been advantages long ago foreseen by the Webster Company. The Webster K-359 is an example of this.

Refinements and more general use of Class B amplification is to be expected. In this respect, the amplifier manufacturer is more fortunate than the radio set manufacturer, as the economic side of his engineering is not under such pressure. **John Erwood,** Webster Co.

I AM of the opinion that the radio art in 1934 will gradually return to a more generous production of the larger or console type of set. This will necessitate the use of the better grades of mica, paper and electrolytic condensers. Such products, while adequately developed today, can still be further developed upon. In line with this modern thought, there has recently been introduced a dual type of moulded mica condenser. This interesting development has a stray capacity not greater than that existing between the elements of an ordinary vacuum tube. ***H. W. Houck,*** Chief Engineer, Micamold Radio Corp.

THE future trend in audio amplifier design, as soon as the present faddism has run its course, will undoubtedly be toward conservatism. So-called Class B and Class A Prime will sooner or later be relegated to the class of the thousand and one trick circuits we knew in the earlier days of the radio industry. The public will even-

(*Continued on page* 446)

E. H. RIETZKE

B. G. ERSKINE

A. E. THIESSEN

McMURDO SILVER

A. H. LYNCH

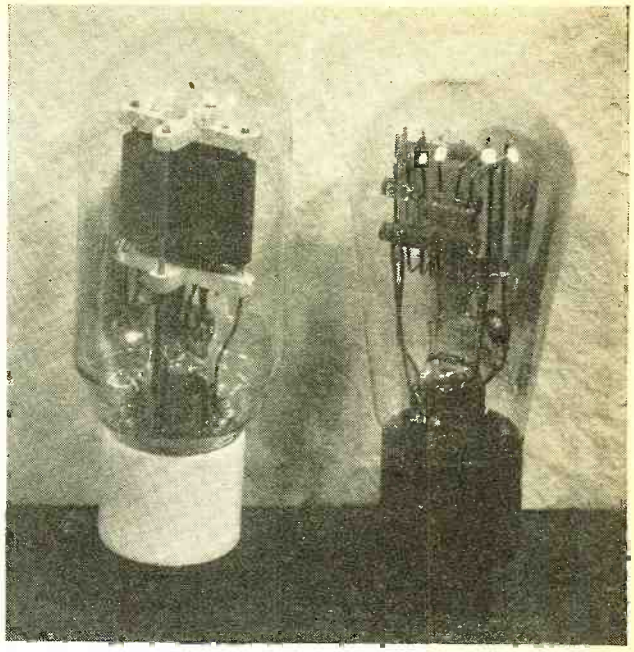
B. C. WRIGHT

MORE POWER TO YOUR TUBES

(Carbon Anodes)

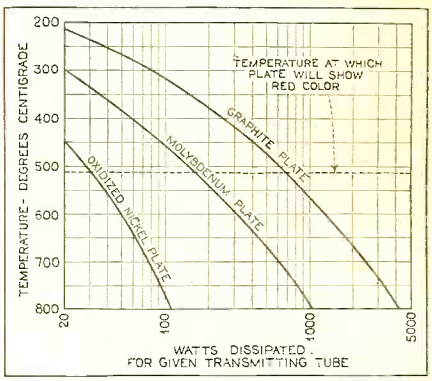
One-piece chemically pure carbon plate, now available in all air-cooled types of transmitting tubes, makes for improved operating characteristics

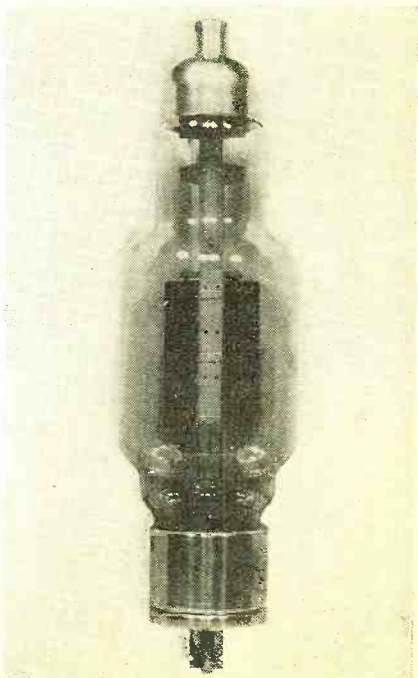
D. E. Replogle



A COMPARISON

Shown above is a new style carbon-anode 210, with the metal-plate 210 at right. Below are temperature curves of the 203-A power tube with three types of plate. Bottom picture is the new 204-A carbon-anode oscillator





FOR each radio tube component, as for that matter each part of any product, there must be a material with pre-eminently ideal characteristics. But such is the paucity of human knowledge and so young is the electronic art in particular that in many instances it is not possible immediately to bring ideal materials and given functions together. In my critical study of standard tube designs, as chief engineer of the Electronics Division of the Hygrade Sylvania Corp., the plate or anode loomed up as the element most susceptible to further refinements. It had long been agreed that the ideal anode requires a pure black body to dissipate as rapidly as possible the heat generated by the steady impact of electrons on its surface. Naturally, carbon has often been indicated as this ideal anode material, but the obstacles to its practical, successful use have seemed insurmountable. Some attempts had already been made to utilize a carbon coating or deposit on metal plates, known as carbonized or graphited plates, in certain types of tubes. In actual operation, however, the loose carbon coating became dislodged from its metal base and spattered about the tube, coating other elements and particularly spacers and glass presses, resulting in untold complications. Also, carbon plates made up of several pieces or segments were tried in larger tubes, but here a two-fold trouble arose, namely, the loosening of amorphous or loose surface carbon as already accredited to carbonized plates, and high contact resistance between pieces or segments.

Quite obviously, then, the carbon plate to be practical must be solid carbon in the first place, machined from solid stock; and in the second place, it must be *pure* carbon or graphite, positively freed of amorphous carbon, the usual binder and all hydrocarbonates. These elements if present are certain to be boiled out or distilled either by the bombardment process during production or in the subsequent operation of the tube over long periods.

We placed the problem squarely before Victor O. Allen, chemical engineer, who has long specialized on filaments, oxide coatings, getters and other tube chemistry. The attack on the problem has been from the standpoint of reducing usual commercial carbon, with all its impurities and binder, to the pure or graphite form *prior* to mounting and bombardment in the tube. Therefore, Allen has worked on the chemical aspects of the case, finally evolving a unique process of pre-treating commercial carbon for the removal of amorphous carbon, binder and hydrocarbonates, thereby obtaining the pure or graphite form. The process lends itself to a carbon mass of any size or shape or thickness, hence one-piece anodes can be machined from solid carbon stock. The mechanics of the process have kept step with the chemical advances, so that the most intricate shapes can now be made.

The pure carbon or graphite anode is a most substantial structure. It is quite strong mechanically and, indeed, compares favorably with the metal which it replaces. Provided with suitable ridges and holes, the carbon anode is mounted on adjacent metal supports by means of screws, nuts and rods, making for a most substantial assembly. Because of low-contact resistance between graphite and metal, there are no losses in this direction. Also, because graphite will not warp or become excessively hot, there is no need for extensive trussing in the supports. A minimum of metal is required. There is much less occluded gas to contend with in the carbon plate tube.

Having developed the graphite anode tubes, just what can we claim for them? Well, these are the more outstanding advantages, disregarding many minor ones:

First and most important, the graphite anode remains comparatively cool during prolonged operation, even under heavy loads. It does not become incandescent as with usual metal plates. The heat (*Continued on page* 444)

THE SHIP AND THE MAN

The S. S. "Bear" ready to sail for the Antarctic and the commander of the expedition, Admiral Richard E. Byrd

Just Say the Word and It's Done!

To the Editor: Just read in the paper Admiral Byrd sails to the Antarctic. I think readers of RADIO NEWS *would be thankful to you if you print in next issue information about his call letters, schedules, etc. It would be a fine test for short-wave listeners to hear his transmissions from Little America. Werner O. Howald, Short Wave League.*

The SOUTH POLE CALLING!

Samuel Kaufman

ADMIRAL RICHARD E. BYRD'S second expedition to the Antarctic Circle and the South Pole is carrying more radio than any other exploration party in history. So much radio equipment has been shipped that even the engineers and the operators could not determine in advance of reaching their destination just how many transmitters would be placed in operation at the "bottom of the world."

Not only will radio be used as a means of two-way communication with the civilized world from the icy wastes of Little America, but it will also be employed to convey regular scheduled programs from the expedition base into the homes of radio listeners throughout the United States. At this writing, a plan is under way to effect a tie-up with American radio amateurs. It is likely that an amateur station aboard Admiral Byrd's flagship, *S.S. Jacob Ruppert,* will establish communication with thousands of American "hams."

The broadcasts from the Antarctic will be conveyed to American listeners via the stations of the Columbia Broadcasting System. The network is in charge of all radio installations, equipment and operation of the expedition, with the exception of the commercial communications system which is handled by the Mackay Radio Company.

Several relays will be necessary to bring the programs from the Antarctic to New York for distribution to the network. The stations with the expedition will all utilize short waves. This will afford DX fans an unusual opportunity to tune in the Antarctic transmitters directly. The main Byrd transmitter, KJTY, has been assigned fifteen frequencies between 6000 and 23,000 kilocycles. Edwin K. Cohan, technical director of the CBS, explained to the writer that the permanent frequencies will be determined after tests from Little America reveal the wavelengths which will yield best reception results in New York. As the expedition will remain in Little America for eighteen months, Cohan pointed out that there was plenty of time for the solving of any problems that might arise in the attempts to convey the unusual programs from the "bottom of the world" to all of the United States, and possibly to the entire world.

Representatives of the world's leading communications firms offered assistance to Mr. Cohan in working out the intricate arrangements for the Byrd broadcasts. Among the consultants were: Dr. T. S. McCaleb, of Harvard University, who is Byrd's counsellor on radio; A. Y. Tuel, vice-president of the International Telephone and Telegraph Company; Harry Young, of the Western Electric Company; William Thompson, of the American Telephone and Telegraph Corporation, and S. H. Simpson, of the Radio Corporation of America.

During his recent visit to New York, which coincided with the departure of the expedition, the Marchese Guglielmo Marconi, the "father of radio," informed the CBS that its proposed series of broadcasts from the Little America base of the Byrd Antarctic Expedition were entirely feasible.

After discussing the frequencies to be used in the broadcasts, and the radio equipment to be taken to the Antarctic, the Marchese Marconi told Cohan: "I think the project is entirely feasible and the manner of carrying it out is sound."

Upon learning that the frequencies to be used ranged from the 6 to 23-megacycle band, the Marchese pointed out that it was possible for signals transmitted in the 23-megacycle end of the spectrum to be heard around the world, and that, therefore, it may be possible sometime during the expedition's stay in the Antarctic to transmit voice direct to New York, instead of relaying it through a short-wave station at Buenos Aires, as will be done with the weekly broadcast programs.

"MIKE" MASCOT

Here is "Mike," the mascot of Admiral Byrd's flagship S. S. Jacob Ruppert, whose voice will be heard from the Antarctic at the beginning of each broadcast

The eminent radio inventor expressed his deep interest in the broadcasting project by saying that he will establish a listening post either aboard his floating laboratory on the yacht *Elettra* or somewhere in Italy to keep in touch with transmissions from Little America.

Cohan offered to collate all technical data accumulated during the period of the broadcasts, and Marconi, in turn, offered to supply the CBS technical director with his own findings in connection with the work.

The 1000-watt broadcast transmitter KJTY was installed aboard the *S.S. Jacob Ruppert*. The CBS sent along its own engineer, John Newton Dyer, as technical supervisor of the program series to be broadcast from Little America over the network. In addition to his broadcasting duties, Dyer is in complete charge of all of Admiral Byrd's communications facilities. The CBS man to go along with the expedition is Charles J. V. Murphy, newspaper man, author and radio announcer, who serves as production man, continuity writer and announcer of the weekly programs to be broadcast from the base of the expedition in Little America. As station manager of the world's most remote unit of any network, Murphy's duties will include introducing speakers and the expedition's potential amateur talent. He will coach and direct all programs.

The expedition will be gone two years. It left the United States last October and it was estimated that it will take three months to reach Little America. After eighteen months in the Antarctic, during which many extensive surveys and studies will be made in twelve branches of science, the expedition will leave for home and should arrive at an American port in the fall of 1935.

The 1000-watt broadcast station on the *Jacob Ruppert* was installed in one of the world's strangest studios adjoining the ship's regular radio room. The studio occupies the working and living quarters of the ship's radio-telegraph operators. The radio room itself is used as a control chamber, and the bunk room is now the studio with its original complement of two bunks, and two more which were added to take care of the CBS men accompanying the expedition.

A plate-glass window was set in the wall between the radio room and the studio. The window is located between the upper and lower bunks which run along the wall. It was planned to set microphones on a table at one end of the cabin. For some broadcasts in which large groups of persons will participate, a line will be run out on the deck to a floor microphone.

En route to the Antarctic, the transmitter will broadcast several programs for dissemination to network listeners. Upon reaching the Antarctic ice barrier, the broadcasting equipment will be transferred to the *S.S. Bear*, which will penetrate the frozen wastes to Byrd's base in Little America. There, the station will be transferred to an ice-hut. The station will then serve to handle the regular weekly programs in which Byrd and the members of the expedition will report on the progress of the explorations.

This station will send the program to the R.C.A. station at Buenos Aires, Argentina, where the impulses will be received on a special directional type antenna. The RCA station will then relay the transmissions to its trans-oceanic receiving station at Riverhead, Long Island. From this latter point, a suburb of New York City, telephone lines will convey the programs to the key CBS station, WABC, for distribution to the entire network.

THE RADIO CONTROL ROOM

Station KJTY, aboard the flagship S. S. Jacob Ruppert, from which all commercial messages on the short waves will emanate

Cohan pointed out that the approximate relay distances were 4000 miles from Little America to Buenos Aires, and 6000 miles from Argentina to New York. He told the writer that past radio tests have proven that north-to-south transmission is better than east-to-west transmission. He said that less trouble was experienced with handling the 6000-mile New York-to-Argentina traffic than the 3500-mile New York-to-London messages.

The voice frequencies granted by the Federal Radio Commission to the Little America station are as follows (in kilocycles): 6650, 6660, 6670, 8820, 8840, 13,185, 13,200, 13.230, 13,245, 13,260, 17,600, 17,620 21,515, 21,600 and 21,625. Although the programs will be conveyed to American listeners via the domestic CBS stations, the transmissions offer short-wave fans the opportunity of trying to tune in Little America directly. Not all of the above listed frequencies will be used. After tests show just which are best, the number of utilized wavelengths will be reduced. At the time of this writing, CBS has completed plans to broadcast the Antarctic programs every Saturday night from 10 to 10:30 o'clock (Eastern Standard Time).

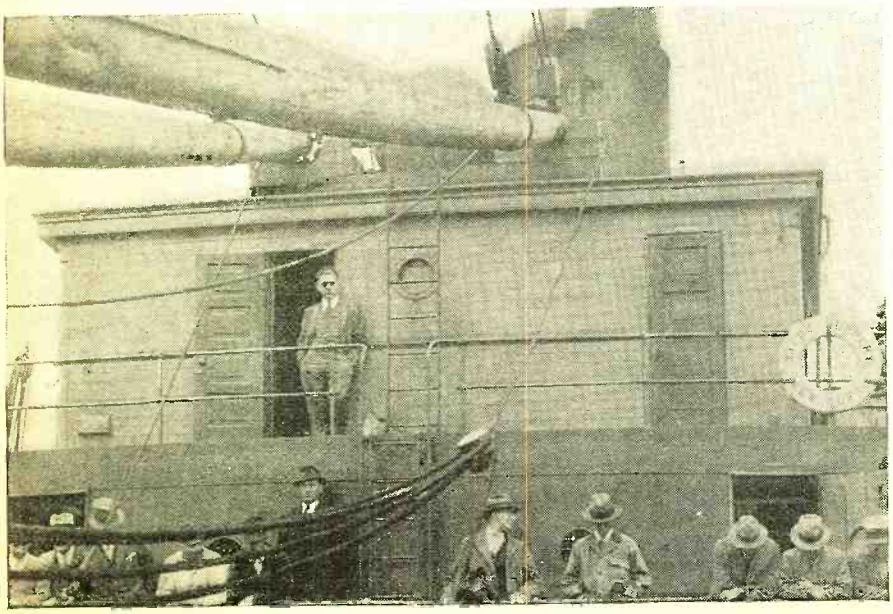
The weekly broadcasts from Little America will be sponsored by a commercial advertiser. The General Foods Corporation is the firm that will pay the bills for the unusual series. Commercial announcements, et al, will be included in the programs. Even an opening theme has been selected. On each program, the bark of Mike, a sandy-haired sled dog, will be heard. Over the two-year broadcasting period, it was estimated by a CBS representative, the commercial programs from the Antarctic will represent an approximate expenditure of $1.000,000.

A total of 5000 pounds of broadcasting equipment was taken to the Antarctic. The heaviest single item in the broadcasting paraphernalia is a 1000-pound gas-driven generator for use on the Ross barrier, where it will be the only reliable source of electrical energy.

The (*Continued on page* 442)

VIEW OF THE RADIO SHACK

Inside of this square cabin is the radio apparatus and control room of KJTY. It is located on the afterdeck of Byrd's flagship



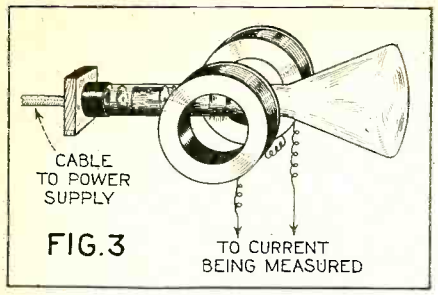


FIG.3

CATHODE RAY TUBES

(Applied to Service Work)

In this, their third article on cathode-ray tubes, the authors describe application in measuring voltage, current, capacity, resistance and impedance; also in analyzing distortion in radio sets and amplifiers

J. M. Hollywood, M. P. Wilder

CATHODE RAY TUBE AS AN AMMETER

IN servicing receivers, it is often necessary to know the value of a d.c. voltage applied between the cathode and some electrode of a vacuum tube, when there is a high resistance in series with the electrode. For instance, a –57 tube might be used with a 150,000-ohm resistance in series with the screen grid for 100-volt operation on a 250-volt supply. If the screen voltage is measured with an ordinary voltmeter of about 250,000 ohms resistance for a 250-volt scale, instead of reading 100 volts when conditions are correct for that voltage, it will read about 70 volts.

If the voltage is measured with a cathode-ray tube, the impedance of the measuring instrument will be so high that it will have negligible effect on the voltage being measured. This is of very great advantage.

To use the cathode-ray tube as a voltmeter, the tube and power supply as shown in the previous article should be set up, and the proper terminals (running to one pair of deflecting plates) connected to the voltage being measured. One of these terminals is ordinarily grounded, and if this is done, care should be taken not to connect this terminal also to another point which is above ground potential. The arrangement is shown in the diagram of Figure 1.

The sweep circuit is not used for applications as a voltmeter and the condenser switch of the sweep circuit shown last month is therefore to be on the short-circuit position. A calibration scale can be marked on a piece of celluloid to be held against the screen. In the power supply described in the previous article, the anode voltage can be changed in a two-to-one ratio, but held as constant as the a.c. line voltage permits. The various fixed anode voltages correspond to the various series resistances used in a multi-scale voltmeter of the usual type; in this arrangement, the calibrated scale will be multiplied by two when the anode voltage is doubled. Calibration can be carried out by connecting a known voltage to the binding posts for the unknown voltage. Only one or two such points are needed, because the scale is linear.

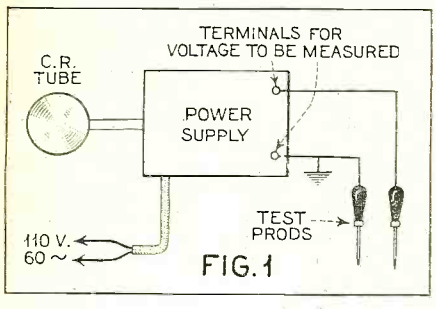


FIG.1

In measuring d.c. voltages, the deflection of the spot off its zero position is observed. If an a.c. voltage is observed, the spot is swept out into a line, the length of which is equal to 2.828 times that caused by a d.c. voltage of the same value. The distance from the zero position to the end of the line will be 1.414 times the deflection caused by a d.c. voltage of the same value.

The instrument can therefore be used as a combined a.c.-d.c. voltmeter without any switching arrangement. The calibration scale might be as shown in Figure 2, if the zero position is moved to one side of the screen by connecting a small 90-volt battery in series with the measured voltage. The accuracy could be doubled for small a.c. voltages by removing the series battery so that the line swept out lies in the center of the screen, measuring its total length and dividing by two, instead of measuring half its length in the more convenient way of leaving the zero position on one side of the screen.

It will be convenient to mark the scale on a celluloid strip mounted so that it can be slid across the screen to any position. For good visibility that cathode-ray tube can be mounted inside of a dull black iron tube. This will also reduce the effect of external magnetic fields and permit mounting the celluloid strip as suggested.

To obtain higher voltage scales than can be obtained with the two anode voltages available in the power supply of the previous article, a voltage divider of high resistance can be connected across the measured voltage, and a portion of it in the desired ratio connected to the binding posts usually connected directly to the measured voltage. For example, two accurate 5-megohm resistors in series can be connected to the unknown voltage, and the voltage across one resistor applied to the deflecting plates, to double the voltage scale. This will sacrifice some of the high-impedance advantages of a cathode-ray tube voltmeter, but it will be much higher than in a moving-coil type voltmeter. The cathode-ray tube voltmeter is not so good for very low voltages. The anode voltage cannot be reduced much below 500 volts and still give sufficient brilliancy; this limits the voltage sensitivity for voltages applied to the deflecting plates.

As a voltmeter the cathode-ray tube offers advantages of instant response, practically unlimited frequency range, operation on a.c. or d.c. without switching, better maintenance of calibration than a rectifier type a.c. voltmeter, high impedance input, no possibility of burnout on overload, and very high voltage ranges with inexpensive extra resistances for voltage dividers. It can be used in place of a vacuum tube voltmeter for moderately large voltages. It has the disadvantages of a minimum full-scale reading of about 150 volts d.c. and 60

CATHODE RAY VOLTMETER

Employed for voltage measurements, as shown schematically in Figure 1, the cathode ray tube offers extremely high impedance and practically an unlimited frequency range. A celluloid scale made up as shown in Figure 2 and held over the tube screen provides direct voltage readings

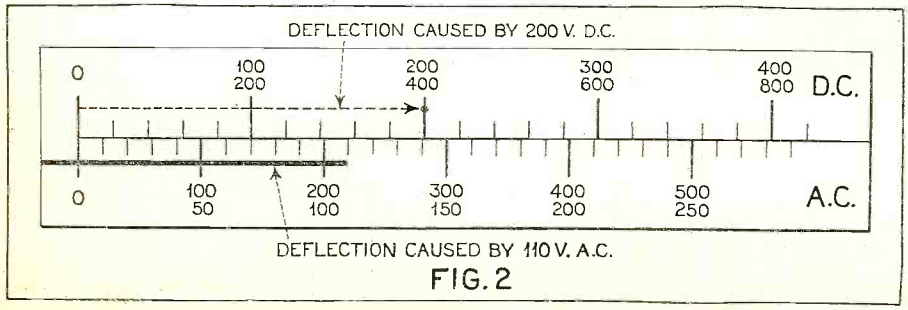


FIG. 2

volts a.c., and greater bulk, cost and complexity than a moving-coil meter.

For measurements of low voltages and for use as an ammeter, the cathode-ray tube can be used with coils for magnetic deflection. It will then require a little more power for deflection than a moving-coil meter, but has the advantages of instant response, frequency range limited only by the coil construction, and a.c. and d.c. measurements without switching. As a simple ammeter, the moving-coil instrument is usually more suitable. The cathode ray tube offers unique advantages, however, for use as an oscilloscope in observing current wave forms.

In using the cathode-ray tube as an ammeter or low-voltage voltmeter, the arrangement of Figure 3 is used. The coils are connected in series so that their magnetic fields add, and are placed with the back edge even with the end of the "electric gun" structure. Their common axis is perpendicular to the tube axis. A coil diameter of five inches and a spacing of two and a half inches between centers gives a fairly uniform field and good sensitivity. The coils should be wound with many turns of fine wire for measurements of voltages too low to be applied to the deflecting plates, or for small currents. For large currents fewer turns of heavier wire should be used. About one hundred ampere turns are necessary for full deflection. Construction similar to honeycomb coils should be used if high-frequency response is desired.

In using magnetic deflection, if the field is not uniform, the current scale is not linear, and calibration as an ammeter should be carried out for many points, by applying known currents and recording deflections. Doubling the anode voltage multiplies the scale by 1.414 for magnetic deflection.

The cathode-ray tube is much superior to a moving-coil meter for measuring large resistances and impedances. Its own impedance is so high that its effect can be neglected, for high-vacuum tubes.

A circuit for measuring d.c. resistances is shown in Figure 4. Table 1 shows the relation between percentage of full-scale deflection and the resistance being measured. The tap on the battery of

TABLE 1. FROM FORMULA $R_X = R_S \left(\frac{1 - \left(\frac{D}{Dm}\right)}{\left(\frac{D}{Dm}\right)} \right)$

R_S = 10 MEG.	R_X MEG.	∞	50	40	30	20	10	5	3⅓	2½	2	0
R_S = 1 MEG.	R_X MEG.	∞	5	4	3	2	1	½	⅓	¼	⅕	0
	(D/D_m)*	0	.166	.20	.25	.333	.50	.666	.75	.80	.833	1

* PERCENT DEFLECTION = $(D/D_m) \times 100$

MEASURING RESISTANCE, IMPEDANCE OR CAPACITY

Figure 4 shows the circuit arrangement for resistance measurements and Figure 5 a universal arrangement for measuring resistance, impedance or capacity. Table 1 shows resistance range distribution in megohms, for different percentages of full-scale deflection

Figure 4 can be changed to vary the location of the spot on the screen. It will not affect the deflection obtained for a given change in the resistance of R_x. By tapping the midpoint, the spot will be in the center of the screen when $R_x = R_s$, and will be deflected an equal amount to either side as R_x is changed from zero to infinite resistance.

Deflection is here considered the distance the screen spot moves when the test prongs are on open circuit, then applied to R_x, the unknown resistance. Full-scale deflection is considered the distance it moves when the test prongs are on open circuit, then shorted. For a given battery voltage, this remains constant when the anode voltage is not changed. A direct-reading resistance scale can therefore be made on a strip of celluloid, as in the case of the voltage scale, from the data given in Table 1.

This arrangement is useful in measuring the leakage resistance of condensers, which is often too high to be indicated on the usual ohmmeter.

The cathode-ray tube ohmmeter is not so useful as the ordinary instrument for low resistances. The voltage across the unknown resistance must be in the neighborhood of one hundred volts in the process of measurement, for good deflection, and if the resistance is small it will draw excessive current. With R_s large, very little current passes through the unknown resistance even though it is small, but the deflection obtained will be small.

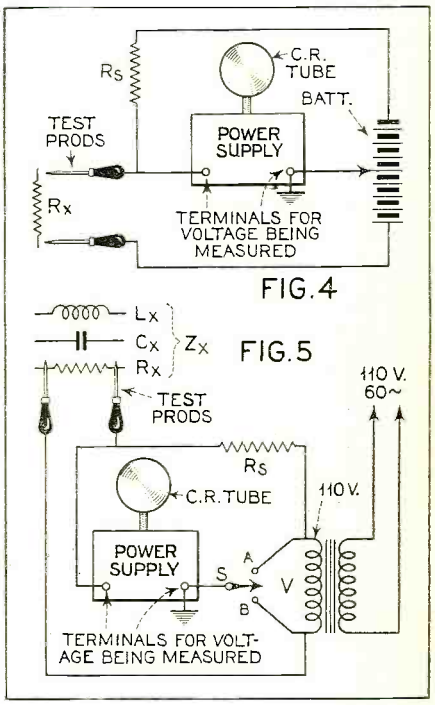


FIG. 4

FIG. 5

Measuring Impedance

A second impedance-measuring system is shown in Figure 5. This can be used to measure a.c. pure resistance or pure reactance, and will duplicate the results of the previous system for measurement of pure resistances.

The spot on the screen is swept out into a line. The length is maximum when the test prongs are open if the switch S is on tap B, and maximum when the test prongs are shorted if the switch is on tap A. When the unknown impedance Z_x is a pure resistance, its value will be given by the formulas:

(*Continued on page 440*)

WAVE-FORM STUDIES

Figure 6. An arrangement for analyzing distortion, stage by stage, in audio amplifiers. Figure 7 shows how overall distortion in a radio receiver may be checked

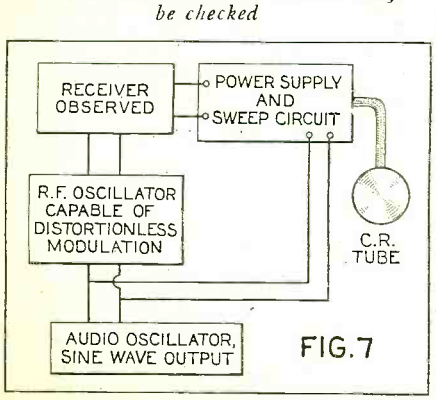
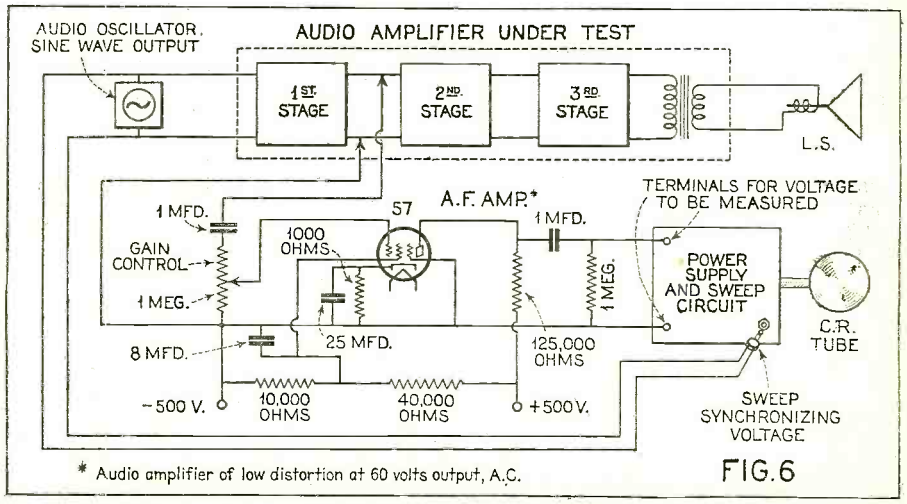
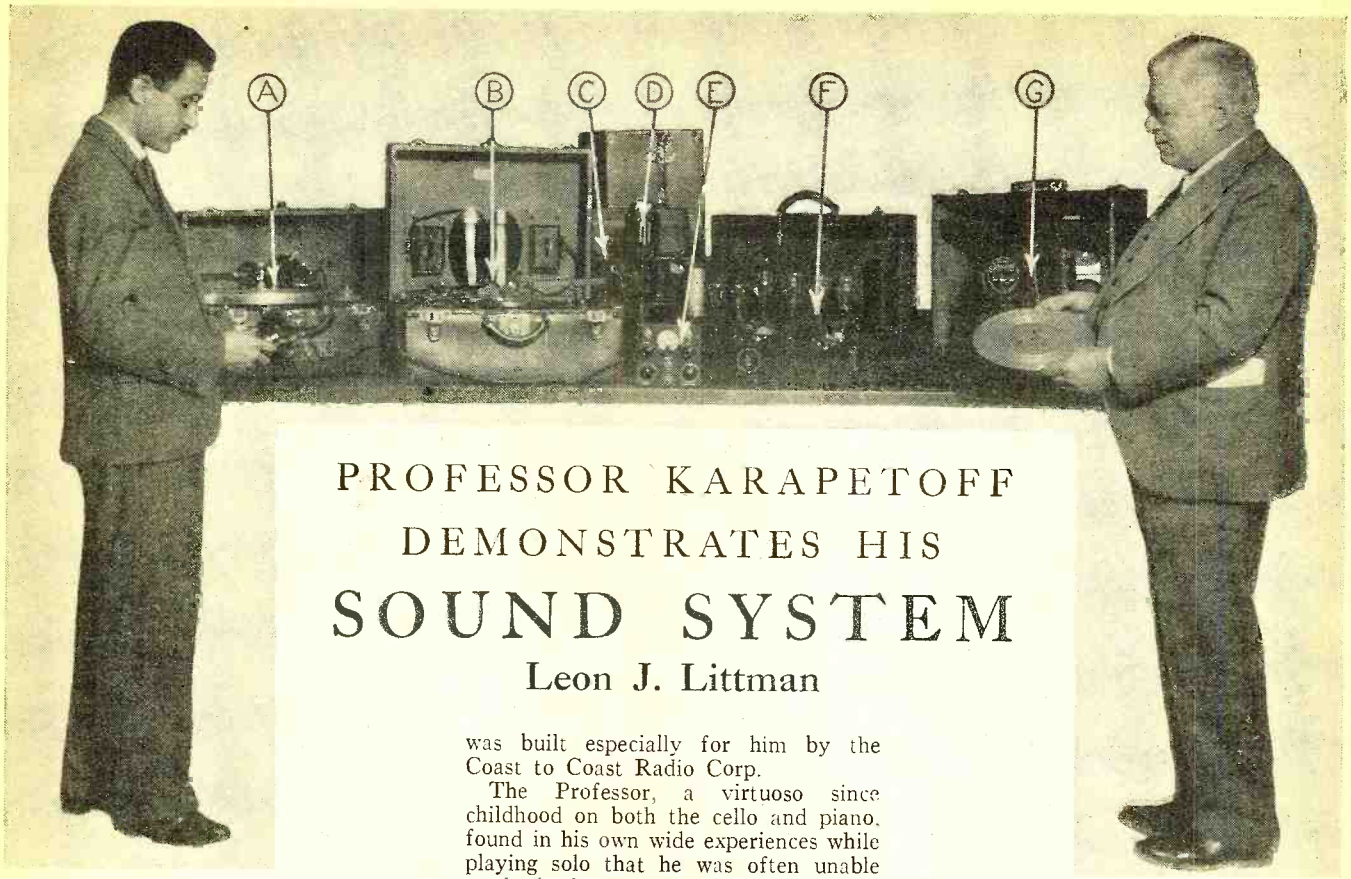


FIG. 7



* Audio amplifier of low distortion at 60 volts output, A.C.

FIG. 6



PROFESSOR KARAPETOFF DEMONSTRATES HIS SOUND SYSTEM

Leon J. Littman

PROFESSOR VLADIMIR KARAPETOFF, author, inventor and teacher of electrical engineering for more than 25 years at Cornell University, is perhaps more widely known to the American public through his broadcast recitals over the stations of WEAF, KDKA, WGY, etc., in which he demonstrates his improved five-stringed cello and his method for employing a remote-controlled electric phonograph for ensemble playing with other musical instruments.

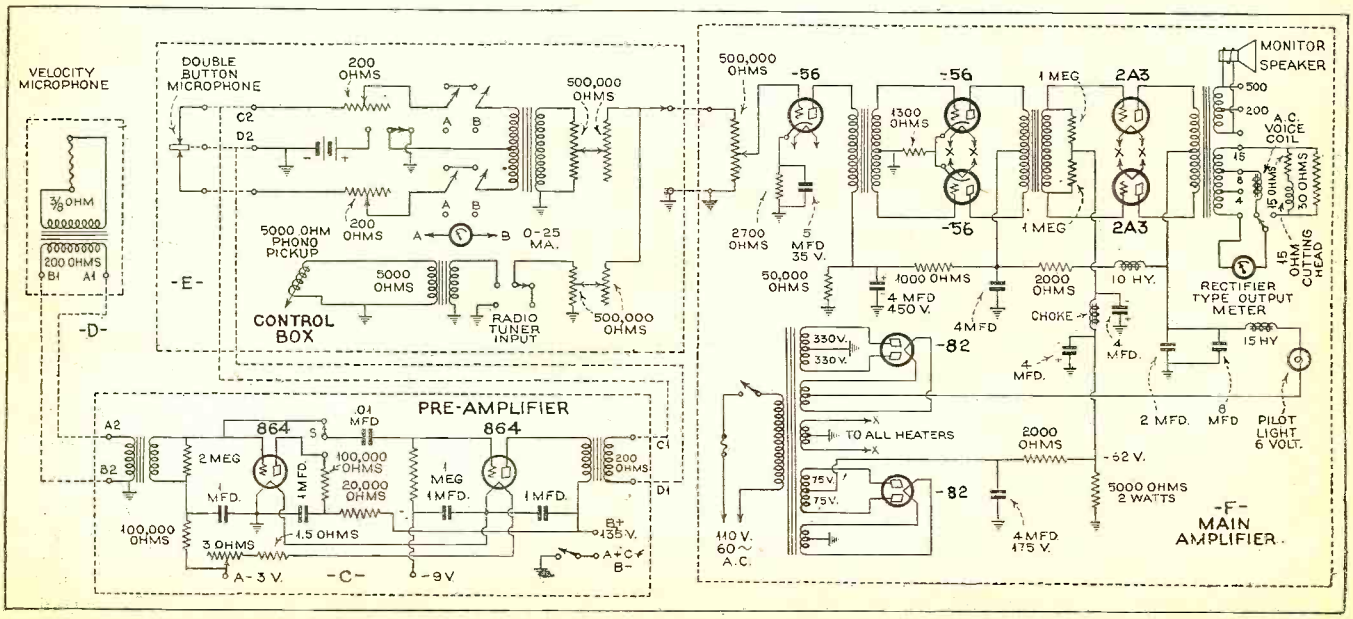
This article describes such a sound reproducing system, which includes a complete recording equipment as employed by Professor Karapetoff for teaching music. The sound system was built especially for him by the Coast to Coast Radio Corp.

The Professor, a virtuoso since childhood on both the cello and piano, found in his own wide experiences while playing solo that he was often unable to obtain the proper accompanying piano or orchestra music, and he developed the idea of securing records of such music or accompaniment as he required and with the necessary electric phonograph and control equipment, he was able to regulate the speed of the phonograph motor as well as the volume of the accompanying music. The electric phonograph and control units are shown in the illustration, designated by the letter (B).

There are two remote-control devices, one for regulating the volume and the other for adjusting the speed of the turntable. These control units permit a musician to play an instrument, for instance, a cello, as in Professor Karapetoff's case, and bring the accompanying record in tune with the instrument, by actuating the remote phonograph turntable speed control pedal, with his foot. He can adjust the volume control pedal with the other foot. This allows him to adjust the pitch and to control the volume of the record to any desired point. As the volume control responds instantaneously to the remote control mechanism, much more life-like and realistic rendition of the original record may be obtained.

Professor Karapetoff realizing that students of music are under a serious handicap, because they cannot hear themselves, in- (*Continued on page* 439)

THE CIRCUIT DIAGRAM



A NEW BALLOON ANTENNA

Here is an idea that may be useful for improving long-distance reception, as well as transmission

Frederic Siemens

YOU experimenters! How about trying a balloon antenna? Experiments have been in progress with KDKA'S new blimp antenna, located at Saxonburg, Pa., near Pittsburgh, which may have considerable effect upon the future efficiency of broadcasting stations. Held aloft by a baby blimp, an odd adjunct to a broadcasting station, an experimental half-wave antenna, about 500 feet long, trails 1500 feet in the air. A light aluminum wire, serving as a combination guy and feed wire serves the dual purpose of restraining the "captive aerial" from free flight and "feeds" it radio programs.

A long period of research is anticipated before engineers can accurately determine the exact degree of success expected to result from this latest experiment in broadcasting. Theoretically, however, at a distance of 40 miles, signal strength several hundred times that now possible using conventional antennas, seems entirely probable.

Walter C. Evans, manager of the radio department of the Westinghouse Electric & Manufacturing Company, says about this revolutionary development: "It is well known that the broadcast frequencies of radiation travel without loss from the boundary of the earth until they encounter the effects of the heavyside layer, where they are partially absorbed and are bent back to earth again. The return path to earth being without loss, it often happens that the waves travel for hundreds of miles and return to earth with fair intensities.

"If these waves were not mixed up in their passage into and out of the heavyside layer, it would appear that it would be worth while to concentrate all the radiation energy into the vertical and let it be returned to earth after having travelled a long distance with very little loss. However, this has been attempted and abandoned due to the interfering effects of the variously polarized and phased waves which returned to earth.

"However, the problem might be solved if the antenna were placed high enough above the earth, so that radiations might be permitted to travel directly from the antenna to the ground. There should be no loss in signal strength until it arrives at the earth's surface, where it will be reduced in strength to a degree determined by conditions immediately surrounding the receiving point.

"In short, if the transmitting antenna be high enough off the ground so that it is in a direct line of sight with the receiving antenna, it may be possible to produce transmission with only negligible loss.

"Computing the curvature of the earth for various distances, we find how high in the air the radiating antenna must be held, if it is to completely "see" the receiver. For the first 30 miles, the antenna elevation is relatively low, while from 30 to 100 miles, it increases rapidly. For example at 30 miles, the antenna elevation is 450 feet, while at 80 miles it is 4200 feet and at 100 miles it is 6700 feet. The problems involved in maintaining an antenna at elevations from 1000 to 10,000 feet are, to say the least, numerous.

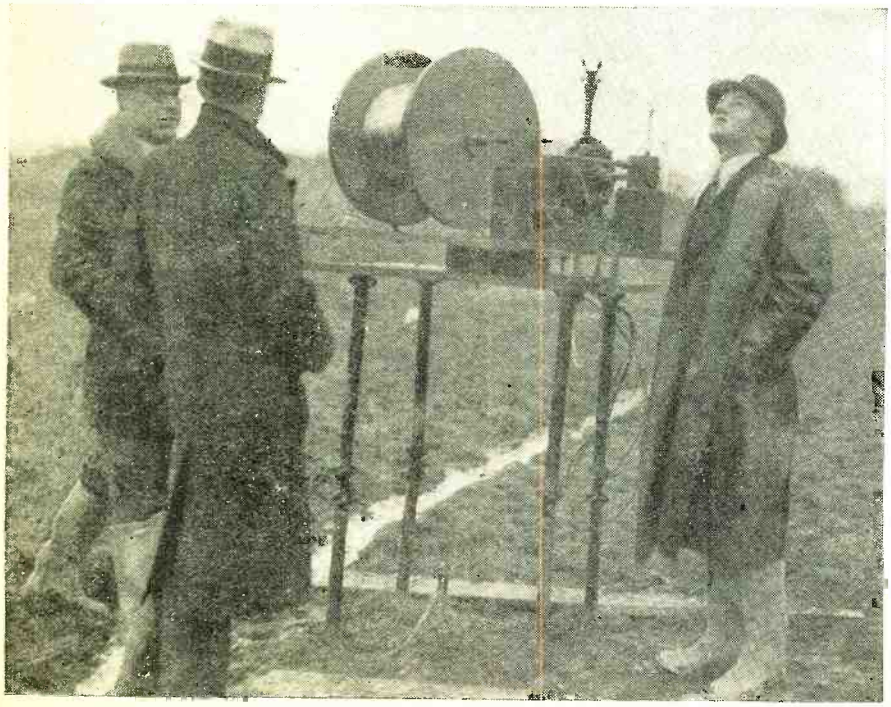
"We have, therefore, decided to begin our experiments with a baby blimp and, if they are promising, we probably will obtain a larger balloon to send our trial antenna higher into the air. Experiments we are making (*Continued on page* 444)

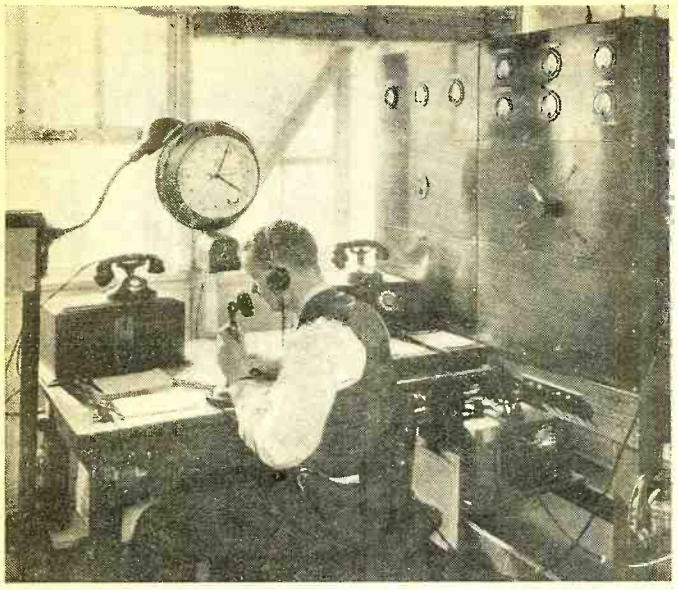
ALL READY, NOW, STEADY; UP SHE GOES!

Engineers of the Westinghouse Electric & Manufacturing Company just about to release their new blimp at Saxonburg, Pa., before it goes on its "maiden" voyage carrying a new experimental 500-foot half-wave antenna

THE AUTOMATIC CONTROL APPARATUS

Ralph N. Harmon, at right, chief engineer, watching the blimp carrying KDKA's experimental antenna. The motor-driven winch automatically regulates the height of the antenna in the air





INTERIOR OF GROUND RADIO STATION

The operator, talking into a microphone of the transmitting equipment, making contact with the plane

DEVELOPMENT IN AVIATION RADIO

Radio enthusiasts will welcome this information giving the insight into the part radio is playing in modern aviation, in commercial, passenger and mail flight

Robert Sparks

HIGH above the earth a large air liner speeds through the night at three miles a minute. It is gliding down the long slope of the Sierra Nevada Mountains, leaving the high summit on the border of California, for the broad, flat terrain below. Soon the plane will reach San Francisco after a twenty-one-hour flight from New York. In the pilot's compartment the co-pilot lifts a small microphone to his lips, presses a button and says, "Huking in 27 over Auburn, 7.000, all O.K." Promptly through his earphones he hears the voice of a dispatcher replying, "Sacramento calling Huking in 27 over Auburn, 7.000. all O.K. Sacramento."

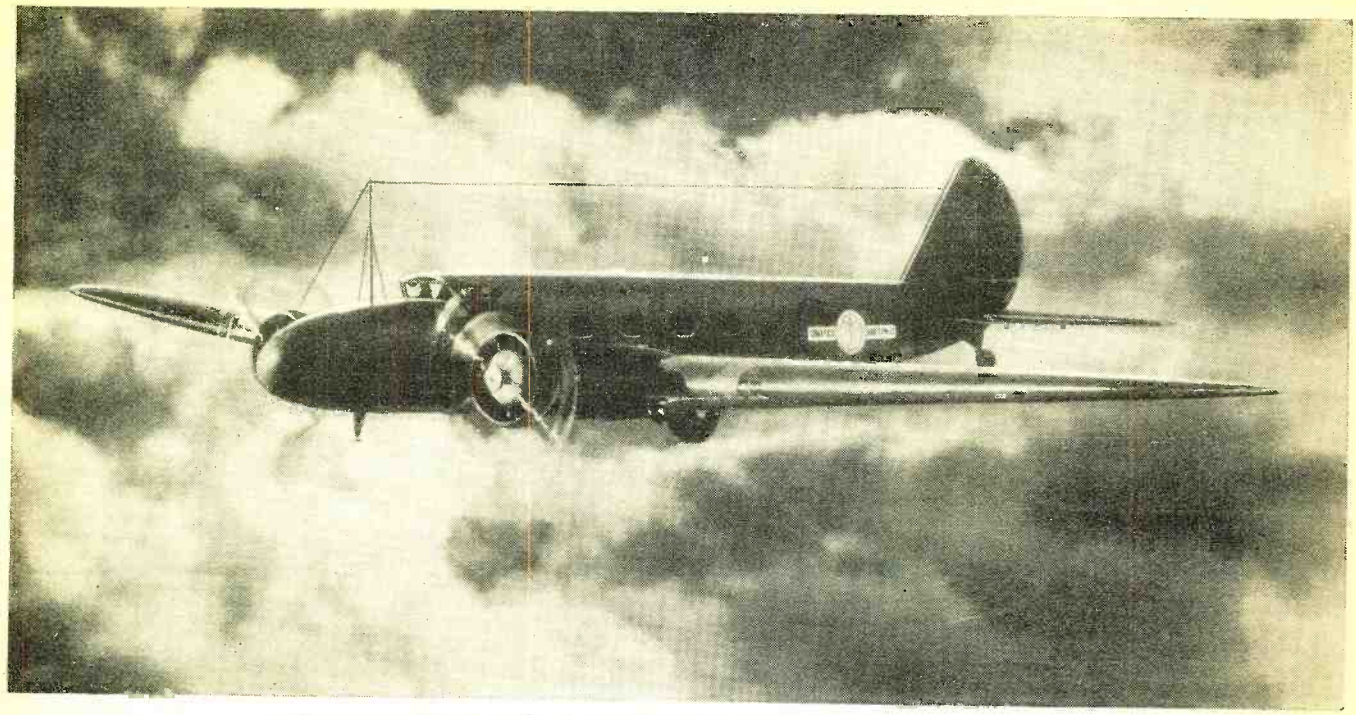
No matter where a plane may be over United Air Lines' nation-wide system of passenger, mail and express airways, the ground is never out of contact with the pilot of the plane, for this company operates a complete two-way, plane-ground radiophone system, the development of which it pioneered several years ago. At every one of its thirty-seven fields throughout the country is located a transmitting and receiving station, and each one of its fleet of more than 100 planes is fully equipped with radio-telephone sets.

Just placed in service is a fleet of 3-mile-a-minute, low-wing, all-metal transports which rate as the world's fastest planes of their class. Carrying ten passengers, mail and express at a top speed in excess of 120 miles an hour and a cruising speed of 117 miles an hour, the new air liners travel from California to New York in twenty hours, Chicago to New York in four and three-quarter hours, from California to Chicago in fourteen hours, and from Cleveland to New York in two and one-half hours.

These modern air liners are equipped with one transmitter and two radio receivers. One of the receivers is a short-wave type for reception of voice signals

TRANSPORT PLANE RADIO OPERATOR AND CO-PILOT CALLING GROUND STATION

Two-way radio communication between planes in flight and operators of ground stations constitutes an invaluable asset in modern air transportation and is responsible for the efficiency of modern scheduled flying



TEN PASSENGERS AND A CREW OF THREE DEPENDING ON RADIO

This airliner relies for its safety on communication with the ground by radio, accomplished just as easily as the ordinary business man would pick up his telephone to talk with his broker

from the ground stations. The other is a long-wave type to receive weather reports broadcast by the Department of Commerce stations, and also directive radio beam signals sent out by special Department of Commerce transmitters.

The installation of this equipment in the planes marks a new innovation for this type of mounting. In the nose of the air liner a metal bench, which has fixed plugs and grooves into which the sets slide easily, is provided. The radio-telephone equipment is slid into place, connected with the plugs at the back of the bench, and is immediately ready for operation. The installation itself weighs 145 pounds. It is particularly important that this installation permits ready removal, inspection and repair of equipment so that it may be replaced without loss of time.

The entire equipment is fully bonded and shielded to reduce the noise level and thus permit proper reception of signals. During the construction of the plane it was found that particular care had to be given the problem of bonding the air liner because of its all-metal construction. However, this project was accomplished with such thoroughness that reception of radio signals is clear and not troubled with static interference.

The antenna on the plane is of the mast type with a 6-foot streamlined duralumin mast projecting above the fuselage at the nose of the plane. In all cases of aircraft radio installation, previous to these new liners, the antenna mast was located toward the rear of the ship. Simplification of wiring for radio installation was made possible by erecting the radio antenna above the installation of equipment in the nose instead of the rear of the cabin.

Complete control for the operation of the radio-telephone is located in the pilot's compartment and in front of the co-pilot's seat, the co-pilot being mainly responsible for the position reports which all pilots make every twenty minutes to the nearest of the 37 ground stations. To facilitate the use of the radio equipment, controls for the short-wave equipment used for the company's two-way communication are all painted red, while the dials for the tuning and regulation of the long-wave equipment for the Department of Commerce radio broadcasts and directive beam signals are painted blue.

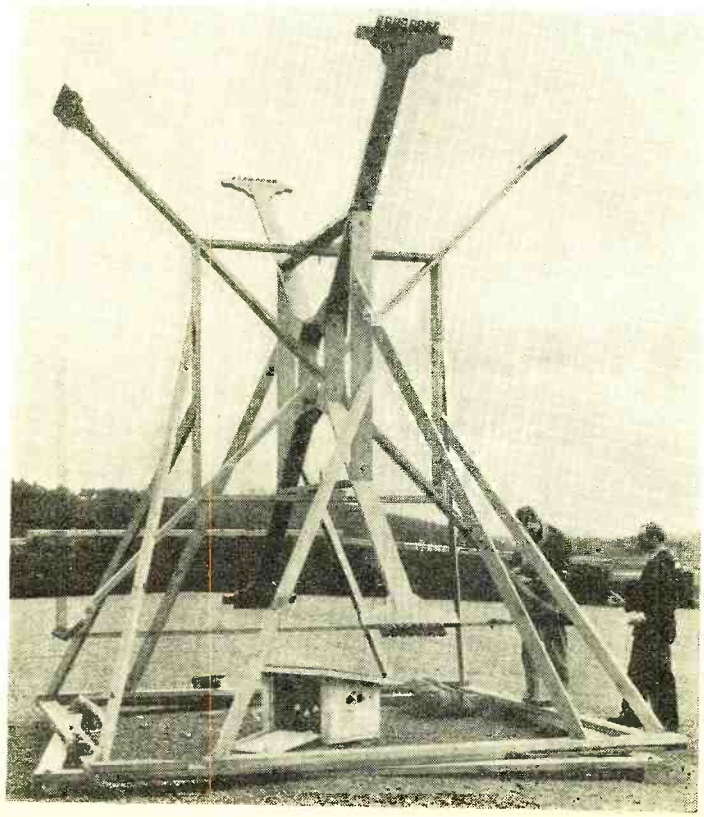
The radio equipment is normally in position to receive. When the pilot or co-pilot desires to transmit, he lifts his microphone to his lips and presses a button located in the wheel of the control column used to direct the flight of the plane. This operates a remote relay which changes the radio equipment to "transmission."

Each transport division operates on one frequency for "day" and another for "night." At sunset it is necessary to change from the day frequency to the night frequency, but in the equipment previously used the job of changing the sets from one wavelength to another was complicated for the pilot

(*Continued on page* 442)

NEW DIRECTIVE RADIO BEAM

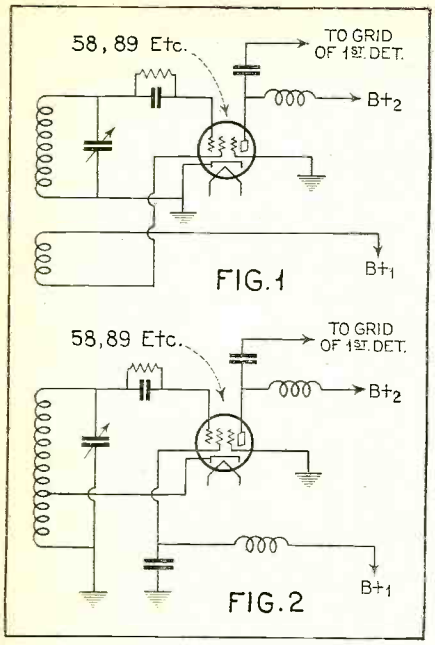
One of the important aids to accurate air navigation is the airport localizer beam antenna. This antenna enables the signals to be sent out in predetermined directions

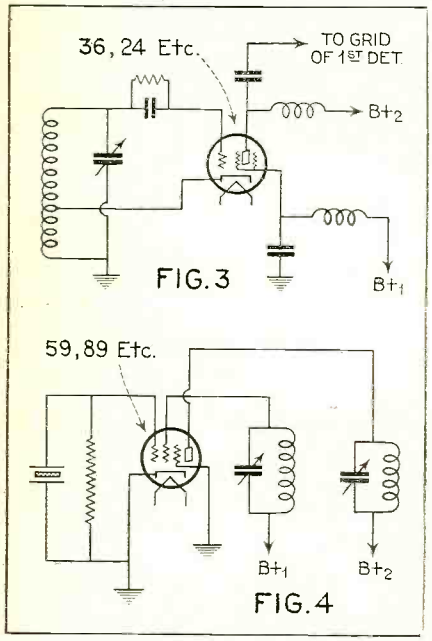


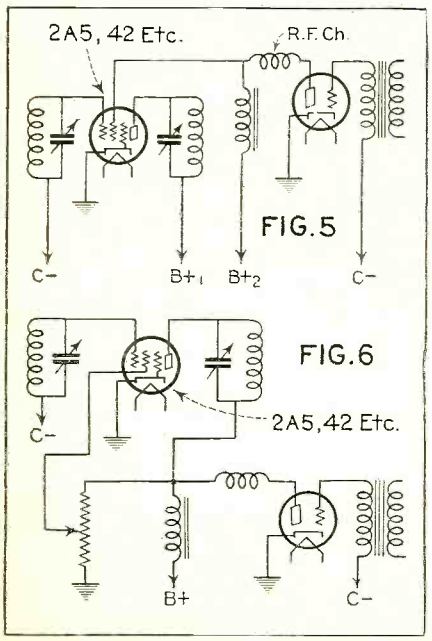
ELECTRON COUPLING

There seem to be many different ideas as to just what "electron coupling" really means. The author throws some light on this subject

John M. Borst

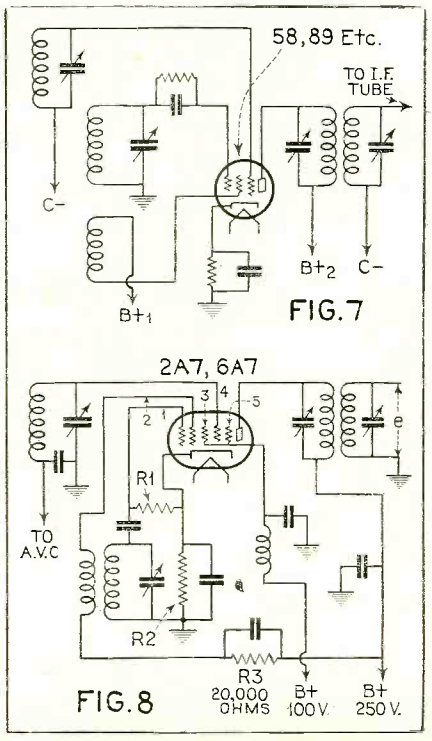






ELECTRON-COUPLING is really a misnomer. The radio industry has been familiar, so far, with three kinds of couplings: inductive, capacitive, and resistive coupling. In all three cases two circuits are so arranged that they have one impedance element in common. Therefore, the first circuit will react on the second circuit but, unfortunately, the second circuit will also react on the first one and will influence its tuning which is in most cases highly undesirable. In the so-called "electron coupling" the action works *only one way* and for this reason the word "coupling" may not be entirely correct, but for want of a better term it is in general usage.

When two circuits are coupled by means of an electron stream they can be so arranged that neither of them will influence the tuning of the other. In this lies the chief merit of this type of circuit. Another advantage is, that the amount of coupling does not vary with frequency. An example of an electron-coupled circuit is shown in Figure 1. This applies to the common problem of the superheterodyne, where a local oscillator must be coupled to the first detector tube without affecting the tuning of the first detector circuit. It can be seen that in Figure 1 this is accomplished because the only link to the oscillatory circuit is through the electron stream of the tube. It should be noted that the plate is statically shielded from the screen-grid circuit and therefore from the circuit which determines the frequency so that capacitive coupling between this oscillator circuit and the first-detector, grid-circuit does not exist. If both coils, that is, the oscillator coil and the first detector coil, are in separate shielded compartments then there should be no inductive coupling, either.



Unfortunately, in practice, it is not possible to make either type of shielding perfect, therefore electron-coupling does not always come unadulterated. Even in the circuit of Figure 1, the shield formed by the suppressor grid might be imperfect. The shields around the coils also might be imperfect. In addition there may be some stray coupling through leads, filament wiring, power supply, etc. These influences, however, are small and generally can be disregarded.

The circuits which are now employed in various type commercial receivers are not always true electron coupling; they are generally mixed with some other type of coupling which may have been done to gain some other advantage. For instance, in the circuit of Figure 2, which is employed in many successful superheterodynes, it will be seen that the oscillator circuit has become a Hartley circuit and the lower part of the coil (the tickler) is in the cathode circuit, in the screen circuit and in the plate circuit as well. Hence, since it is common to the grid circuit and the plate circuit, it forms a common impedance and there is inductive coupling between the plate and the control-grid circuit. How large this inductive coupling is and how much it will subtract from the benefits of electron coupling will depend on the constants in the circuit; in some cases it may be quite unimportant.

Another example of partial electron coupling is shown in Figure 3. This is the same as Figure 2 except that the suppressor grid—and therefore the electro-static shield—has been omitted. So, besides the inductive coupling just mentioned, there also is a small electro-static coupling between the plate circuit and the screen-grid or oscillator circuit.

The amount of impedance coupling in this case depends on the sizes of condensers and coils involved.

The test to determine whether coupling is truly electron-coupling or a mixture of electron-coupling and impedance-coupling is as follows: Does the alternating current in the plate circuit flow through any part of the circuit which determines the frequency? If it does, there also exists impedance coupling.

A disadvantage of electron-coupling is that it is not selective. By this we mean that any alternating current of any frequency, existing in the electron stream, will be carried over to the plate circuit and hence will be coupled to the first detector; the harmonics too. When the first detector is inductively coupled to the oscillator, the harmonics are small, compared to the fundamental, due to the large current of fundamental frequency in the tuned circuit. In that case one obtains a more favorable ratio between fundamental and harmonic. In a superheterodyne this effect can be remedied by having sufficient selectivity ahead of the first detector.

Electron-coupling is used in cases where it is imperative that circuits be coupled without either of them influencing the tuning of the other. For instance, this is the case in a circuit of a frequency-doubler in transmitters. A typical frequency doubler is illustrated in Figure 4. The tube employed could be any type of pentode which has its suppressor grid ending in an external terminal. In Figure 4 the cathode, control grid and the screen grid form a triode which may be made to oscillate—by means of a crystal, for instance. Suppose it is desired to couple the plate circuit to another tube in which it is desired to amplify only the second harmonic. A tuned circuit is inserted in the plate circuit of the oscillator and adjusted to the second harmonic. It is important that the adjustment of this second harmonic circuit must not influence the frequency of the master oscillator. As long as the only link is the electron stream, this desired condition will be attained. If the suppressor grid in Figure 4 were omitted, then there would exist a small capacity coupling between the tuned-plate circuit and the grid, as well as the screen-grid circuit, and they would mutually influence each other. If electron-coupling is not used, an extra "buffer-stage" becomes necessary.

One type of modulation system might be called "electron-coupled." This is illustrated in Figure 5. Instead of applying the audio frequency to the plate circuit (as in the Heising system) the audio amplifier is coupled to the screen circuit of a radio-frequency power-amplifier and therefore it acts directly on the electron stream. An advantage of this system, is that less power is required in the audio amplifier. We understand that it is impossible, with this type, to attain 100% modulation. If complete modulation is desired the audio component should be applied simultaneously to the plate and screen circuits in the same phase and in the proper ratio. This effect is attained by the use of a divider as shown in Figure 6.

When we consider the circuit of Figure 1, many will wonder why it would not be possible to employ the third grid for the coupling of the first detector circuit; in other words, to introduce the signal at the third grid making one tube do the work of two. If this were done, the circuit would become as shown in Figure 7. This circuit would be unsuccessful for the following reasons: There is capacity-coupling through the elements of the tube, between the plate-tuned circuit (tuned to the I. F.) and the signal-frequency circuit. There is also capacity coupling between the oscillator circuit and the first detector tuned circuit. The result is a loss of efficiency and interlocking of circuits. If we could electro-statically shield the various elements, then the converter tube would be complete and this has been done in the new pentagrid tube. The pentagrid tube, otherwise known under the name of 2A7, 6A7 and 1A6, contains five grids—as the name implies. Around the cathode are placed two concentric grids, which in conjunction with the cathode, form a small triode. This triode can be made to oscillate and the electron stream will then be modulated at the oscillator frequency. The remaining outer grids form a four-element tube which can be made to modulate the same electron-stream. In the plate lead is placed a tuned circuit (tuned to the intermediate frequency). The hook-up is shown in Figure 8. Due to the presence of grids three and five, which are connected together and form a screen, there is electro-static shielding between the three different circuits so that no interlocking takes place. This type of tube (*Continued on page* 443)

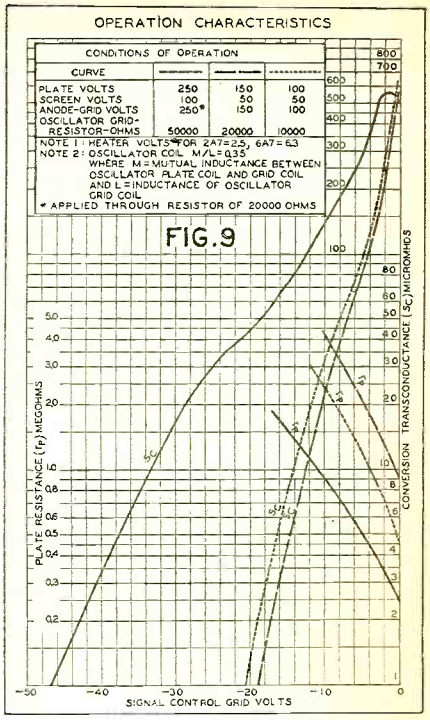


FIG. 9

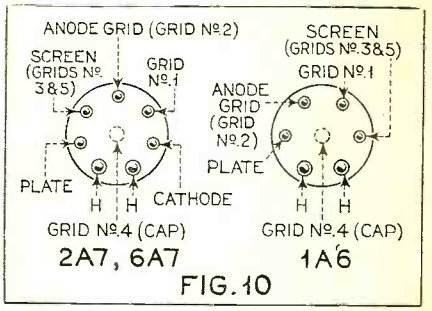


FIG. 10

	2A7	6A7	1A6	
Heater volts	2.5	6.3	2.0	
Heater amps.	0.8	0.3	0.060	
DIRECT INTERELECTRODE CAP. (APPROX.): (WITH SHIELD CAN)				
Grid 4 to Plate	0.5	0.5	0.25	
Grid 4 to Grid 2	0.25	0.25	0.2	
Grid 4 to Grid 1	0.15	0.15	0.1	
Grid 1 to Grid 2	1.4	1.4	0.8	
Grid 4 to all others (R.F. Input)	9.4	9.4	10.5	
Grid 2 " " " (Osc. Output)	6.1	6.1	6.0	
Grid 1 " " " (Osc. Input)	7.2	7.2	5.0	
Plate to all others (Mixer Output)	10.2	10.2	9.0	
Overall length	4 19/32" - 4 27/32"	4 19/32" - 4 27/32"	4 9/32" - 4 17/32"	
Max. diameter	1 9/16"	1 9/16"	1 9/16"	
Bulb	ST-12	ST-12	ST-12	
Base	Small 7-Pin	Small 7-Pin	Small 6-Pin	
CONVERTER SERVICE				
Plate voltage	250 Max.	250 Max.	180 Max.	
Screen voltage (Grids 3 & 5)	100 Max.	100 Max.	67.5 Max.	
Anode-grid (Grid 2), Volts	200 Max.	200 Max.	135 Max.	
Control-grid (Grid 4), Volts	-3 Min.	-3 Min.	-3 Min.	
Total cathode current, Ma.	14 Max.	14 Max.	9 Max.	
TYPICAL OPERATION				
Heater volts	2.5	6.3	2.0	2.0
Plate volts	250	250	135	180
Screen volts	100	100	67.5	67.5
Anode-grid volts	200	200	135	135
Control-grid bias, Volts	-3	-3	-3	-3
Osc.-grid (Grid 1) resistor, R1	50,000	50,000	50,000	50,000
Plate current, Ma.	4.0	4.0	1.2	1.3
Screen current, Ma.	2.0	2.0	2.5	2.4
Anode-grid current, Ma.	3.5	3.5	2.3	2.3
Osc.-grid current, Ma.	0.5	0.5	0.2	0.2
Plate resistance, Megohms	0.3	0.3	0.4	0.5
Conversion conductance, Micromhos	475	475	275	300
Conversion cond. at -22.5 V. on Grid 4	-	-	4	4
" " " -42.5 V. " " "	-	2	-	-
" " " -50 V. " " "	2	-	-	-
Total cathode current, Ma.	10.0	10.0	6.2	6.2

NEEDED RADIO INVENTIONS

Irving J. Saxl, Ph.D.

WITH a new year upon us, and based upon the background of a great array of new devices and methods which were made possible by the advanced radio techniques of the past year, dreams surge onward toward new possibilities which some lucky amateur may some day attain. RADIO NEWS often receives inquiries from men who believe they have found new things, from persons who feel that there is a definite need for certain inventions, and last but not least, from industries which are looking forward to new designs that will increase the range of radio and various electronic applications and will create profitable enterprises.

In the unbelievable development that the radio sciences have taken since James Clerk Maxwell wrote his first hypothetical formula more than sixty years ago, *full credit must be given to the amateur* who again and again in the development of this science has added valuable details, has discovered new laws, has improved equipment and has extended the range of the art far beyond the limits set for it by theorizing. The work of the amateur in this art must be praised to the highest degree, because it was primarily he who made of radio the *practical* thing of every-day life that it is today.

It was Marconi—himself an amateur at that time—who played with the Hertz transmitter coils, with coherers, and other equipment at the beginning of this century, and by persistent experimentation developed his improved system and finally succeeded in receiving signals across the Atlantic with his kite antenna system.

Again, after radio had developed considerably, particularly due to the urgent necessities of the World War, it was the amateur who gave a new and important impetus to broadcasting by introducing short-wave, long-distance communication—a communication which every sound mathematical theorist denied even as a distant possibility after the first successful investigations on long waves.

Time and again the amateur, unhandicapped by the possession of too much experience about unsuccessful previous attempts, free of interference in his endeavors by the knowledge of a thousand and one reasons why certain things should *not* be undertaken theoretically, has succeeded in his endeavors.

Naturally, these fundamental discoveries were followed by systematic, strictly scientific methods, and practically always it was proved that a perfection of the method was achieved only after a thorough and systematic scientific development. This development was often undertaken by the amateur himself after he had seen the far-reaching possibilities of his discovery and had seriously studied the general background upon which were based the effects that had to be isolated.

What are some of the most important (and reasonable) inventions needed at present in radio and its allied arts? Where can the experimenting amateur search for fertile territory? There is one field in particular that today seems to be very much in the same state as it was when Marconi entered the wireless field. Who will be the lucky amateur to develop a really successful method for practical Television or will the developments of the future be born first in the brain of a mathematical physicist?

The world is waiting for this optical illusion combined with radio transmission, and an enormous potential market awaits this problem if it can be solved economically.

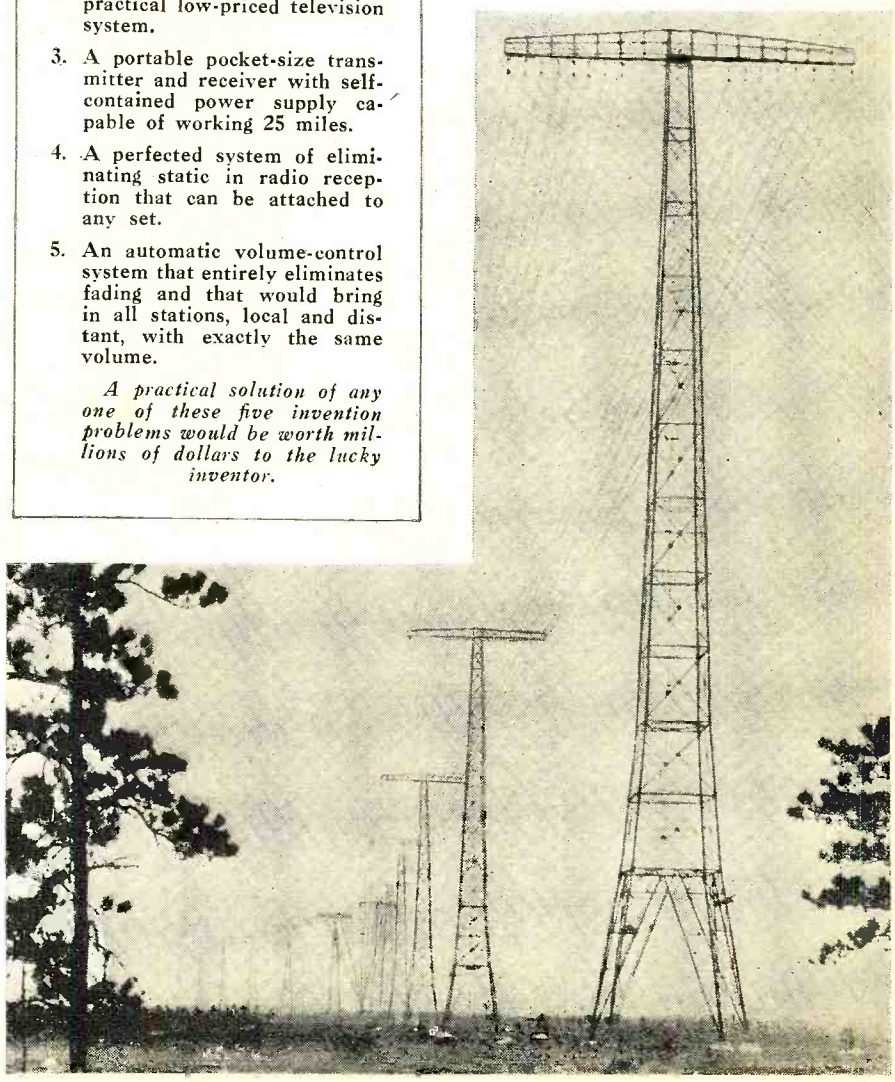
From the original Nipkow's disk to the Carolus wheel, from the Kerr-cell to Mihaly's spiral, from cathode ray receiving tubes to Zworykin's iconoscope—to mention only a few of the available devices—there is an enormous assembly of material. Perhaps by some lucky chance there will someday be devised a method to combine these materials in a home television receiver which will be commercially practical.

Will the modulation of the light intensities be made by a powerful light source of constant flux and with a valve like the Kerr-cell interposed? Will a new type of high powered gas filled lamp, similar to the newly developed CO_2 lamps, give a beam of modulated light directly? Will the cathode ray tube be the final answer?

Can You Invent These?

1. An entirely new and practical low-priced television system, or
2. A combination of known television ideas into a new and practical low-priced television system.
3. A portable pocket-size transmitter and receiver with self-contained power supply capable of working 25 miles.
4. A perfected system of eliminating static in radio reception that can be attached to any set.
5. An automatic volume-control system that entirely eliminates fading and that would bring in all stations, local and distant, with exactly the same volume.

A practical solution of any one of these five invention problems would be worth millions of dollars to the lucky inventor.



FOR ELIMINATING INTERFERENCE

Figure 1. Beam antenna system array for directional transmission at Radio Central, Rocky Point, L. I.

Many are the possibilities through which a solution of this problem of a practical television transmitter and receiver may be approached.

Will it be possible to simplify these systems and reduce their price and size so that they can be readily used in every-day homes? Will it be necessary to invent still more new methods? Will it be sufficient to combine present systems in some way unknown thus far in order to make a workable thing?

Another field in which we are still far from the hopes of the early technicians is the actually transportable, pocket-size sending and receiving unit, including its own current and voltage supply.

It is true that our radios, particularly those adapted principally for speech reproduction, are becoming smaller and smaller. A well-known manufacturer has recently brought out a *pocket-size* radio with a loudspeaker included.

When radio was first conceived, the ideal, that thinkers imagined, was a small box which could be carried in a pocket, and with which it was possible to communicate with any person in any part of the world at any time. Well, radio has made great strides forward, but we are still rather far from the hopes centered in this little magician's chest forty years ago. Who is going to do it?

But we must digress from hopes to the solution of some very definite problems that would have an immediate practical application, would be within the range of systematic development and which have not yet yielded to the systematic approach of the big development laboratories.

Of paramount importance is the problem of static. While we have progressed to a considerable extent in eliminating *man-made* static, the increased elimination of *natural* static is a problem that has not thus far yielded to the development in this science, and in which tremendous possibilities are buried if it can be solved.

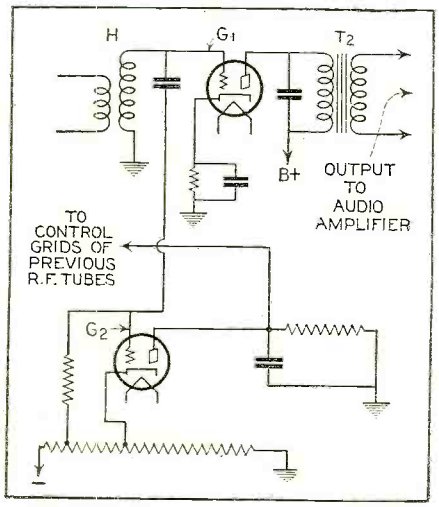
Of the many solutions undertaken for eliminating static efficiently without interfering with broadcasting, not one was completely successful. The methods which came closest to the solution of this problem were the use of directional antenna systems, sometimes several miles long, of the type used in long-distance telephony.

Figure 1 shows the two long-wave transmitting antennas of R. C. A. at Rocky Point, Long Island. Each of the long-wave antennas shown, is supported by six towers. Each antenna is 7,400 feet long. The towers are 410 feet high. The operating voltage is 130,000 volts at the antenna. In the ground beneath the antenna 450 miles of bare No. 10 copper wire is buried for a "ground".

Either of these antennas may be operated on a frequency of 18.2 KC or 18.8 KC by the Communications Company for radio-telegraph work. Either may also be tuned to a frequency of 60 kilocycles when used by the American Telephone and Telegraph Company for international telephone work.

DEAN OF INVENTORS

Guglielmo Marconi, center, standing with David Sarnoff, President of the R. C. A., at right, and E. T. Cunningham, of "tube" fame. Mr. Cunningham holds a replica of Marconi's famous kite with which he (Marconi) received the first wireless signals across the Atlantic. The kite was used to support a long antenna wire



AUTOMATIC VOLUME CONTROL

Figure 2. The fundamental circuit of present-day automatic volume controls that only partly justify the name. Can you improve on it?

Naturally, it is only the biggest companies who can afford to erect such gigantic systems.

While these systems are able to reduce static to a marked degree—sufficient for many practical applications—the real solution of this problem has not as yet been achieved. For the owner of a small station the erection of such huge and expensive antenna systems is out of the question. Who is going to develop a simple static eliminator?

Synonymous with the problem of static elimination is the problem of automatic volume control. It is not only background noise that interferes decidedly with the enjoyment of D. X. reception, but fading and multiple signals also detract considerably from the joy of long distance reception.

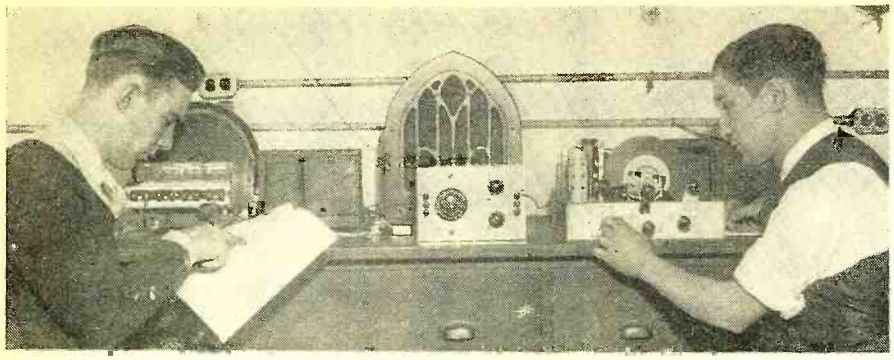
Automatic volume control can be achieved today to a certain extent. However, the present solution—the use of diversity antenna systems plus tube-controlled devices—is both expensive and not 100 percent effective.

The physical principles underlying automatic volume control—as far as the tube part within the receiving apparatus is concerned—are depicted in Figure 2.

The input radio frequency transformer, H, operates the grid, G_1, of the first detector tube. At the same time, a voltage is impressed upon the grid, G_2, of the volume-control tube. The internal resistance of the volume-control tube, G_2, is changed in proportion to the signal strength, and therefore the bias voltage of previous R.F. tubes is increased or decreased according to the fluctuations of the signal voltage. If the circuit constants are chosen properly, a constant output characteristic should be achieved—theoretically.

While there are a great number of

(*Continued on page* 437)



THE DX CORNER

FOR BROADCAST WAVES

BROADCAST-BAND DX fans have been urging an extension of the DX Corner to cover *their* interests as well as those of short-wave listeners. In response to this demand this new section of the DX Corner is being presented this month, for the second time, on a trial basis. If the response from readers, and their support, is such as to warrant its continuance, it will be established as a permanent monthly feature.

DURING the early morning hours of the first seven days of each month, the Federal Radio Commission requires that certain of the smaller stations be in operation so that their transmitting frequencies may be checked. The schedules of the transmissions, covering the first Monday and Tuesday of each month, are on page 420. Schedules for the other five days appeared in this department last month. Each of the stations goes on the air for 20 minutes, beginning at the time shown in the first column, and is required to announce its call letters every three minutes.

These schedules provide an excellent opportunity for DX'ers to log a large number of stations which normally cannot be heard due to blanketing by other stations operating on the same frequencies.

Reception in England

From F. R. Crowder of Leeds, Yorkshire, England, comes an interesting communication: "I have been prompted to write to you as I thought that perhaps a letter from a British reader might be of interest.

"I think that we in England have the advantage over the American listener because, with a good selective receiver, we can tune in a great number of continental stations. The average receivers used over here are four and five-tube sets and will bring in about thirty different programs.

"The receiver I am using, a nine-tube superheterodyne, will receive about ninety stations, at least fifty of program value, and, as nearly all European stations close down at midnight, G.M.T., we have the opportunity on a favorable night, of hearing U.S.A. stations on the broadcast band.

"I am just in receipt of my 12th verification for what one might term summer reception of U.S.A. stations (July to September). Such stations as WCAU, WPG, WTIC, WNAC, WBZ, WABC, etc., can be picked up here with ease on favorable nights. My best catches this summer are: XEAW, Reynosa, Mexico, and KSL, Salt Lake City, both verified.

"Most of the Argentine stations can be heard here all the year round."

DX Program

The International DX'ers Alliance announces that they have arranged for a special DX program to be put on the air from 2 to 4 a.m., on December 17th or 18th by station FQN of St. Pierre, Miquelon, Newfoundland. This station operates on 570 kilocycles, using 250 watts. Here is a chance for DX'ers to add another scalp to their collections.

"From Missouri"

C. H. Long of Winston, Missouri, reports that in his locality DX conditions improved somewhat during October, but to quote from his letter:

"Reception conditions on the broadcast band have improved in some respects in the last month. In addition to the stronger Australian and New Zealand stations, the Japanese stations can now be heard quite well when conditions are favorable. Static continues to be very troublesome except on a few occasions. In addition to the list of Australian and New Zealand stations given last month, the 10 kw. Japs are now being well received, including the new JOCK 2 on 1175 kilocycles."

International Time Conversion

A sliding-scale time converter which represents one of the handiest things of its kind that has come to the Editors' attention, is shown in the accompanying illustration. This device converts the time and date of any one country to that of any other, and converts any specified time, stated in G.M.T., to local standard time in all countries of the world, and vice versa. It indicates instantly, with no calculations, whether same day, day before or day after.

This scale was designed by W. H. Reeks, a well-known DX fan of Chicago, Illinois. It is made of a heavy special six-ply material which is tougher and stronger than bristol board and should last indefinitely. Further information may be obtained by addressing the Broadcast DX Corner, RADIO NEWS.

October DX in New York City

In and around New York City DX conditions do not seem to be picking up as rapidly as they did at this time a year ago. One reason has undoubtedly been the unusually warm weather that has continued more or less without a break right through the greater part of October. Conditions are a little unusual, too, in that some of the Midwestern stations, including such stations as WCCO, Minneapolis, and WBAP-WFAA, Texas, are coming in extremely well—well enough to be dependable from approximately 6 p.m. on (New York time), whereas the stations further west are as a rule not heard until the evening is well advanced.

KFI, which has always been used as an indicator of DX conditions by listeners here in New York, has not been well received recently. When it does come through, it is partially obscured by strong heterodynes caused by stations across the border working on split frequencies.

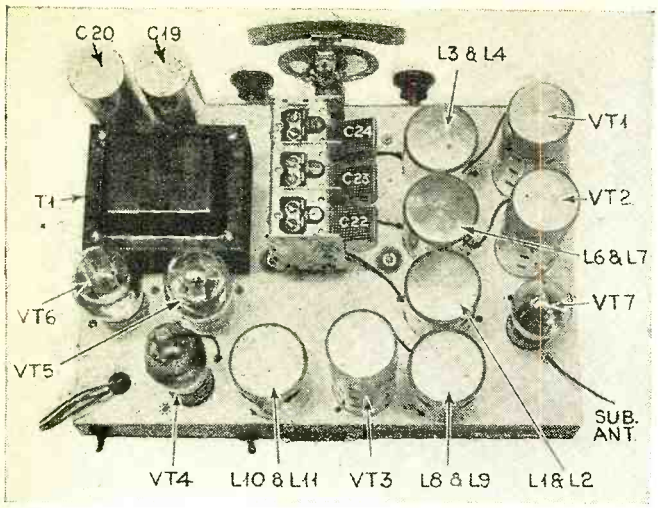
Transpacific Reception

Taken from reports submitted by Eugene S. Allen of Reedley, California: "On the broadcast band the Japanese stations are coming in strong during the morning hours from 2 to 5 a.m. The stations that come in good and their frequencies are as follows: JOIK, 830; JOCK, 810; JOHK, 770; JOBK, 750; XGOA, Nanking; China, 680; JFAK, Formosa, 670; JOAK, 870. Also, Japanese stations on 890 and 1090 kilocycles have been received. The above stations all have 10-kilowatt power and are received here with greater volume than the east coast 50-kilowatt stations. On the broadcast band I use a Bosch seven-tube receiver."

DX Clubs

Many readers of this department are members of DX clubs, but there are many others who do not belong to any organization. For the benefit of the latter the Editors will be glad to publish information concerning the various DX clubs now operating and will welcome such information from club executives. In sending information on your organization it is suggested that you include the name and mail address, membership requirements and annual dues. State what service the club renders to its members, size of present membership, whether it is a local, national or international organization, and whether its interest lies in broadcast-band reception, short-

(*Continued on page* 420)



BUILD THIS LOW-COST "SUPERHET"

Because of the low cost for the kit of parts this receiver should appeal to fans who like to "roll their own"

H. L. Shortt

Part Two

FEW people realize the extraordinary advances made during the past few years in overcoming the mechanical difficulties associated with amateur or home radio receiver construction.

In the early days of radio, the chief incentive to home set construction was the pleasure and knowledge to be gained from actually doing work of this nature. The early radio kits employed simple circuits, and in most cases it was an easy matter to get the set into some sort of working condition.

Nowadays, the picture has changed entirely. The present incentive to home set building, is to be able to obtain a finer performing "custom-built" receiver and to take advantage of all the newer developments in tubes, circuits and components which would not be obtainable in a factory-built set at least until the following season. An additional present-day incentive, and an important one, is the fact that the home-built set costs much less than the factory-built set of the same quality, due to elimination of distributor and dealer profits, as well as the sales tax which applies to completely built sets but not to parts.

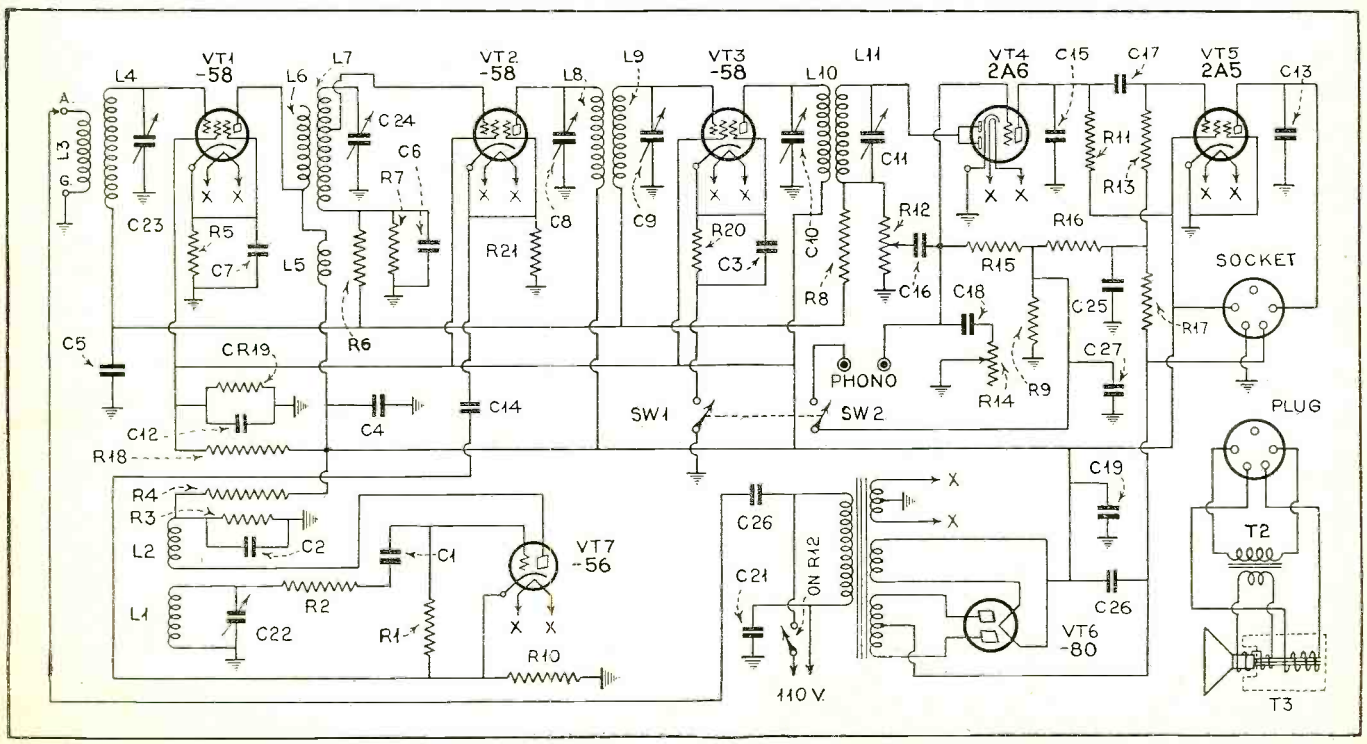
Modern circuits, however, are anything but simple, and for a time it seemed as though this one fact would prevent further development in the field of home construction.

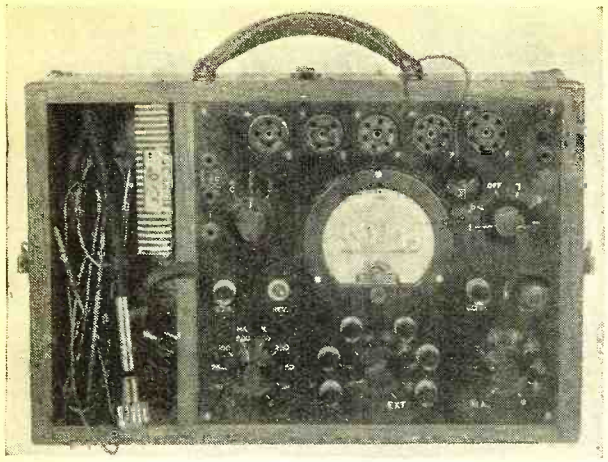
But the ingenuity of American radio engineers has overcome this difficulty completely. The modern seven-tube superhet kit, such as the Air-Marshall, is really easier to build than the four-tube battery job of former days. This seeming miracle has been accomplished through careful pre-design of the kit and through the furnishing of detailed instructions which leave nothing to the imagination.

To illustrate the above facts, refer to the schematic diagram shown herewith. Each specific symbol is identified by a descriptive "letter-number". The same "letter-number" is used to designate the component in the list of parts, so that the value or "constant" of the particular part is immediately discernible from the list. In addition to the photographs which show top and bottom views of the receiver, pictorial diagrams are given in the instruction pamphlets issued with the kit. These show the actual location of each and every part, with designations which correspond to those used in the list of parts and on the diagrams.

The power transformer and the I. F. transformers and other coils are color coded. Each lead coming from each of these parts is thus definitely marked, and the instructions tell exactly what the colors mean. Even tube socket terminals are carefully charted in special sketches. Hence, when wiring up a new tube socket such as the one used for the 2A6 diode-triode, one merely follows the clear directions given in the sketch. Guesswork is eliminated entirely.

The work of assembling the parts is really no work at all, for the chassis is furnished with mounting holes for every part. The parts are mounted in accordance with specific directions, and even the wiring follows a definite routine which reduces (*Continued on page* 443)





THE TESTER WITH COVER REMOVED

Considering the complete variety of tests for which it provides the controls are extremely simple. In appearance this unit leaves little to be desired

The "UTILITY-PLUS"

SERVICE TESTER

This service unit permits complete analysis of any circuit, including point-to-point resistance, point-to-point voltage, and all current tests. Hum and output tests are also provided for

Clifford E. Denton

THE analyzer described here was designed for any and all tubes to come. For this reason advantage was taken of the use of numbers to supplant element or prong designations. The meter looks through the tube or element as a number, and any value or kind of test can be applied to any number (element) using any other number as a reference point; i.e., gradient voltage, a.c. component, d.c. voltage, current, etc. The analyzer will take care of all present-day tubes, including those with 8 elements.

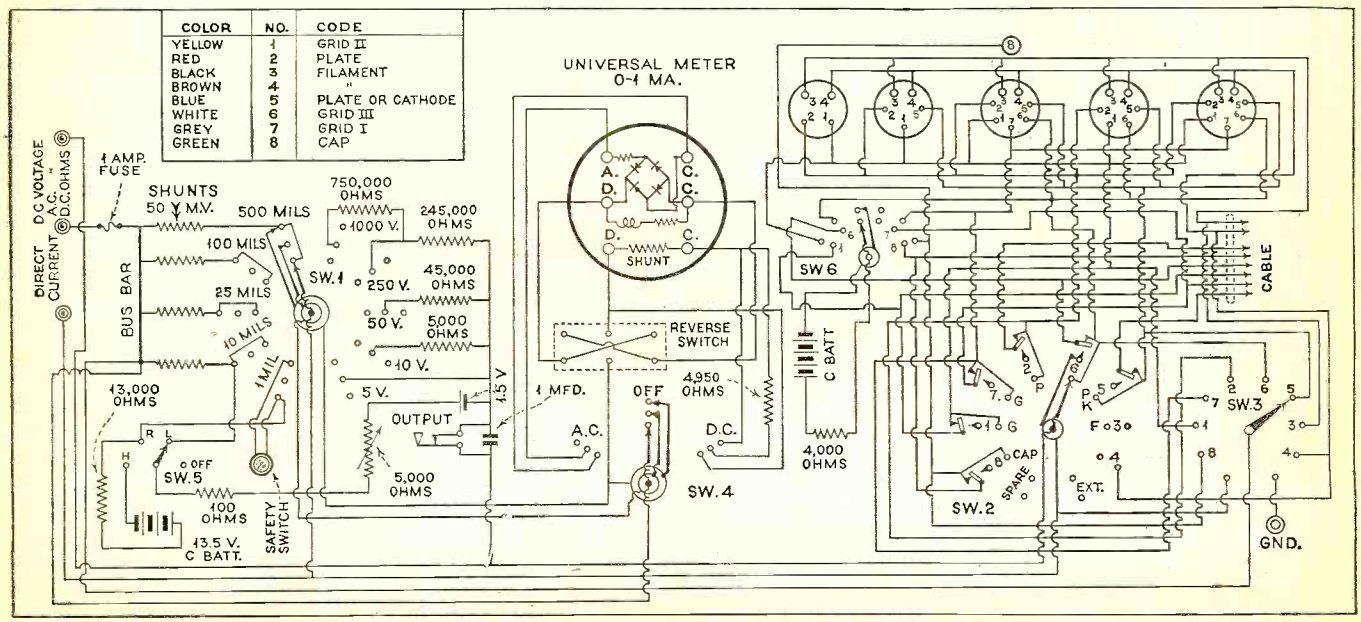
Spare contacts are provided so that as new elements are developed, or as one element of a tube is supplanted by another, the number system takes care of these innovations or changes, without complications or difficulties of any kind.

A genuine point-to-point resistance testing system can in most cases service a radio set without any external supply current. The resistance values for many receivers are readily available from service manuals, from manufacturers' data, or from trade magazines. Most servicemen are already acquainted with the most important resistance values of the various types of radio sets. By using this system of testing, it is possible in most cases to find the trouble after the usual preliminary inspection is made.

While the "Utility-Plus" Tester is primarily designed for making tests directly from the sockets of a radio receiver, three external connections are provided so that resistance or any other desired external test may be made as well. Five sockets are provided on the panel of the tester so that no complications in contacts may arise. Looking at the panel, the three main switches will be found at the bottom. The switch (SW1) at the lower left is the meter-control switch showing milliampere ranges on one side and voltage ranges on the other. The switch (SW2) at the center has number designations from 1 to 8, an "External Test" position, and one spare. Six of these are accompanied by current push-buttons. The "external" test position of this switch should be used while making measurements externally through the jacks provided at the upper left of the panel. The switch (SW3) at the extreme right, with numbers 1 to 8, is a reference point switch, and this is connected with the same contacts as switch SW2. Returning to the push-button above switch SW1 at the extreme left, this is marked "S. SW." This is the safety switch for the 1 ma. position of SW1. To the right of this is the regular toggle reversing switch, used in case the meter shows a reverse reading.

Above the reference switch at the extreme right, there are two switches; one of these is the switch marked COND. (condenser), which cuts in a series condenser when making output tests, or any a.c. component test, such as hum, etc. Be sure that this switch is in the short-circuiting position when making other tests. This is the "up" position. To the right is the ohmmeter switch, marked "Off. L. R. and H." Be sure to keep this switch "off" when the analyzer is in use. It is to be used only when the set current is off. "L" is the low resistance up to 10,000 ohms; "R" is the regular resistance up to 100,000 ohms; "H" is for the 0-1 meg. range. Use the 1 ma. position of SW1 for "R" and "H" and the 10 ma. position for "L" or 10,000-ohm range. Above this

FIGURE 1. THE CIRCUIT DIAGRAM



ohmmeter switch is the rheostat to adjust all ranges to zero.

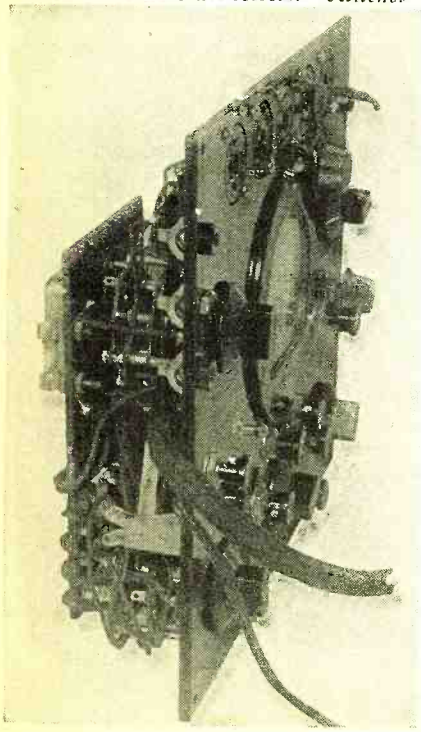
There is another switch at the left of the panel and directly to the right of the three external jacks. This switch, SW4, is marked "A.C." "OFF" and "D.C." and its purpose is self-evident. There is an external jack on the panel, above the ohmmeter rheostat, marked "G." This is to be connected to any desired point on the chassis of the radio set, or ground, for point-to-point testing. Switch SW6, below the two right-hand sockets, is for inserting any desired voltage in any of the grids used for transconductance testing of tubes.

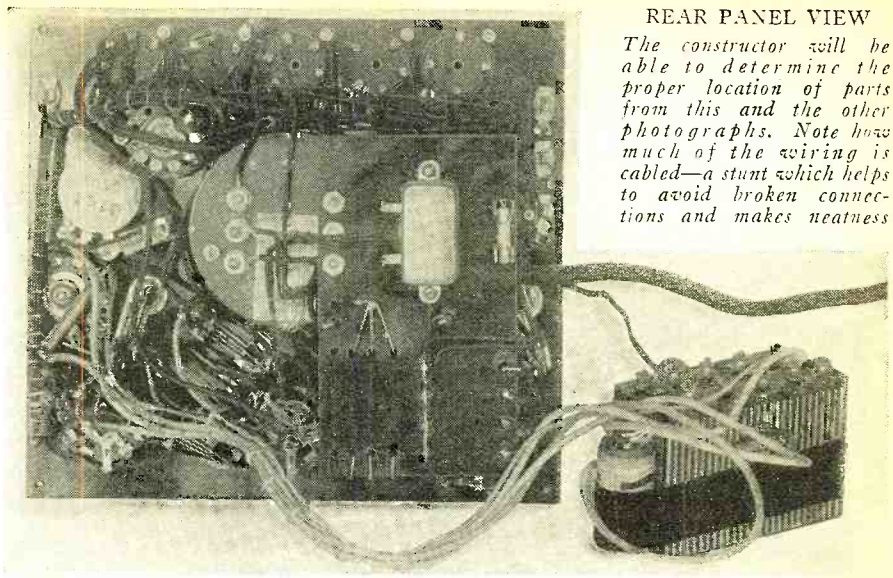
It is suggested that the code numbers from 1 to 8 be memorized. These are shown on the table accompanying the schematic diagram, Figure 1. This Analyzer is connected to the set in the usual way.

See that the a.c.-d.c. switch is properly set. From now on all ordinary tests will be performed using SW1 to control meter ranges, SW2 to select the circuit and SW3 for the reference point. Suppose a plate reading is necessary, set SW1 at 1000 volts, SW2 at point 2 (plate) and SW3 at point 5 (cathode) thus your voltage from plate to cathode. If the a.c. component is desired set the a.c.-d.c. switch for a.c. and adjust the voltage range necessary on SW1. Then with the condenser switch in, a.c. hum, output and many other tests can be made for voltage readings. Current readings will be made by setting SW3 on "MA." and pressing the button indicated on SW2. Bring the ranges to suit on SW1. Another method of measuring current is to set SW2 and SW3 on the same points, then press the corresponding push button at SW2. The same operation can be completed for all elements of any tube.

A SIDE VIEW

The shunts and multipliers are mounted on a small sub-panel below the a.c.-d.c. and scale-selector switches





REAR PANEL VIEW

The constructor will be able to determine the proper location of parts from this and the other photographs. Note how much of the wiring is cabled—a stunt which helps to avoid broken connections and makes neatness

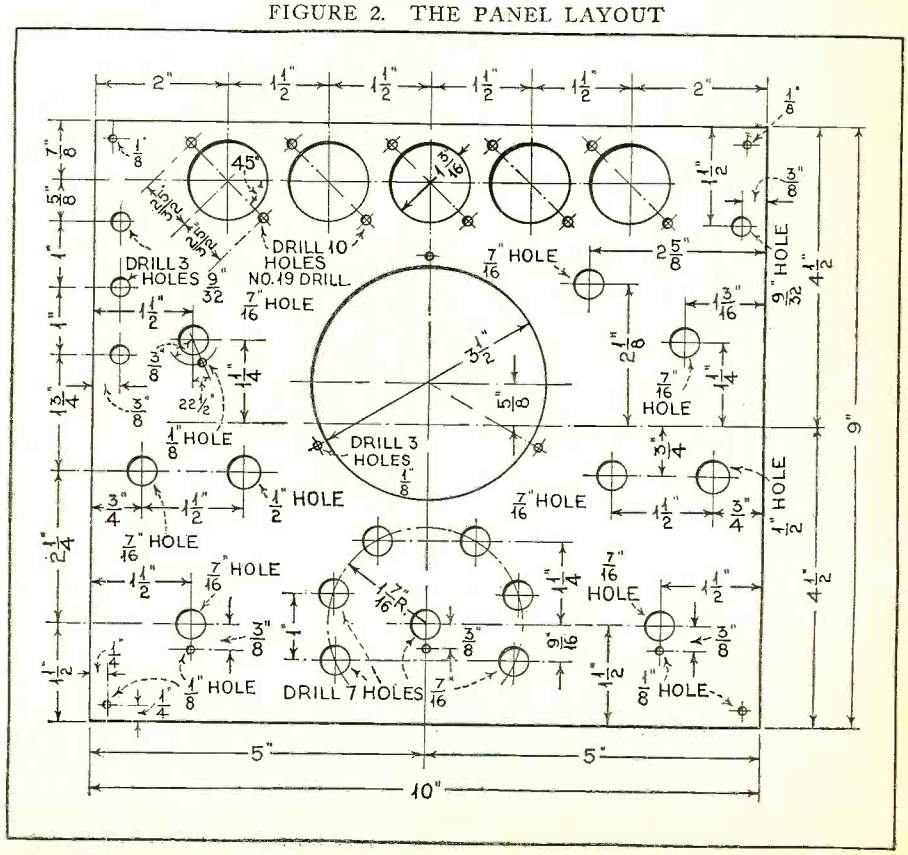
SW6, in making transconductance tests, is employed. Points marked 1, 6, 7 and 8 are to be used for a conductance test. They merely connect a variable biasing voltage (5540 Burgess C battery and 4000 ohms resistance, secured in the tool chest compartment) in series with any grid lead.

This test is a very important one and represents the last word in tube checking due to the fact that any voltage can be inserted in any grid circuit. The plate or other current readings for this test are made in the usual way.

By using circuit selector switch, SW2 and reference point switch, SW3, setting SW2 to point 4, and SW3 to position 4, 5 or "ground" connection from the external jack (marked G on the panel) it is possible to make hum tests, using a low voltage range and pressing the condenser button, and setting for a.c. on the a.c.-d.c. switch. This being an example of a.c. component or hum. Output measurements can be made from any point to any other point just by cutting in this condenser and setting the switches. Be sure to close this switch when returning to other measurement.

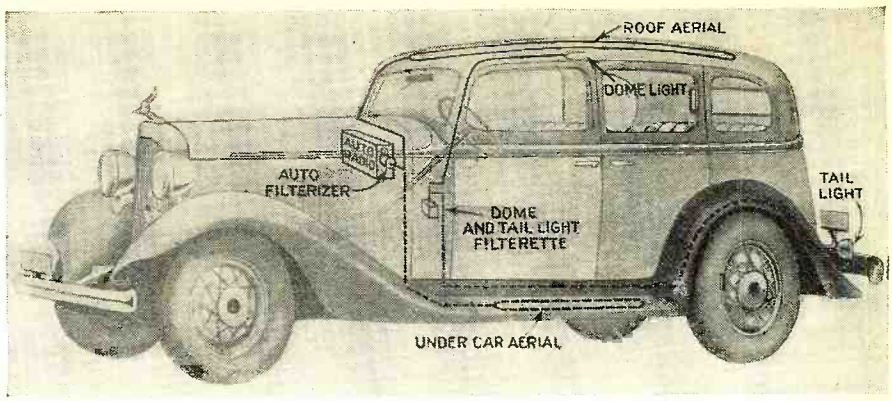
The Bakelite panel is available, engraved and drilled for mounting the various parts. The meter and the sockets are mounted first; the four prong red socket is mounted at the left, next the five prong green socket, next the 6 prong blue socket, next the medium size orange 7 prong socket and finally the large orange 7 prong socket. Next the three jacks are mounted to the left with the red jack (*Continued on page* 431)

FIGURE 2. THE PANEL LAYOUT



SUPPRESSING AUTO RADIO NOISE

Glenn Browning



DURING the last few months the sale of the auto radio has been increasing by leaps and bounds and as a result there has been an increasing demand for some device which will reduce, or eliminate, the interference caused by the car's electrical system. It is true, of course, that spark plug resistors reduce this interference but even with such devices some radio installations are noisy when the motor is running. As the public demand for quiet reception from the auto radio increased engineers of the Tobe Deutschmann Corporation started a systematic study on the problem.

It was found that with ordinary spark plug resistors such as are usually furnished with the auto receiver, the ignition interference drops off very rapidly as the distance is increased between the radio pick-up and the spark plugs. Figure 1 shows the results of measurements taken where noise in microvolts plotted against distance between the spark plugs and the radio antenna.

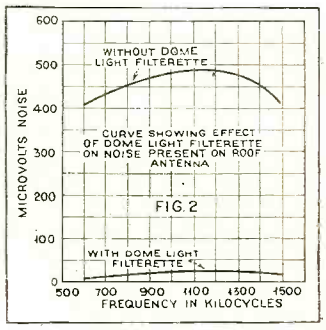
The data shown in Figure 1 gives the fundamental facts upon which are based the methods developed for reducing spark plug and ignition noise; for in most cars the antenna proper is at least four feet away from the engine and in many cases is farther. In such cases the lead-in which is usually within a foot of the engine picks up about 80% of the noise which is heard in the loud speaker. Not only is the lead-in from the antenna close to the source of interference but it is also close to the wiring of the car, which in turn picks up the noise and transmits it to any conductors sufficiently near to be in the magnetic field.

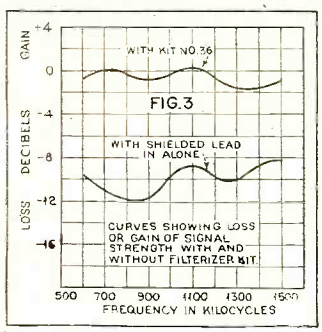
A study of these coupling effects between the car wiring and the pick-up for the radio set gave data which at first was very surprising until complete analysis bore out the measurements. An auto with a roof antenna already installed was chosen. The lead-in in the front of the car was disconnected at the antenna proper and a very short lead-in was taken off the back of the antenna and connected to a portable radio set located on a plane with the top of the car where the set and lead-in would both be at least as free from interference as the antenna itself. The receiver used was a special type equipped for accurately measuring the magnitude of noise received. Spark plug suppressors were used as well as the other usual devices which are recommended to minimize interference. From the measurements previously taken the interference, with the engine running, should have been a maximum of 15 microvolts per meter, for the pick-up device and lead-in was at least eight feet from the engine. However, the measurements showed some 450 microvolts of noise. Checking back showed that something was wrong. A wire ran to a dome light in the car and was within about six inches of the roof antenna. Disconnecting this dome light wire at the dash and grounding it proved conclusively that *it* was transmitting the noise to the antenna.

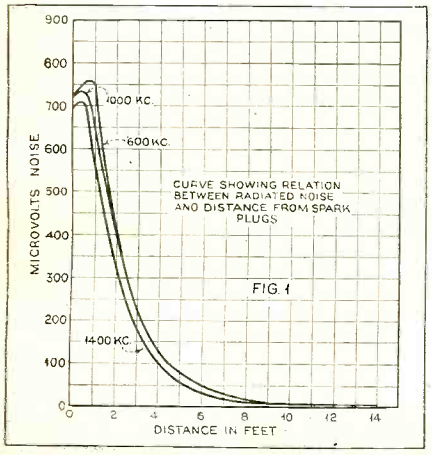
As a consequence work was started on a suitable dome light filterette which would take out the noise and at the same time not dim the light. How well this filter does its work is shown by Figure 2, which shows the interference under the conditions outlined above with and without this filter.

Having thus found out some actual facts, with figures to back them, concerning interference in auto radio receivers it remains to design a suitable system which is practicable. The interference picked up by the lead-in can be eliminated by shielding the lead-in and grounding it to the chassis of the car. Unfortunately, when this is done the signals input to the receiver drop off because of the by-passing effect of the capacity of the lead-in. With even ten feet of shielded lead-in, signals are reduced from 8 to 12 decibels, as shown by Figure 3. Consequently, it is necessary to design an impedance matching transformer. This transformer should match the impedance looking into the receiver and at the same time the shielded lead connected to the transformer should match the impedance of the car antenna.

(*Continued on page* 427)

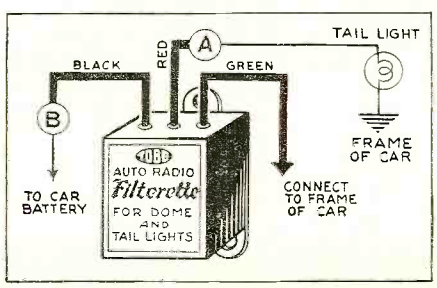


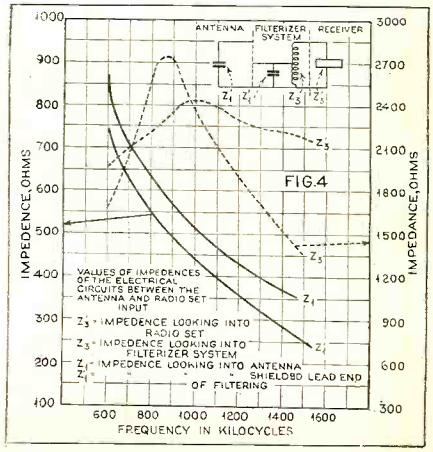




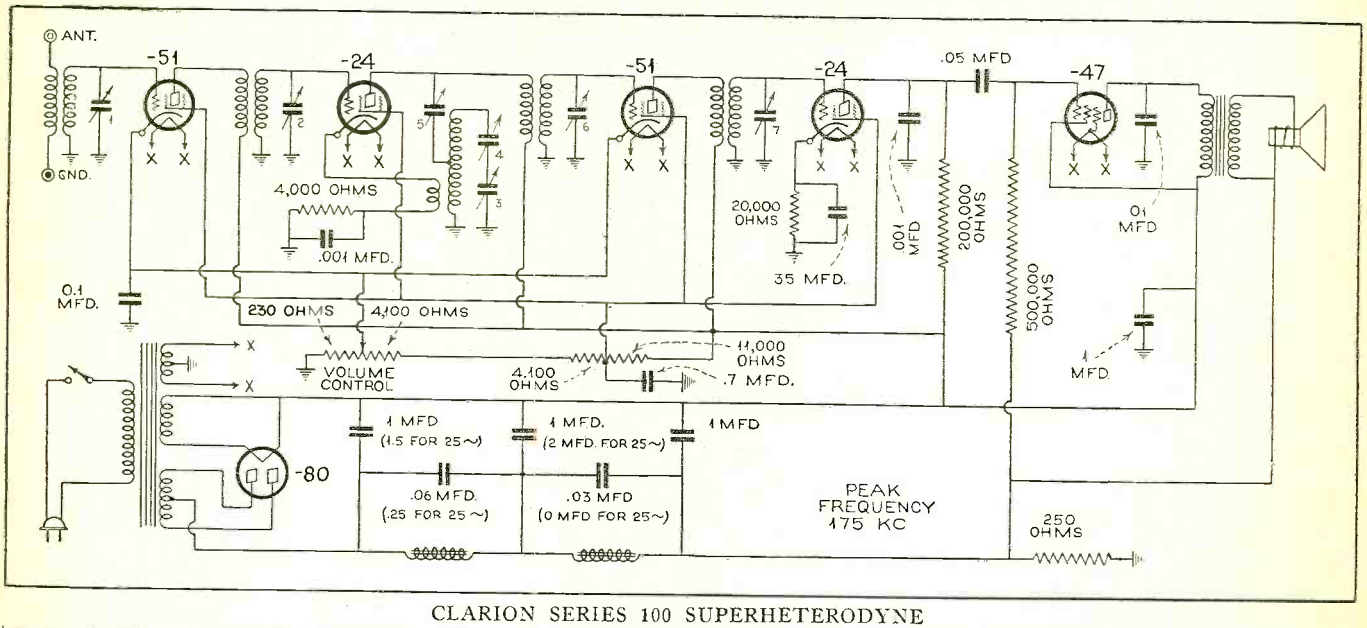
DOME AND TAIL LIGHT FILTER

Below is shown a filterette to be used in the automobile radio installation to take out ignition noises from the lighting wiring that might communicate itself to the antenna circuit

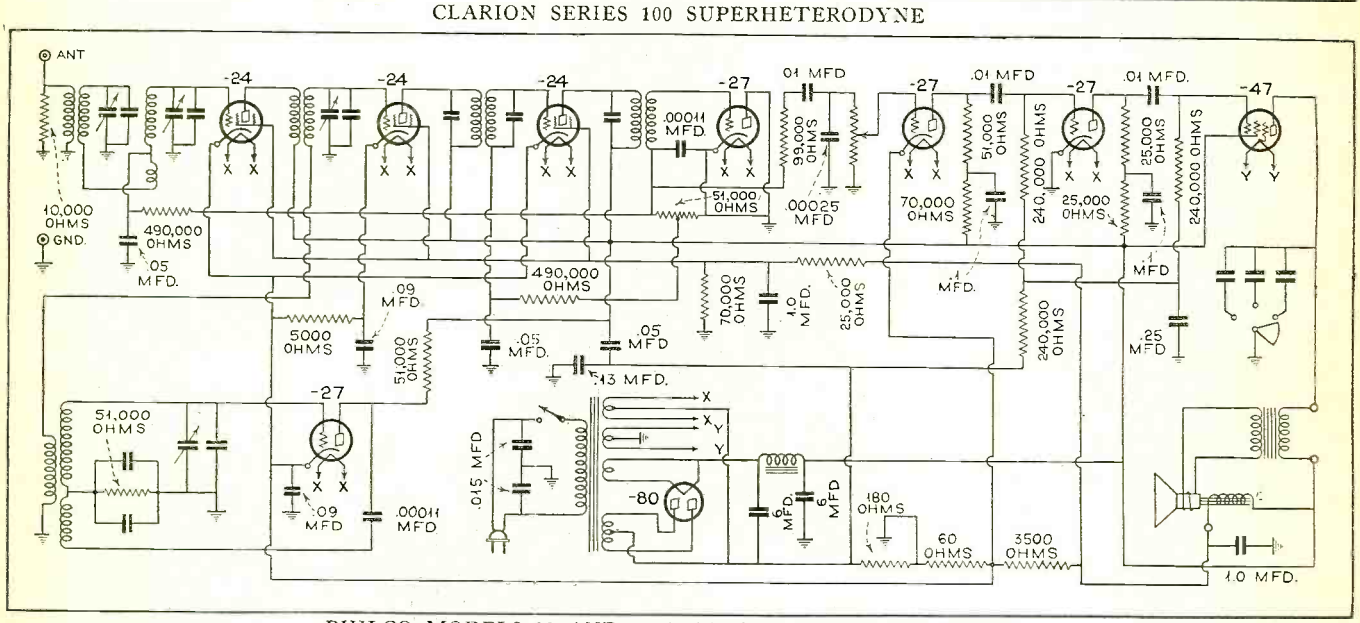




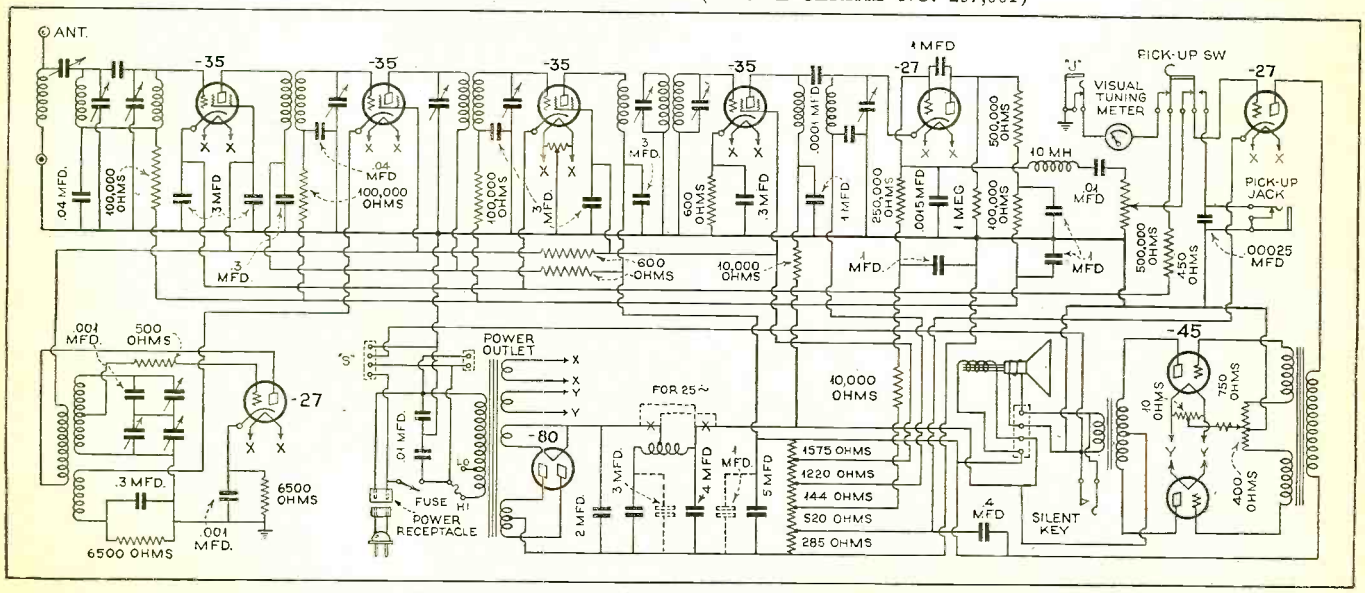
Service Data for Servicemen



CLARION SERIES 100 SUPERHETERODYNE



PHILCO MODELS 90 AND 90-A (ABOVE SERIAL NO. 237,001)



STROMBERG-CARLSON MODEL 22-A SUPERHETERODYNE

Compiled from J. F. Rider's Perpetual Trouble Shooter's Manual.

S. W. TIME SCHEDULE

RECEPTION REPORTS

IN this tenth installment of the DX Corner we have listed a time schedule of Short-Wave Best Bets, a list of stations logged during the past month at the RADIO NEWS Short-Wave Listening Post in Westchester County, New York, and at other Official R. N. Listening Posts throughout the world. The schedule includes only the best received stations, hourly, from 5 o'clock in the morning to 12 midnight, E.S.T. Space has been left for filling in local time. Space has also been left opposite the call letters for your own dial settings for each station you pick up. Unless otherwise noted, stations are heard daily.

Short-Wave "Best Bets"

Wavelengths in Meters	*Call Letters*	*Dial Settings*
10 G.M.T. 5 A.M. E.S.T.		**Local Time**
19.8+	HVJ	
30.5	J1AA	
31.2+ Sun.	VK2ME	
31.5 Wed., Sat.	VK3ME	
70.2	RV15	
11 G.M.T. 6 A.M. E.S.T.		**Local Time**
19.7	DJB	
25.5	DJD	
30.5	J1AA	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5 Wed., Sat.	VK3ME	
49.4+ Irregular	W8XAL	
70.2	RV15	
12 G.M.T. 7 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
16.9	GSG	
19.6	FYA	
19.7	DJB	
23.3+ Sun.	CNR	
25.3	GSE	
25.5	DJD	
25.5+ Irregular	PHI	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8	PLV	
49.4+ Irregular	W8XAL	
70.2	RV15	
13 G.M.T. 8 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
16.9	GSG	
19.6	FYA	
19.7	DJB	
23.3+ Sun.	CNR	
25.3	GSE	
25.5	DJD	
25.5+ Irregular	PHI	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8+	PLV	
35.5 Irregular	PRAG	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	OXY	
49.9+	VE9DR	
70.2	RV15	
14 G.M.T. 9 A.M. E.S.T.		**Local Time**
16.9+	W8XK	
19.6	FYA	
19.7	DJB	
19.8	GSF	
25.3	GSE	
25.5	DJD	
25.5+ Irregular	PHI	
25.6 Except Sun.	VE9JR	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8+	PLV	
35.5 Irregular	PRAG	
49.0 Except Sat.Sun	VE9HX	
49.1+ Sun.	YV1BC	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9+	VE9DR	
15 G.M.T. 10 A.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8+	W3XAL	
19.6	FYA	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
19.8	GSF	
25.3	GSE	
25.5	DJD	
25.5+ Irregular	PHI	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.8+	PLV	
45.3	RV72	
49.0+ Ex. Sat., Sun	VE9HX	
49.1+ Sun.	YV1BC	
49.2	VE9GW	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9+	VE9DR	
16 G.M.T. 11 A.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
23.3	HJ1ABB	
25.2	FYA	
25.3	GSE	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Except Sun.	VE9JR	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
40.5 Except Sun.	HJ3ABD	
45.3	RV72	
49.0+Exc.Sat.,Sun.	VE9HX	
49.1+ Exc. Sun.	YV1BC	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9	VE9BJ	
49.9+ Except Sun.	VE9DR	
17 G.M.T. 12 Noon E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
23.3	HJ1ABB	
25.2	FYA	
25.3	GSE	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Sat.	VE9JR	
31.2+	W3XAU	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
40.5 Ex. Sun.	HJ3ABD	
45.3	RV72	
49.0+ Ex.Sat.,Sun.	VE9HX	
49.1+ Except Sun.	YV1BC	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Sun.	UOR2	
49.9	VE9BJ	
49.9+	VE9DR	
18 G.M.T. 1 P.M. E.S.T.		**Local Time**
13.9+	W8XK	
16.8	W3XAL	
19.7	W8XK	
19.7	DJB	
25.2	FYA	
25.5 Irregular	DJD	
25.5	GSD	
25.6 Sat.	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3+	W1XAZ	
31.5	GSB	
45.3	RV72	
49.1+ Exc. Sun.	YV1BC	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Temporary	OXY	
49.9+	VE9DR	
19 G.M.T. 2 P.M. E.S.T.		**Local Time**
16.8	W3XAL	
19.5 Ex.Tu.Th.Sat.	W2XAD	
19.7	W8XK	
25.2	FYA	
25.3	I2RO	
25.3+	W2XE	
25.5 Irregular	DJD	
25.5	GSD	
25.6 Ex.Sat.,Sun.	VE9JR	
30.4 Sat	EAQ	
31.2+	W3XAU	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
37.3+ Sun.	CNR	
45.3	RV72	
49.1+ Sun.	YV1BC	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Tues.	UOR2	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.2+	HVJ	
20 G.M.T. 3 P.M. E.S.T.		**Local Time**
16.8 Except Sat.	W3XAL	
19.5+Ex.Tu.Th.Sat	X2XAD	
19.7	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5 Irregular	DJD	
25.5	GSD	
25.6	FYA	
25.6 Ex. Sat., Sun.	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
37.3 Sun.	CNR	
45.3+ (chimes)	RV72	
49.1+ Sun.	YV1BC	
49.1+ Sat.	W3XAL	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Tues.	UOR2	
49.5 Temporary	OXY	
49.6+ Sun.	W1XAL	
49.9	VE9DR	
50.0	RV59	
21 G.M.T. 4 P.M. E.S.T.		**Local Time**
19.7	W8XK	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	DJD	
25.5	GSD	
25.6	FYA	
31.2+	W3XAU	
31.3+	W1XAZ	
31.3	DJA	
31.5+	GSB	
37.3 Sun.	CNR	
46.7 Fri.	W3XL	
48.8+	W8XK	
49.1+ Sun.	YV1BC	
49.1 Except Sat.	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.0	RV59	
22 G.M.T. 5 P.M. E.S.T.		**Local Time**
16.8 Except Sat	W3XAL	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	GSD	
26.8+ Tues., Thurs	CT3AQ	
30.4	EAQ	
31.2+ Tues., Fri.	CT1AA	
31.2+	W3XAU	
31.3 Sat.	HBL	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
38.4+ Sat.	HBP	
45.0+ Sun.	HC2RL	
46.6+ Fri.	W3XL	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Except Sun.	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5 Temporary	OXY	
49.8	DJC	
49.9	VE9DR	
50.0	RV59	
50.6 Irregular	HJ4ABE	

23 G.M.T. 6 P.M. E.S.T.		Local Time
25.2	W8XK	
25.6	FYA	
26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.2+ Tues., Fri.	CT1AA	
31.3 Sat.	HBL	
31.3	GSC	
31.3+	W1XAZ	
31.3+ Irregular	DJA	
31.4+	W2XAF	
38.4+ Sat.	HBP	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2	VE9GW	
49.3+	W9XAA	
49.4+ Sun.	W8XAL	
49.5+	GSA	
49.5 Temporary	OXY	
49.8	DJC	
49.9+	VE9DR	
50.6 Tu., Th., Sat.	HJ4ABE	

00 G.M.T. 7 P.M. E.S.T.		Local Time
25.2	W8XK	
25.5	GSD	
25.6 Except Sun.	VE9JR	
25.6	FYA	
30.4 Sat.	EAQ	
31.3	GSC	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
45.6+ Fri.	W3XL	
48.5	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Ex. Sat., Sun	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.5+	GSA	
49.8	DJC	
49.9	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Ex. Wed., Sun.	HJ4ABE	

01 G.M.T. 8 P.M. E.S.T.		Local Time
25.2	W8XK	
25.6	FYA	
25.6 Except Sun.	VE9JR	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
40.5+ Except Sun.	HJ3ABD	
45.0+ Sun.	HC2RL	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
48.5+	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1 Except Sat.	W9XF	
49.2	VE9GW	
49.3+ Sun.	W9XAA	
49.4	CP5	
49.4+	W8XAL	
49.4+	W3XAU	
49.8	DJC	
49.9+	HIX	
49.9+	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Mon.Wed.Fri.	HJ4ABE	
73.0+ Except Mon.	HCJB	

02 G.M.T. 9 P.M. E.S.T.		Local Time
25.2	W8XK	
25.6	FYA	
25.6 Except Sun.	VE9JR	
31.3+ Irregular	DJA	
31.3+	W1XAZ	
31.4+	W2XAF	
40.5+ Except Sun.	HJ3ABD	
45.0+ Tues.	HC2RL	
45.2+	Quito	
45.3 Thurs.	Prado	
46.5	HJ1ABB	
46.6+ Fri.	W3XL	
48.5+	TGW	
48.7	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4	CP5	
49.4+	W8XAL	
49.4+	W3XAU	
49.8 Irregular	DJC	
49.9+	HIX	
49.9+	VE9DR	
50.4 Irregular	HJ2ABA	
50.6 Mon.Wed.Fri.	HJ4ABE	
73.0 Except Mon.	HCJB	

03 G.M.T. 10 P.M. E.S.T.		Local Time
25.6	FYA	
25.6 Sat.	VE9JR	
31.0	T14NRH	
31.2+	XETE	
31.3+	W1XAZ	
31.4+	W2XAF	
40.5+ Except Sun.	HJ3ABD	
45.0+ Tues.	HC2RL	
45.2	Quito	
45.3 Thurs.	PRADO	
46.6+ Fri.	W3XL	
48.5	TGW	
48.8+	W8XK	
49.0	W2XE	
49.0+ Sat., Sun.	VE9HX	
49.1+ Sat.	W3XAL	
49.1+	YV1BC	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.4	CP5	
49.4+	W8XAL	
49.4+	W3XAU	
49.9+	HIX	
49.9+	VE9DR	
50.6 Mon.Wed.Fri.	HJ4ABE	

04 G.M.T. 11 P.M. E.S.T.		Local Time
25.6	FYA	
25.6 Sat.	VE9JR	
31.2+	XETE	
31.3+	W1XAZ	
45.0 Fri.	TGW	
45.0+ Tues.	HC2RL	
45.2	QUITO	
46.6+ Fri.	W3XL	
48.8+	W8XK	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Except Sun.	VE9GW	
49.4+	W8XAL	
49.4+	W3XAU	
49.9+	VE9DR!	

Station Locations

Wavelength	Call Letters	Location
13.9+	W8XK	Pittsburgh, Pa.
16.8+	W3XAL	Bound Brook, N. J.
16.8+	PHI	Huizen, Holland
16.9	GSG	Daventry, England
19.5	W2XAD	Schenectady, N. Y.
19.6	FYA	Pontoise, France
19.6+	W2XE	New York, N. Y.
19.7	W8XK	Pittsburgh, Pa.
19.7	DJB	Zeesen, Germany
19.8	GSF	Daventry, England
19.8	HVJ	Vatican City
23.3	CNR	Rabat, Morocco
25.2	FYA	Pontoise, France
24.2	W8XK	Pittsburgh, Pa.
25.3	GSE	Daventry, England
25.3+	W2XEJ	New York, N. Y.
25.4	I2RO	Rome, Italy
25.5	GSD	Daventry, England
25.5	DJD	Zeesen, Germany
25.6	FYA	Pontoise, France
25.6	VE9JR	Winnipeg, Canada
26.8+	CT3AQ	Funchal, Madeira
30.4	EAQ	Madrid, Spain
31.0	T14NRH	Heredia, Costa Rica
31.2+	XETE	Mexico City
31.2+	W3XAU	Philadelphia, Pa.
31.2+	VK2ME	Sydney, Australia
31.2+	CT1AA	Lisbon, Portugal
31.3	HBL	Geneva, Switzerland
31.3	GSC	Davzntry, England
31.3+	W1XAZ	Springfield, Mass.
31.3+	DJA	Zeesen, Germany
31.3+	W2XAF	Schenectady, N. Y.
31.5	VK3ME	Melbourne, Australia
31.5+	YV3BC	Caracas, Venezuela
31.5+	GSB	Daventry, England
31.8+	PLV	Bandoeng, Java
35.5	PRAG	Porto Alegre, Brazil
37.3	CNR	Rabat, Morocco
38.4+	HBP	Geneva, Switzerland
39.4	X26A	Nuevo Laredo, Mexico
40.5+	HJ3ABD	Bogota, Col.
45.0+	HC2RL	Quayaquit, Ecuador
45.3	RV72	Moscow, Russia
45.2		Quito, Ecuador
45.3	PRADO	Riobamba, Ecuador
45.3+	REN	Moscow, U. S. S. R.
46.5	HJ1ABB	Barranquilla, Colombia
46.7	W3XL	Bound Brook, N. J.
48.5	TGW	Guatemala
48.7	YV3BC	Caracas, Venezuela
48.8+	W8XK	Pittsburgh, Pa.
49.0	W2XE	New York, N. Y.
49.0+	VE9HX	Halifax, N. S.
49.1+	YV1BC	Caracas, Venezuela
49.1+	W3XAL	Bound Brook, N. J.
49.1+	W9XF	Chicago, Ill.
49.2	VE9GW	Bowmanville, Can.
49.3+	W9XAA	Chicago, Ill.
49.4	CP5	La Paz, Bolivia
49.4+	W8XAL	Cincinnati, Ohio
49.5	UOR2	Vienna, Austria
49.5	W3XAU	Philadelphia, Pa.
49.5	OXY	Skamleback, Denmark
49.6	GSA	Daventry, England
49.6+	W1XAL	Boston, Mass.
49.8	DJC	Zeesen, Germany
49.9	VE9BJ	New Brunswick, Can.
49.9+	HIX	San Domingo, Haiti
49.9+	VE9DW	Montreal, Can.
50.0	RV59	Moscow, U. S. S. R.
50.0+	HVJ	Vatican City
50.4	HJ2ABA	Tunja, Colombia
50.6+	HJ4ABE	Medellin, Colombia
70.2	RV15	Khabarovsk, Siberia
73.0	HCJB	Quito, Ecuador

Official RADIO NEWS Listening Post Observer Appointments

Listed below by states and countries are the official RADIO NEWS Short-Wave Listening Post Observers who are serving conscientiously in logging stations for the DX Corner. This information is combined in this month's log with the results obtained in our Westchester Listening Post.

Alabama, J. E. Brooks; *California,* C. H. Canning; *Florida,* E. M. Law, James F. Dechert; *Georgia,* C. H. Armstrong; *Illinois,* Robert L. Weber; *Indiana,* J. R. Flannigan; *Maine,* R. I. Keeler; *Massachusetts,* Arthur Hamilton, Roy Sanders; *Mississippi,* Dr. J. P. Watson; *Missouri,* C. H. Long; *New Jersey,* William Dixon, R. H. Schiller, William F. Buhl; *New York,* Donald E. Barne, I. H. Kattell; *North Carolina,* H. O. Murdoch, Jr., W. C. Couch; *Ohio,* R. W. Evans, C. H. Skatzes; *Oregon,* Glenn E. Dubbe; *Pennsylvania,* K. A. Staats, C. T. Sheaks, George Lilley, John A. Leininger, F. L. Stitzinger; *Tennessee,* Adrian Smith; *Virginia,* D. W. Parsons; *Washington,* Chas. G. Payne; *Wisconsin,* Willard M. Hardell; *Canada,* A. G. Taggart, W. H. Fraser, Douglas Wood; *Cuba,* Frank H. Kydd; *England,* Donald Burns.

Applications for Official Observers in the remaining states should be sent in immediately to the DX Corner. Listeners outside of the United States who feel that they would like to serve in this capacity are also requested to file their applications as soon as possible before final appointments are made.

Reception Conditions This Month

The outstanding reception results are being obtained, now, on the 49-meter band, although at intervals a few stations on the 25 and 31-meter bands show surprising stability and signal strength. The 19-meter band seems to be erratic. Static conditions on all wavelengths seem to be better than at previous periods during 1933.

British Empire Transmissions

An official communication from the British Broadcasting Company states that their programs for the coming month will be as shown in Best Bets. Substitutions of stations may be made at any time as follows: GSE may be substituted for GSD, GSB may be substituted at any time for GSC or vice versa.

W2XAD Transmissions

An official communication from station W2XAD at Schenectady, states that they will be on the air on 19.56 meters on Monday, Wednesday and Friday from 2:30 p.m. to 3:30 p.m., E.S.T., and on Sunday from 2 p.m. to 4 p.m.

W2XAF Transmissions

An official communication from W2XAF at Schenectady states that they will be on the air on 31.48 meters, daily, from 7:45 p.m. to 11 p.m., E.S.T.

HJ1ABB Transmissions

An official communication from station HJ1ABB, formerly HKD, at Barranquilla, Colombia, states that they will change their wavelength from the present 50.5 meters to 46.5 meters on the 8th of December. The broadcasting hours from the 8th of December on will be from 11:30 a.m. to 12:30 p.m. and from 6:30 to 10:00 p.m., E.S.T. During the day time a wavelength of 23.25 meters will be used.

On Christmas Eve at midnight HJ1ABB will broadcast, from the Cathedral, the solemn high mass and Catholic services. On New Year's Eve, the coming of the New Year will be broadcast at twelve with all

the details and noises of the crowd to welcome 1934, the sirens, whistles, etc.

The German Transmissions

We have received an official communication from Reichsrundfunkgesellschaft as follows: DJA on 31.38 meters will transmit daily from 2 to 6 p.m.; DJB on 19.73 meters transmits from 8 a.m. to 1:40 p.m.; DJC on 49.83 meters transmits from 5 to 9 p.m. and occasionally a half-hour later; DJD on 25.51 meters transmits a program from 10 a.m. to 4:50 p.m.

The Australian Transmissions

We received an official communication from stations VK2ME and VK3ME. VK2ME will be on the air during the month of December on a wavelength of 31.28 meters from 1 to 3 a.m., from 5 to 9 a.m., and from 9 to 11 a.m., E.S.T., on Sunday mornings.

VK3ME will be on the air, on 31.55 meters, from 5 to 6:30 a.m. on Wednesdays and from 5 to 7 a.m. on Saturdays, E.S.T.

HJ4ABE Transmissions

We have received an official communication from station HJ4ABE, formerly HKO, Medellin, Colombia, stating that they transmit on a wavelength of 50.6 meters on Mondays from 7 p.m. to 11 p.m., on Tuesdays, Thursdays and Saturdays from 6:30 to 8 p.m., on Wednesdays and Fridays from 7:30 to 11 p.m. All E.S.T.

PHI Transmissions

An official communication was received from PHI, Huizen, Holland, stating that they now transmit on a wavelength of 25.57 meters on the following schedule: Monday from 7:30 to 8:30 a.m., Tuesday and Wednesday, silent, Thursday and Friday from 7:30 to 8:30 a.m., Saturday and Sunday, 7:30 to 9 a.m.

Another Dutch Station

Mr. Willard M. Hardell of Rhinelander, Wisconsin, reports that station PCV of Kootwijk, Holland, has been heard at his listening post on 17.830 kc. or 16.82 meters, at 8:40 a.m. C.S.T. on Saturday, playing American jazz music but announcing in the Dutch language. He comes in close to W3XAL on his converter.

An Official Report from Pennsylvania

Mr. C. T. Sheaks reports that the 48-meter band seems to be improving greatly and gives the following Best Bets for this month: FYA, EAQ, DJC, DJD and VE9GW.

Official Report from Alabama

Mr. J. E. Brooks, observer for this state, reports the following Best Bets in his location: GSG, GSF, GSE, GSC, GSB, DJB, DJD, DJC, PHI, I2RO, FYA, VE9JR, VE9GW, EAQ, VK2ME, VK3ME, W8XK, W3XAL, W3XL, W3XAU, W2XE, W1XAL, W2XAF, W2XAD, W9XF.

He states that WEA and WEJ relay N.B.C. programs to Bogota and Buenos Aires about once a week and LSX frequently relays programs to the United States. He has heard DENNE (the Graf Zeppelin) on 6425 kc. and heard them talking to W3XL on 30.83 meters for fifteen minutes. A few words were spoken by a little girl and then a woman and then a man. They said they had enjoyed a very comfortable trip.

He also states that EAQ has a program, on Saturdays, by the International Broadcasting Corporation of London, lasting from 7 to 7:30 p.m., E.S.T. To become a member of this Association all that is necessary is to write them, giving a full report.

A Report from Ohio

Mr. C. H. Skatzes reports Best Bets for his location: EAQ, GSC, GSB, GSA, DJD, I2RO, VK2ME, VE9GW, GAU, W3XAL, W3XL, W2XE. He reports hearing a station he believes is Costa Rica on about 48 meters. He states that GAU is a London station and was heard on 16 meters. He wonders if it is a new telephone station.

An Official Report from Florida

Mr. E. M. Law sends in the following Best Bets for his location: VK2ME, VK3ME, GCB, VE9GW, W3XL, EAQ, GSF, GSE, GSG, FYA, PHI, DJB, DJD, DJA, DJC, YV1BC, W8XK, W9XF, W3XAU, W2XE, GSB, GSD, VE9JR, HJ3ABF, W8XAL, HC2RL, W2XAF, XER, PRADO, I2RO. He states that some Mexican station plays around on many wavelengths playing a few records and then saying "Bueno, Bueno, Mexico" and never signs off.

Best Bets for New Jersey

Mr. William F. Buhl, official observer for New Jersey, reports the following Best Bets: GSG, GSE, GSB, GSD, DJA, I2RO, DJD, FYA, VE9GW, EAQ, HBL, HBP, GSC, W8XAL.

A Report from Missouri

Mr. C. H. Long reports as follows: Reception conditions on all bands have improved considerably here in Missouri. Less static on the 49 and 31 meter bands as well as increases in signal strength. W2XAD, W2XE, W8XK, FYA, DJB, GSF are all coming in on the 19-meter band. FYA on 25.2 meters is good around 10 to 11 a.m. as is also GSE, I2RO, DJD, GSD, W8XK and W2XE on this same band. EAQ comes in fine on 30.4 meters from 5 p.m. till "sign-off." VK2ME and VK3ME are strongly received. GSB or GSC is very strong from 5 to 7 p.m. but sometimes spoiled by code interference. Quito can be heard irregularly on 45 meters. HJ1ABB can be heard on 46.5 meters, HJ3ABD is heard on 48 meters. HJ4ABE can be heard reasonably well on 50.6 meters. VE9GW is exceptionally strong Sunday afternoons.

An Official Report from North Carolina

Mr. W. C. Couch reports the following Best Bets: FYA, DJB, DJC, GSF, GSE, GSD, GSC, GSA, HBL, HBP, EAQ, YV3BC on 48.7 meters, HJ1ABB, HC2RL, I2RO, W3XL, VE9GW. He states that W1XAZ has not been back on the air, after station rebuilding, as yet.

A Report from Umtata, Transkei, South Africa

Mr. Mike Kruger using a Pilot superhet, as well as a National SW58, receiver is a member of the International Short Wave Club. He sends in the following Best Bets for his location in South Africa: GSB, GSC, GSD, GSE, GSF, W3XAL, W3XL, W2XAD, W2XAF, W3XAU, W8XK, W9XAA, W9XF, W8XAL, FYA, CNR, DJB, DJD, DJA, I2RO, RV72, RV59, OXY, CR7AA (Laurenco Marques, Africa, on 80 meters), EAQ, VQ7LO, JB, CT1AA, PHI, TI4NRH.

Report from Indiana

Mr. Freeman C. Balph of Indianapolis reports the following Best Bets: EAQ, GSB, FYA, GSC, GSE, GSD, DJD, HBL, XETE, YV1BC, LSA, VE9GW, W2XAF, W1XAZ. He reports he has also heard the following stations: K6CID, EAM, CMB, PPW, XDA, HBR, XDC, UOR2, FYC, LSX, VE9JR, LSI, YVQ, CMG, FYR, VOQH, PPM.

A Report from Kent, England

Mr. M. C. Smith of Kent, England, reports the following Best Bets for his location: Jeloy (LCJ), Norway, on 43 meters, RW50, OXY, HVJ, CT1AA, DJB, CNR, HBL, I2RO, FYA, GSB, W3XL, VE9GW, VK2ME, W3XAL, W2XAD, W8XK, W2XE, YV1BC, PHI, GSF, VQ7LO. He uses a regenerative detector and two stages of audio with an inverted "L" broadcast antenna, 30 feet high and fifty feet long. He uses, also, a balancing condenser in the antenna lead.

A Report from Los Angeles

Mr. Jerome Shaps reports the following Best Bets: GSA, W3XAL, W2XAF, W3XAU, W8XK, VE9JR, KKQ, VK2ME, KAZ. These stations were received on a 20 meter coil with a spread of 30 to 16 meters. He uses a three tube receiver and headphones.

A Very Complete Report

Dr. J. P. Watson, an official RADIO NEWS Observer for Mississippi, sends us a log and report that is so complete that it corresponds almost exactly with the DX Best Bets given this month.

A Good Idea

Mr. Arthur Hamilton of Somerville, Massachusetts, writes us on a new letterhead he has had printed, with the following legend, "Official RADIO NEWS Short Wave Listening Post Observer for Massachusetts." He sends in a complete list of Best Bets for his location including FYA, DJB, GSF, GSE, DJD, VE9JR, EAQ, VK2ME, VK3ME, DJA, GSB, DJC, VE9GW, VE9HX, I2RO, YV1BC and many other American stations.

Best Bets in Texas

Mr. Heinie Johnson of Big Spring, Texas, sends us the following list of Best Bets. He uses a National 45, with two added stages of t.r.f. ahead. He employs a tuned-doublet antenna with transposed lead-in. GSE, GSB, GSD, all the German stations, VK2ME, LSX, W8XK, I2RO, HVJ, EAQ as well as other Canadian and American stations.

A Report from Porto Rico

Senor Luis Garcia of Puerta de Tierra reports the following Best Bets with an Atwater Kent 708: DJD, EAQ, GSD, HIC, HI1A, HJ1ABB, I2RO, REN, PRA3, YV2AM, YV3BC, YV1BC, PHI, FYA, XETE, HBL, PRADO, W3XAL, W2XE, W2XAD, W8XK.

A Report from Minnesota

Mr. Mark L. Thrun of Winona, Minnesota, reports the following Best Bets on a Majestic short-wave converter: TJW, WOV, W1XAL, GSA, W8XAL, W3XAU, VE9GW, W9XAA, W9XF, W3XAL, W2XE, WEF, ERVA, GSB, W3XAF, EAQ, VE9JR, GSD, W8XK, CGA, GSC, DJB, W3XAD.

Readers Who Helped Log Stations for This Month's Report

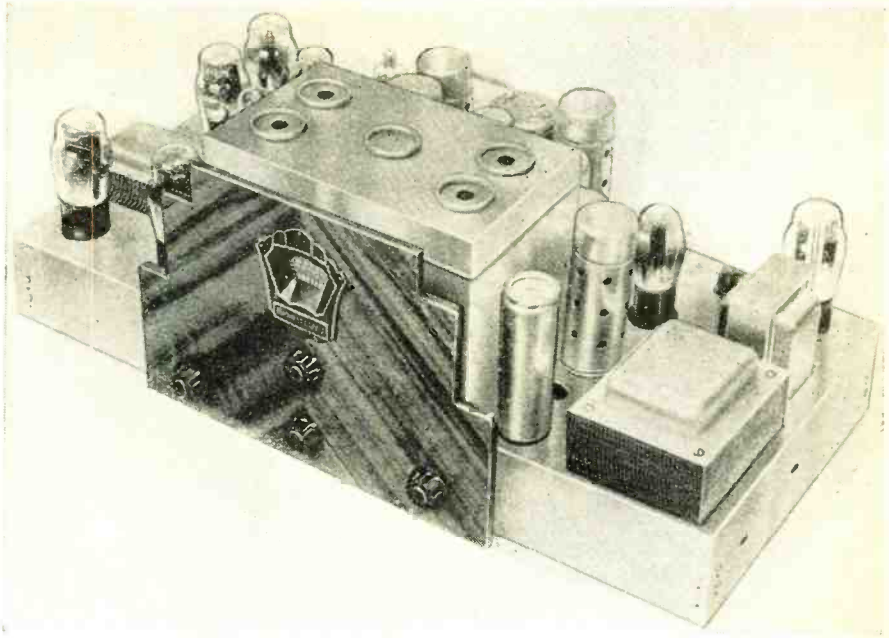
We are indebted to the following readers of RADIO NEWS who sent in reports of reception this month: R. G. Summers, Buffalo, N. Y.; R. H. Shiller, Hawthorne, N. J.; J. N. Noff, Camden, Tex.; Werner Howald, East Los Angeles, Cal.; F. F. Pernell, Columbia, S. C.; A. Hamilton, Somerville, Mass.; O. F. Sternemann, Honolulu, T. H.; D. A. Burns, Manchester, England; C. H. Armstrong, Atlanta, Ga.; E. M. Law, Miami, Fla.; W. H. Fraser, Bracebridge, Ont., Can.; Roy Sanders, Worcester,

(*Continued on page* 437)

DESCRIBING A NEW

ALL-WAVE "SUPER"

The Midwest 16-tube all-wave receiver covers a wavelength range from 9 to 565 meters and from 850 to 2000 meters



THIS 16-tube all-wave receiver was received for test by the technical staff of the RADIO NEWS laboratory. Upon arrival of the receiver we find that it consists of two sections, a chassis and a dynamic speaker. The chassis contains the power supply and audio amplifier as well as the receiver proper.

The tubes employed are sixteen in number and of the following types: first r.f., 6D6; first detector, 6C6; oscillator, –56; two i.f. stages, –78's; second detector, 6B7; a.v.c. 6B7; statomit, –37; first audio stage, –37; second audio stage, two –37's in push-pull; output stage, four –45's in push-pull-parallel; rectifier, 5Z3. Tubes of the 6-volt series have been used because they permit a saving in power consumption.

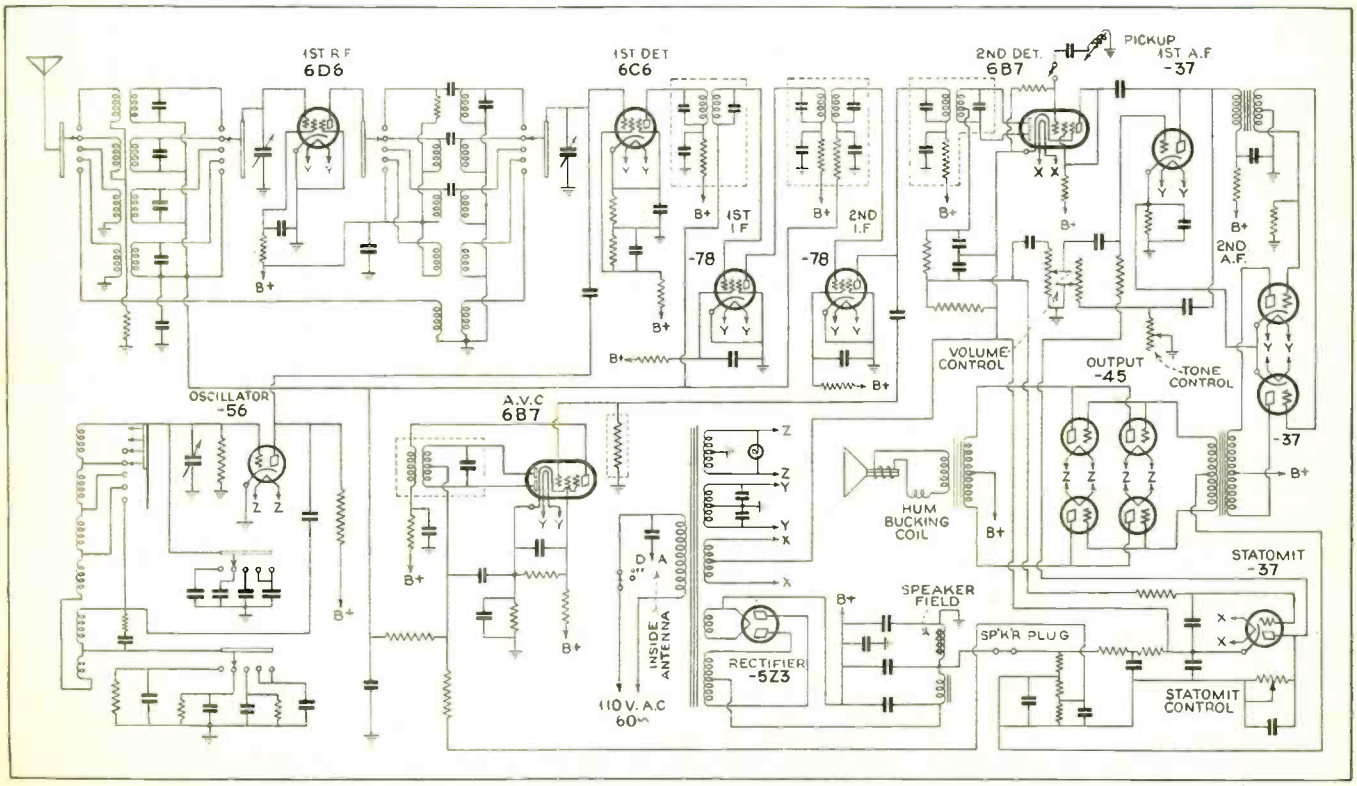
The frequency range covered is from 150 kc to 370 kc and from 530 kc to 33,000 kc; or (in wavelength) from 9 to 565 meters and from 850 to 2000 meters. Note that the broadcast band has been extended to 530 kc. instead of 550, in order to be able to receive two additional stations in Canada.

Changing over from one range to another is accomplished with a multiple switch of novel construction. There are 5 ranges and since there is an r.f. stage, a detector circuit and an oscillator circuit to be switched, one can imagine that it is quite a feat. The coils have been made much smaller than was customary a short time ago and this permits the coils to be placed close to the switch section which connects them so as to have the shortest possible leads. Coils of different stages are shielded from each other by metal plates, through which the switch shaft extends.

The dial also deserves some mention. The five bands are represented by five semicircles which are calibrated, separately for each band, in kilocycles and megacycles. The particular band in use is illuminated by the light falling through a clear window in an otherwise opaque shield, interposed between pilot light and dial. When switching to another band this window moves so that it will always be in the right position to illuminate only that small portion of the dial representing the wavelengths where one is tuning.

To make it easy for the listener, the frequencies which are employed by *broadcast stations, police, amateurs, commercials,* etc., are marked by these words printed on the dial at the right place so that one can see immediately where to tune for foreign short-wave stations. The individual bands cover the following ranges. The first band, known as the E band (*Continued on page* 445)

THE WIRING DIAGRAM



1934 MODEL

LABORATORY-BUILT SUPERHETERODYNE

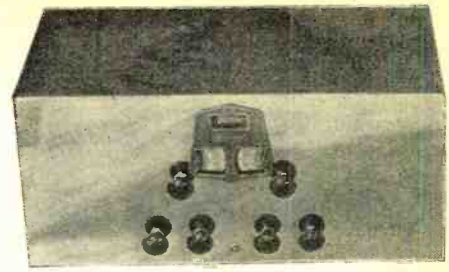
Additional technical and operating data on a new receiver which was described in the November issue

IN an article in the November issue, McMurdo Silver described his latest receiver development, known as the Masterpiece II, and pointed out the changes which permit this receiver to accomplish as much or more than the original Masterpiece, in spite of a considerable saving in the number of tubes employed.

The circuit diagram for the new receiver is shown in Figure 1. It will be noted that the tuning range of the receiver, covering from 530 kilocycles to 28,000 kilocycles, or 567 meters to 10.7 meters, is divided into four bands, as indicated by the six groups of four coils each shown at the bottom left. Ranges are selected by means of the six-gang switch. This switch performs the additional function of cutting in the correct padding condenser for each oscillator range and also automatically performs the function of connecting the r.f. grid return, in the broadcast range, to the A.V.C. line, so that in this band the sensitivity of the r.f. tube is also controlled automatically. The three i.f. tubes are automatically controlled in all ranges. The balance of the circuit should be clear if studied in conjunction with the article in the November issue.

During the last two weeks of Octobr, the receiver has been in operation at one of the RADIO NEWS test stations in New York. All of the important short-wave stations have been tuned in, including those in Europe, South America and Australia. On the broadcast band stations from Maine to California and from Southern Mexico to Northern Canada have been tuned in. At 7 o'clock one evening, running through the broadcast band from top to bottom produced reception on every channel assigned by the Radio Commission excepting one. This was the 850 kilocycle channel occupied by stations in Shreveport and New Orleans, one of which was heard later that evening. In addition, a number of Mexican and Canadian stations operating between the American channels were heard.

The operation of the receiver is really extremely simple—more simple than the first glance at the seven controls on the front panel would indicate. The purpose of each of these individual controls was briefly stated in the November article, but a little more information on their actual operation will undoubtedly be of interest. The upper right-hand knob is the main tuning control. This is in every sense the single tuning control, as the entire range of the receiver, broadcast and short wave, can be accurately tuned with this control alone.

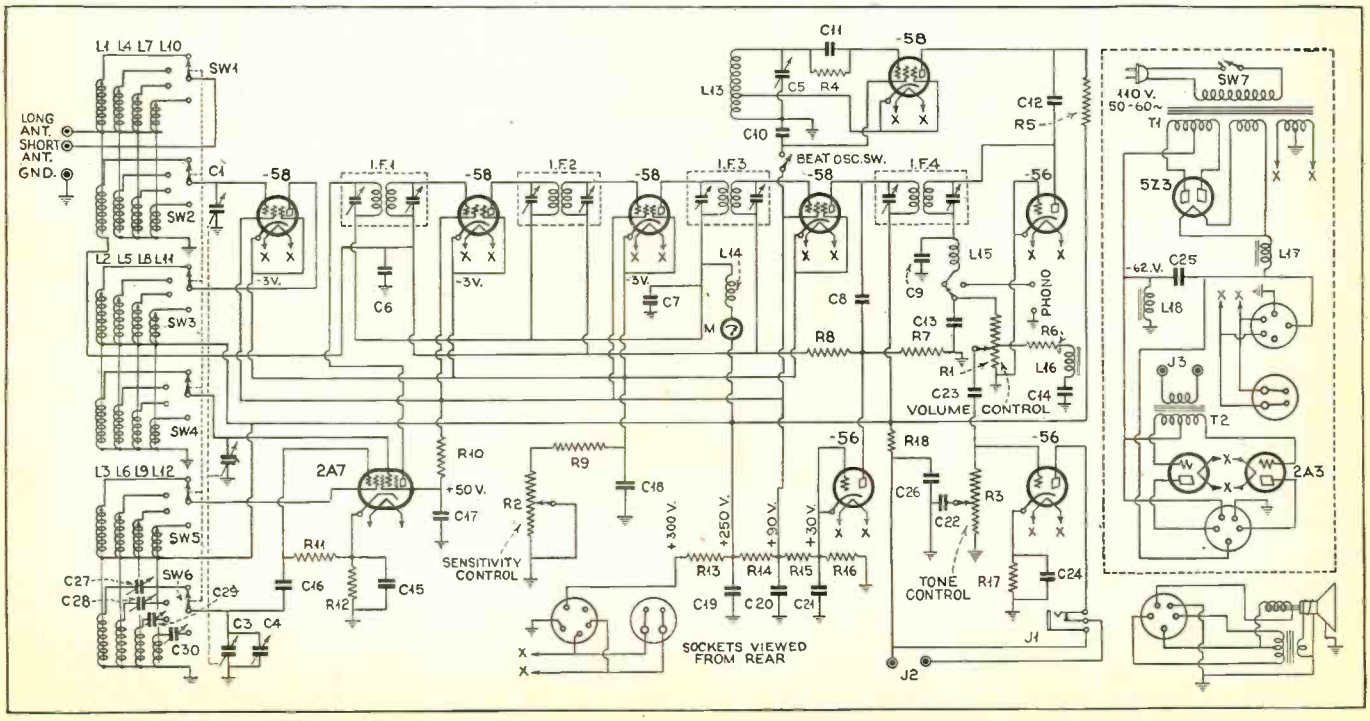


One of the striking features of this tuning control is the absolute ease with which the knob rotates. So easy is this action, in fact, that one almost wonders whether the knob will stop turning when the hand is removed.

The calibrated scale which revolves as this control is turned carries four calibrations, one for each band, each on a background of a different color. These calibrations are: 530-1500 kc., 1.8-4.6 megacycles, 5-11 megacycles, and 11-28 megacycles. The extremes of the dial are not calibrated, and these areas provide for ample overlap.

The upper left-hand knob is purely a refinement to make short-wave tuning easier. An example of the advantage of this control is found in the fact that when the main tuning control is set for the middle of the 49 meter short-wave band, the group of stations operating therein is spread over approximately 70 degrees on the band-spread dial, whereas on the main tuning dial this spread would be only the equivalent of about 3 degrees. Thus stations which are only a hair's breadth apart on the main dial are from 5 to 20 degrees apart on the band-spread dial. This spreading-out effect makes it a simple matter to tune to exact resonance and thus obtain the best quality of reproduction. Incidentally, this band-spread knob controls condenser C4, and tunes the oscillator only. On the short-wave bands below 100 meters, the r.f. and detector input tuning are not critical, and it is this fact that permits band-spread tuning of the oscillator only. (*Continued on page* 435)

FIGURE 1. THE CIRCUIT DIAGRAM



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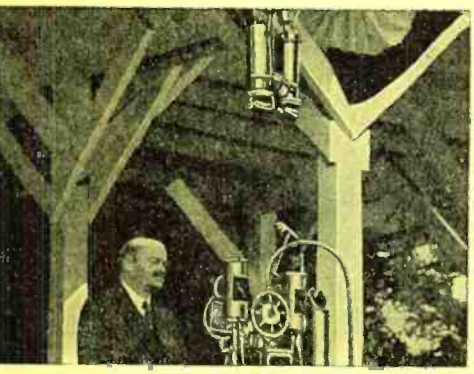
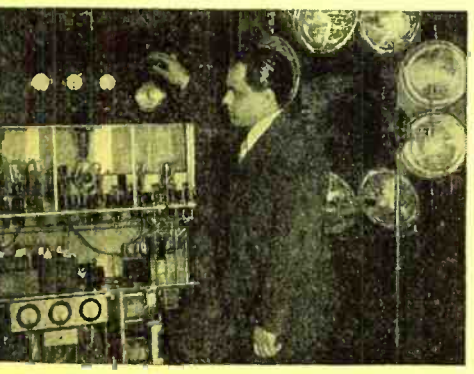


LOUD SPEAKER installation and service work is another growing, money-making field for trained Radio men.



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(Continued on other side)

PLACE ONE CENT STAMP HERE

MR. J. E. SMITH, President
NATIONAL RADIO INSTITUTE
16th and U Streets, N. W.
Dept. 4AR **WASHINGTON, D. C.**

Many Radio Experts make $40, $60, $75 a week

(Continued from other side)

SET SERVICING has paid many N. R. I. men $200 to $1,000 a year for their spare time. Full-time men make as much as $40, $50, $65 a week.

Many make $5, $10, $15 a week Extra in spare time almost at once

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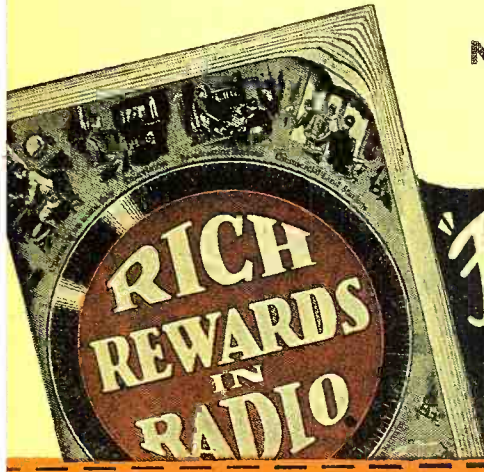
Act today. Mail the post card below. My 64-page book will be sent free to any ambitious fellow over 15 years of age. It tells about Radio's opportunities—explains the eighteen star features of my Course—shows letters of what others are doing and making. There is no obligation. Put a one cent stamp on the post card and mail it now.

J. E. SMITH, President
NATIONAL RADIO INSTITUTE
WASHINGTON, D. C.



"Find Out What Radio Offers You
MAIL THIS NOW"

Mr. J. E. SMITH, *President*
National Radio Institute, Dept. 4AR
Washington, D. C.

Dear Mr. Smith: Without obligating me, send your book which points out the spare-time and full-time job opportunities in Radio and explains your amazingly practical 50-50 method of training men quickly and inexpensively at home in their spare time to be Radio Experts. *(Please print plainly.)*

Name.....*Age*.....

Address.....

City.....*State*.....

Some Other Jobs N.R.I Trains Men For

Broadcasting engineer
Operator in broadcasting station
Maintenance man in broadcasting station
Superintendent in Radio factory
Engineer in Radio factory
Inspector in Radio factory
Radio operator on ships
Sales manager for Radio stores
Service manager for Radio stores
Buyer for Radio stores
Government Radio electrician
Government Radio supervisor
Operator of government Radio beacon stations
Aircraft Radio operator
Aircraft Radio dispatcher
Television engineer
Television transmitter operator
Television maintenance man
Engineer in commercial Radio land stations
Installation man on loud speaker systems
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Automobile Radio installation and service man
Police Radio transmitter operator
Police Radio receiver serviceman

Here's Proof

$50 to $75 a week

"The National Radio Institute put me in a position to make more money than I ever made in good times. I am in the Radio service business for myself, where it is possible for me to make from $50 to $75 a week. Service work has increased because people, who in normal times would buy a new Radio, now are contented to have the old one 'pepped up'."—BERNARD COSTA, 150 Franklin St., Brooklyn, N. Y.

"Made $6,000 in 2 years"

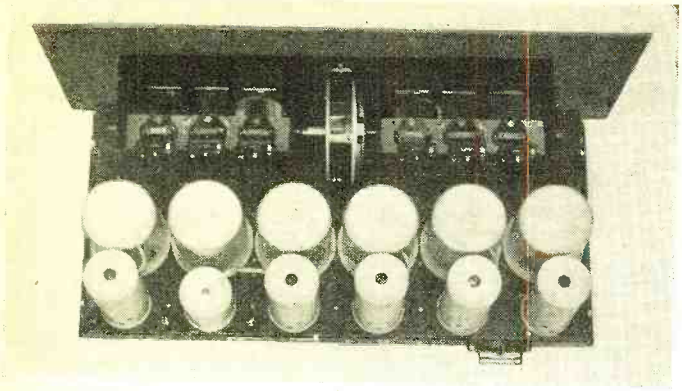
"Soon after the depression started, I found myself without a job, but I was well protected with N. R. I. training. I swung right to full-time Radio servicing and I have made over $6,000 in a little over two years."—WM. SPARTIVENT, Sparty Radio Service, 93 Broadway, Newark, N. J.

"$500 a Year in Spare Time"

"Although doing spare-time Radio work only, I have averaged about $500 a year extra in addition to my regular income. Full-time Radio work would net me many times that amount."—EDW. H. FAWCETT, Slough Road, Ladner, B. C., Canada.

"Good Position, Good Pay"

"I am Chief Operator at Radio Station WSMK. This is a good position, with good pay. I have advanced in Radio right along. I recommend N. R. I. to anyone who wants to be successful in Radio."—JOHN HAJDUK, JR., 3 Broxey Apts., Southern Hills, Dayton, Ohio.



THE TUNABLE I.F. AMPLIFIER

Below are shown the bottom and rear views and above the top view of the revamped MB-32 chassis which is employed as the i.f. amplifier in this unique superheterodyne

A CRYSTAL CONTROLLED S. W. SUPER

In this article the constructional data is completed. Information on the adjustment and operation of this unusual receiver will be included in the final article next month

Frank H. Jones

Part Four

THE circuit diagram was published on page 281 of the November issue, and some additional data on circuit values is provided as follows: In the top section of the circuit (push-pull t.r.f.), R1, R2, R4, R5, R6, R7 are 2-megohm resistors; R3, R8 and R9, 25,000 ohms; R9 (first stage cathode resistor) and R10, 400-ohm variable resistors; C4—320 mmfd.; RFC1, RFC2 and RFC3, 250-millihenry chokes; RFC4, RFC5, RFC6, 100-millihenry chokes. The screen grids of the push-pull first detector should have a 25-volt supply and *not 250 volts as shown in the diagram.*

Second section (a.v.c. and oscillator). R10 is a variable resistor, 100,000 to 500,000 ohms instead of a 500,000-ohm fixed resistor as shown. Also a 2-mfd. condenser should be connected from plate of the a.v.c. tube to ground. This condenser and R10 determine the speed of a.v.c. action. R11 is a 1-megohm resistor and R12, 100,000 ohms. C10 and C11, Hammarlund 80-mmfd. midget variable condensers; RFC7, RFC8 and RFC9, 100-millihenry chokes. Milliammeter No. 3 is the tuning meter. The coils in the neon-light signal circuits are: left-hand coil, secondary 12 turns on 1½-inch form; primary 2 turns on ½-inch diameter inside of secondary. Right-hand secondary consists of 18 turns on a 1½-inch form and its primary 2 turns on ½-inch diameter inside the secondary.

In the third section (i.f. amplifier) the r.f. chokes shown in the line along the bottom are all 100-millihenry chokes. The 14 condensers in a straight line just above these coils are as follows, reading diagram from right to left: .015 mfd., .01, .01, .01, .01, .01, .015, .01, .01, .1, .01, .01, .1, 1 mfd. The condenser in the plate circuit of the second i.f. tube is .1 mfd. The resistors of 1000 ohms each in the cathode circuits of the four i.f. tubes should be variable resistors and are ordinarily adjusted to approximately 400 ohms.

The resistor connected between filament center-tap and ground in the circuit of the type –50 output tube should be 1600 ohms.

We shall now consider section "D," which is the tunable i.r.f. amplifier and the second detector. You can make this circuit from the drawing if you want to, but I advise not. It is nothing more than a National MB32 tuner, the circuit of which was shown in Figure 4 (November issue).

I will assume you now have this tuner. Get busy and take out the ganged condenser covers. Put type –24 tubes in the r.f. sockets and a type –27 in the detector socket. Connect up about 150 volts on the plates and 67 volts for the screen grids and connect the detector output to some amplifier, or use headphones direct on the detector as described previously. Better still, change the sockets to the six-prong type and use type –58 tubes and also the special –58 type tube shields. If you make this change it will be necessary to readjust this amplifier very carefully so that it will not oscillate, as the greater gain made possible by these new tubes may cause oscillation if there is any defect in the shielding at this point.

Check on signals to see if all is okay as is.

Then carefully break off with long-nosed pliers one movable condenser plate from each condenser section. Now carefully check again and re-align with a signal oscillator or by listening to some broadcast station. Repeat the above operation till the lowest frequency you can tune in is about 950 kc. Now carefully re-align and put in perfect adjustment.

This may not raise the high-frequency end as high as we must have it eventually, but it will probably cover 1543 kc. or even 1746 kc., which will let us tune in 9530 kc., which is W2XAF on 31.48 meters. We can also tune W8XK on 6140 kc.

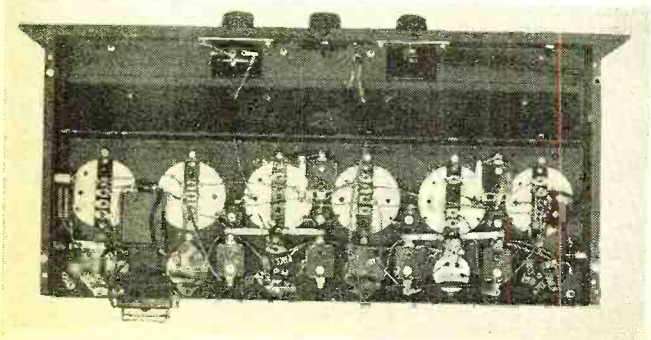
I have not described the power supplies, as there is nothing special about them, and further, they were clearly circuited in Figure 4, as also was the type –50 audio stage clearly indicated. These are to be mounted in section "F." So with the power line noise filter and all else in place, we are set to go. The power line filter is important for most localities and is shown in Figure 18.

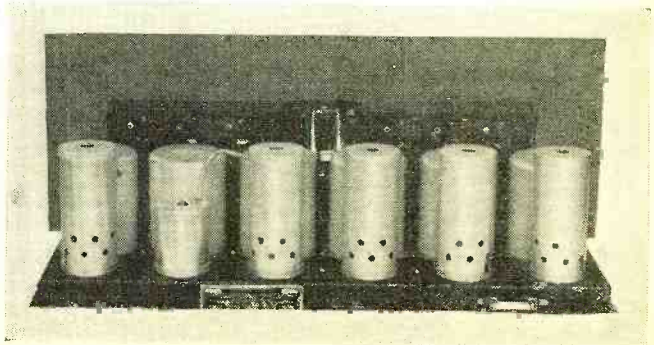
For aesthetic reasons it makes a beautiful job if you put mahogany-finished bakelite panels on each front section.

All of these sections are conveniently mounted in a vertical angle-iron frame (or you can use wood). as shown in Figure 17, last month. Each section is made to slide in and out as the drawers of a desk.

When you have all mounted together as described, you should interconnect all circuits, as shown in Figure 4, November. All connections are made at the back, using shielded high-tension cable as used in automobiles that are equipped with radios. Make all these connections as short as possible and

(*Continued on page* 438)





GETTING ACQUAINTED *with* SHORT WAVES

The number of short-wave listeners is being swelled by thousands whose interest has only recently been pricked. To them the short waves present a mysterious aspect. This series for the beginner will provide a short-wave primer dedicated to an intelligent understanding of what short waves are and how to derive the greatest pleasure from them

James Millen

IN speaking of short waves—or long waves, for that matter—it is a good idea to have some definite conception of just what a *wave* is. The short-wave beginner, who is probably a broadcast enthusiast, is familiar with the term wavelength; but it usually means nothing more to him than a secondary identification of different stations. It would help a little, even in the operation of a broadcast receiver, if wavelengths held, for the operator, a bit more significance than the mere etching on a tuning dial. And in short-wave reception it is definitely desirable that operation be assisted by an intelligent appreciation of what wavelengths are and how they affect reception. Almost anyone can drive an automobile—steer it, shift gears and apply the brake. But only the driver who has some knowledge of what goes on between gas tank and exhaust can operate a car so as to derive the greatest possible enjoyment and utility from its possession.

The same reasoning holds with short-wave radio—and we'll start in on the short *waves* themselves. We are all familiar with wave-forms of some type or another: ripples on the water, the visible waves of a vibrating string and the wavy convolutions of a rope when it is "snaked." These are all illustrative of the general principle, and the water-wave picture has often been evoked to create, in the non-technical mind, a conception of radio waves. When a stone is cast into a pond, visible water waves are set up and travel in all directions from the point where the stone went down—in a manner somewhat similar to the way radio waves travel from the antenna of a wireless transmitting station. (Wireless, by the way, is exactly the same as radio.) This analogy ha been objected to by technical purists on two grounds. First, it shows only a two-dimensional wave—on the surface of the water—while a radio wave leaves the antenna in all directions (up and down as well as horizontal), more after the manner of the gases leaving a bursting shell. Secondly, it presupposes the existence of some medium (analogous to water) in which the waves may travel, which, up until recent years, had been called the "ether." Recent investigations by Einstein, Morley and Michelson have thrown considerable doubt on the reality of this ether, and they prefer to consider the waves as undulations in an energy field created simultaneously with the wave motion. However, be all this as it may, the water analogy creates the most substantial idea of wave action, and we shall stick to it.

All wave-motion has four predominant characteristics: *intensity, velocity, wavelength* and *frequency*. Wavelength and frequency, as will be seen, are closely interrelated. In the water wave there is a vertical distance between the crests of the waves and the troughs. This corresponds to *intensity* in a radio wave. Close to where the stone strikes the water (the transmitting aerial), a cork will bob up and down through a greater vertical distance (a strong signal) than it will twenty feet farther away (a weak signal). The waves recede from the point of generation at a certain *velocity* which—to keep as close to radio as possible—can be measured in *meters per second*.

The distance between two adjacent crests (or any similar points on successive waves) is considered the *length of the wave*—or *wavelength*. The number of waves which pass a given point in a given period of time (in radio a second is taken as the unit of time) is the *frequency*. As the action effected on the cork, when the water wave slides under it from crest to crest, completes one cycle of up-and-down motion, the phrase *frequency in cycles per second* is often employed, and words *frequency* and *cycles* are loosely synonymous.

It is obvious that if the *velocity* is constant and the *wavelength* shortened, the *frequency* must increase. For instance, let us assume a water velocity of ten meters per second, and a distance between crests of two meters. In one second five of these crests will have passed our cork (or receiver), which will have gone through five up-and-down cycles in that period. In other words, the frequency is five cycles per second. If now we shorten the wavelength to one meter (maintaining the same ten-

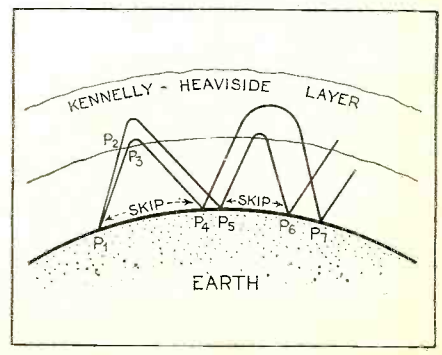
FREQUENCY CHART

Figure 1. This chart shows graphically the relation between wavelength and frequency and the number of available channels in each band

500 KC.	ROOM FOR 10 STATIONS	600 METERS
600 KC.	ROOM FOR 15 STATIONS	500 METERS
750 KC.	ROOM FOR 25 STATIONS	400 METERS
1000 KC.	ROOM FOR 50 STATIONS	300 METERS
1500 KC.	ROOM FOR 150 STATIONS	200 METERS
3000 KC.	ROOM FOR 2,700 STATIONS	100 METERS
30 MC.		10 METERS
ULTRA	SHORT	WAVES

SKIP DISTANCE

Figure 2. A picturization of the skip distance effect. The signal cannot be heard between P1 and P4 nor between P5 and P6



meter-per-second velocity), the cork will go through ten cycles per second and our frequency will have been doubled.

This illustrates the important relationship between wavelength and frequency. When the wavelength is lengthened, the frequency becomes lower, and vice versa. The *frequency* is always equal to the *velocity divided by the wavelength,* and the *wavelength* equals the *velocity divided by frequency.* This assumes a constant velocity, which, in the case of radio waves, is 300,000,000 meters per second. In the scientific shorthand of mathematics, this is expressed by the equations:

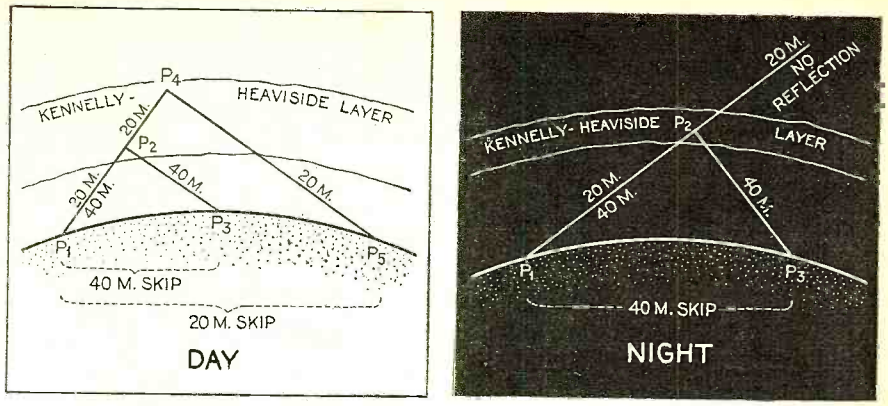
$$\lambda = \frac{v}{f} \text{ and } f = \frac{v}{\lambda}$$

—where v = *velocity* in *meters per second,* λ = *wavelength* in *meters* and f is the *frequency in cycles per second.*

It is generally accepted that the short waves are those between the lower end of the conventional broadcast band, at 200 meters, and the top of the ultra-short-wave region which starts, on the way down, at 10 meters. The frequency of 200 meters is 1,500,000 cycles per second, and that corresponding to 10 meters, is 30,000,000 cycles per second. The short-wave field therefore encompasses a wave spread of 190 meters and the vastly larger frequency band (or spectra) of 28,500,000 cycles.

As the wavelength drops, the increasing frequency in cycles-per-second becomes a clumsy figure to handle. Even on the broadcast band the *unit of one thousand cycles,* the *kilocycle,* or "kc" is more convenient. Below 100 meters the kilocycle in turn becomes cumbersome and the *megacycle,* "mc," takes its place. One megacycle equals 1,000 kilocycles and 1,000,000 cycles.

While frequency and wavelength necessarily go hand in hand, the former quality is the more important from the standpoint of convenience in analyzing radio phenomena.



DAY AND NIGHT SKIP DISTANCE EFFECTS

Figure 3. These charts illustrate the difference in skip distance effect between day and night reception. In each case the 20- and 40-meter signals start at P1. The 20-meter signal is reflected during the day at P4, having twice the skip distance of the 40-meter signal reflected at P2. At night the point of 40-meter reflection is higher and the skip distance considerably increased. At night the 20-meter signal goes right on through the layer without reflection

For example, the majority of engineers are agreed that all radio-telephone stations within interfering distance at the point of reception should be separated by a frequency band or spectrum, 10,000 cycles (10 kc.) wide, to prevent cross-talk and whistles. In other words, using a highly sensitive receiver, all stations within a thousand-mile radius should not be placed closer together than 10,000 cycles (10 kc.)—i.e., one station for each 10 kilocycles in the band allocated for broadcasting. If we want to find out how many such stations there is room for between 100 and 200 meters, we shall first have to change to frequency—3,000,000 (3 mc.) and 1,500,000 cycles (1.5 mc.), respectively—and establish the width of the band in frequency. Subtracting the latter figure from the former, we find that between 100 and 200 meters there is a frequency band 1,500,000 cycles wide. Dividing this by 10,000 (10 kc.), we determine that there is room for exactly 150 stations within interfering distance of each other. The reader must *not* jump to the conclusion that *there is room for 150 stations for every 100 meters!* Making a similar calculation for the band between 200 and 300 meters, *we find room for only 50 stations!*

Thus we demonstrate both the desirability of dealing with cycles rather than wavelengths, and one of the most important advantages of the short waves —or high frequencies. As the wavelength is shortened and the frequency rises, there is room for *more* stations per wavelength. We have just observed that there is room for three times as many stations between 100 and 200 meters as there is between 200 and 300 meters. There is *ideal etheric space* for just 100 stations over the entire broadcast band between 200 and 600 meters, while the short-wave spectra, from 10 to 200 meters, will accommodate 2850 stations! Figure 1 shows this graphically.

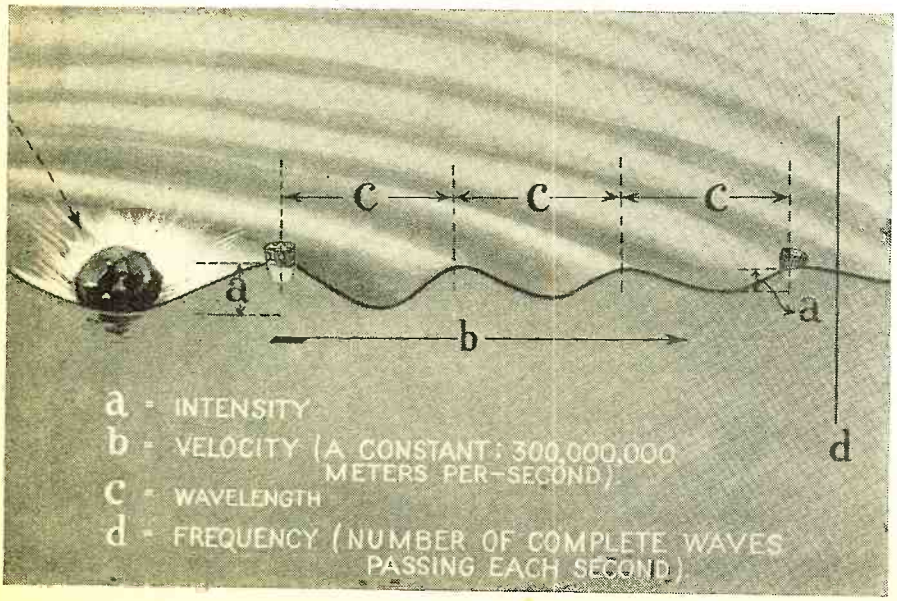
Thus the short waves have been enthusiastically proposed as the solution to the congested conditions existing on the air.

The multiplicity of available channels, however, is by no means the sole advantage of short-wave communication. The fact that extremely long distances can be spanned at a great economy of power contributes the real commercial utility of the high frequencies. This characteristic of short-wave transmission is due to the *skip-distance effect.*

The phrase "skip-distance effect" is accurately descriptive of the phenomenon. A station broadcasting in New York City on about 30 meters (10 mc.) will be heard locally, on a direct *ground wave* (wave following the ground), within a radius of some twenty-five miles—the signal rapidly becoming weaker as this limit is approached. Outside of this zone, for a skip-distance of approximately one thousand miles, the signal cannot be heard, while at Chicago excellent reception may be had. Proceeding westward, the signal disappears, to pop up again at Salt Lake City. Approaching the Rockies, it is lost once more. (*Continued on page* 429)

A GRAPHICAL ANALOGY OF CONTINUOUS WAVE MOTION

A stone thrown into a pond makes circular waves on the surface. Such an analogy with radio waves may help to give us a better understanding of such terms as intensity, velocity, wavelength and frequency. The diagram below and its legend explains these various terms



BROADCASTING STATIONS IN ASIA

CEYLON

Call	Location	Kc.	Kw
	Colombo	600	1.75

CHINA

XCBL	Shanghai	1280	.4
XGCU	Shanghai	1140	.1
XGKO	Shanghai	820	.1
XGLS	Soochow	1230	.1
XGOA	Nanking	681.8	75.0
XGOD	Hangchow	977.5	1.0
XGOY	Yunnan	698	.5
XHHA	Shanghai	700	.1
XHHE	Shanghai	940	.1
XHHF	Shanghai	960	.1
XHHG	Shanghai	1020	.1
XHHH	Shanghai	1040	.1
XHHI	Shanghai	1060	.1
XHHK	Shanghai	1420	.1
XHHM	Shanghai	1180	.1
XHHN	Shanghai	1200	.1
XGHHS	Shanghai	1100	.1
XHHU	Shanghai	1160	.5
XOPP	Peiping	952.3	.1
XOST	Tsinan	857.1	.5
XQHD	Shanghai	1360	.1
COTN	Tientsin	625	.5
CMB	Kwangchow	843	.1

INDIA

VUB	Bombay	840	3.0
VUC	Calcutta	810	3.0
VUL	Lahore	882	.1
VUM	Madras	770	.2
2HZ	Rangoon	857	.35

INDO-CHINA

F3ICD	Saigon	840	12.0

JAPAN

JFAK	Taihoku	670	10.0
JFBK	Tainan	720	1.0
JOAK I	Tokio	590	10.0
JOAK II	Tokio	870	10.0
JOBK	Osaka	750	10.0
JOCK	Nagoya	810	10.0
JODK I	Keijo	900	10.0
JODK II	Keijo	610	10.0
JOFK	Hiroshima	850	10.0
JOGK	Kumamoto	790	10.0
JOHK	Sendai	770	10.0
JOIK	Sapporo	830	10.0
JOJK	Kanazawa	710	3.0
JOKK	Okayama	700	.5
JOLK	Fukuoka	680	.5
JONK	Nagano	940	.5
JOOK	Kyoto	960	.3
JOPK	Shizuoka	780	.5
JOQK	Niigata	920	.5
JORK	Kochi	720	.5
JOSK	Kokura	735	1.0
JOTK	Matsuye	625	.5
JOUK	Akita City	645	.3
JOVK	Hakodate	680	.5
JQAK	Dairen	760	.5

MANCHUKUO

MOHB	Mukden	674	

SIAM

HSP1	Bangkok	857	2.5
HS7PJ	Sala Daeng	750	

U. S. S. R.

RW1	Moscow (Comintern)	202.5	500 0
RW2	Moscow	416.7	20.0
RW3	Saratov	340	20.0
RW4	Kharkov	320	20.0
RW5	Swerdlovsk	363.6	50.0
RW6	Novosibirsk RW6	404	4.0
RW7	Tiflis	280	10.0
RW8	Baku	238	10.0
RW8	Baku	240	35.0
RW9	Kiev	290	100.0
RW10	Minsk	271.5	100.0
RW11	Tashkent	256.4	25.0
RW12	Rostov-on-Don	365	20.0
RW13	Odessa	662	10.0
RW14	Irkutsk	187.5	10.0
RW16	Samara	404	10.0
RW17	Kazan	644	10.0
RW18	Samarkand	342.8	2.0
RW19	Achkabad	330	10.0
RW19	Achkabad	333	4.0
RW20	Kharkov RW20	815	10.0
RW21	Erivan	394	10.0
RW22	Oufa	444.4	2.0
RW22	Oufa	617	10.0
RW23	Groznyi	676	1.2
RW24	Smolensk	475	2.0
RW25	Voronej	450	10.0
RW26	Stalino	779.2	10.0
RW27	Makhatch	689	4.0
RW28	Vladivostok	635.6	.3
RW28	Vladivostok	725	10.0
RW29	Petrozavodsk	385	10.0
RW30	Dnepropetrovsk	869	4.0
RW31	Ivanovo	625	10.0
RW32	Elista	671	2.0
RW33	Krasnodar	650	1.0
RW34	Stalingrad	554	10.0
RW35	Astrakhan	589	10.0
RW36	Arkhangelsk	662	10.0
RW37	Moscow	792.5	1.0
RW38	Alexandrovsk, Sakhaline	580	1.2
RW39	Moscow	707	100.0
RW40	Gomel	621.1	1.0
RW41	Syktykvar	563	1.2
RW42	Gorkii	598	
RW44	Omsk	471.7	1.2
RW45	Orenburg	461.5	1.0
RW46	Karaganda	653	10.0
RW46	Karaganda	686.5	1.2
RW47	Stalinabad	421.3	2.0
RW48	Tomsk	645.2	1.2
RW49	Moscow	230.1	100.0
RW51	Naltchik	748.1	1.2
RW52	Simferopol	630.2	4.0
RW53	Leningrad	300	100.0
RW54	Khabarovsk RW54	320	10.0
RW55	Engels	959	1.0
RW56	Penza	640	1.2
RW57	Tiraspol	838	4.0
RW58	Moscow	250	40.0
RW60	Alma Ata	310	10.0
RW61	Iochkar-Ola	888	1.0
RW62	Iakutsk	165	10.0
RW63	Verkhneoudinsk	350	1.0
RW64	Ordjonikidze	752	10.0
RW65	Saransk	734	1.0
RW66	Krasnoiarsk	333	.5
RW67	Oukhta	354	2.0
RW68	Tcheliabinsk	824	.2
RW69	Odessa, RW69	1900	3.0
RW70	Leningrad	860	10.0
RW71	Petropavlovsk Kamtchatski	689	1.2
RW73	Simferopol RW73	725	10.0
TW74	Tcheboksary	680	1.2
RW75	Winnitsa	968	10.0
RW76	Novosibirsk, RW76	217.5	100.0
RW78	Ijevsk	825	4.0
RW79	Mourmansk	743	10.0
RW80	Magnitogorsk	571	10.0
RW81	Tourtkoul	350	2.0
RW82	Frounze	608	4.0
RW83	Oirot-Toura	440	1.2
RW84	Oust Abakansk	635	1.2
RW85	Igarka		2.0

The DX Corner (Broadcast)

(*Continued from page* 406)

wave reception, or in both activities.

E.S.T. (a.m.)	*Frequency (Kc.)*	*Call*	*Location*	*Power (Watts)*
First Monday Each Month				
2:00	1500	**WMIL**	Brooklyn, N. Y.	100
2:00	1310	**WJAC**	Johnstown, Pa.	100
2:10	1210	**WFAS**	White Plains, N. Y.	100
2:10	1370	**WRAK**	Williamsport, Pa.	100
2:20	1500	**WNBF**	Binghamton, N. Y.	100
2:30	1420	**WAGM**	Presque Isle, Me.	100
2:30	1370	**WBTM**	Danville, Va.	100
2:40	1200	**WABI**	Bangor, Me.	100
2:40	1500	**WWSW**	Pittsburgh, Pa.	100
2:50	1420	**WHDL**	Tupper Lake, N. Y.	100
2:50	1310	**WHAT**	Philadelphia, Pa.	100
3:00	1200	**WCAX**	Burlington, Vt.	100
3:00	1370	**WLVA**	Lynchburg, Va.	100
3:10	1500	**WSYB**	Rutland, Vt.	100
3:10	1310	**WTEL**	Philadelphia, Pa.	100
3:20	1200	**WIBX**	Utica, N. Y.	100
3:20	1420	**WAZL**	Hazleton, Pa.	100
3:30	1370	**WQDM**	St. Albans, Vt.	100
3:30	1370	**WSVS**	Buffalo, N. Y.	50
3:40	1310	**WMBO**	Auburn, N. Y.	100
3:40	1420	**WTBO**	Cumberland, Md.	100
3:50	1370	**WGLC**	Hudson Falls, N. Y.	100
3:50	1210	**WBAX**	Wilkes-Barre, Pa.	100
4:00	1220	**WCAD**	Canton, N. Y.	500
4:00	1500	**KPQ**	Wenatchee, Wash.	100
4:10	1260	**WNBX**	Springfield, Vt.	250
4:10	1210	**WMBG**	Richmond, Va.	100
4:10	900	**KGBU**	Ketchikan, Alaska	500
4:20	1290	**WNBZ**	Saranac Lake, N. Y.	50
4:20	1310	**WBRE**	Wilkes-Barre, Pa.	100
4:20	1200	**KGVO**	Missoula, Mont.	100
4:30	1040	**WESG**	Elmira, N. Y.	1000
4:30	1200	**WNBO**	Silverhaven, Pa.	100
4:30	1370	**KOOS**	Marshfield, Ore.	100
4:40	600	**WICC**	Brdgeport, Conn.	250
4:40	1310	**WRAW**	Reading, Pa.	100
4:40	1210	**KGY**	Olympia, Wash.	100
4:50	940	**WAAT**	Jersey City, N. J.	300
4:50	1210	**WJBU**	Sunbury, Pa.	100
4:50	1370	**KFBL**	Everett, Wash.	50
5:00	570	**WSYR**	Syracuse, N Y.	250
5:00	570	**WMAC**	Syracuse, N. Y.	250
5:00	1200	**KFXD**	Nampa, Idaho	100
5:10	600	**WCAC**	Storrs, Conn.	250
5:10	1370	**KVL**	Seattle, Wash.	100
5:20	1310	**KGEZ**	Kalispell, Mont.	100
5:30	1370	**KUJ**	Walla Walla, Wash.	100
5:40	1310	**KGCX**	Wolf Point, Mont.	100
5:50	1230	**KFQD**	Anchorage, Alaska	250
6:00	1310	**KIFH**	Juneau, Alaska	100
6:10	1200	**KVOS**	Bellingham, Wash.	100
6:20	1310	**KIT**	Yakima, Wash.	100
6:30	1120	**KRSC**	Seattle, Wash.	100
9:40	1310	**KXRO**	Aberdeen, Wash.	100
6:50	1120	**KFIO**	Spokane, Wash.	100
7:00	1210	**KFJI**	Klamath Falls, Ore.	100
7:10	1310	**KMED**	Medford, Oregon	100
7:20	1420	**KORE**	Eugene, Oregon	100
First Tuesday Each Month				
2:00	1210	**WQDX**	Thomasville, Ga.	100
2:10	1200	**WBHS**	Huntsville, Ala.	100
2:20	1370	**WHBQ**	Memphis, Tenn.	100
2:30	1210	**WJBY**	Gadsden, Ala.	100
2:40	1500	**WKEU**	La Grange, Ga.	100
2:50	1200	**WRBL**	Columbus, Ga.	100
3:00	1370	**WMBR**	Tampa, Fla.	100
3:10	1210	**WHET**	Troy, Ala.	100
3:20	1310	**WSJS**	Winston Salem, N. C.	100
3:30	1500	**WHEF**	Kosciusko, Miss.	100
3:40	1200	**KMLB**	Monroe, La.	100
3:50	1420	**WAMC**	Anniston, Ala.	100
4:00	1210	**WKFI**	Greenville, Miss.	100
4:00	1200	**KWG**	Stockton, Calif.	100
4:10	1310	**WTJS**	Jackson, Tenn.	100
4:10	1500	**KPJM**	Prescott, Ariz.	100
4:20	1370	**WPFB**	Hattiesburg, Miss.	100
4:20	1200	**KERN**	Bakersfield, Calif.	100
4:30	1420	**WENC**	Americus, Ga.	100
4:30	1500	**KXO**	El Centro, Calif.	100
4:40	1200	**WBBX**	New Orleans, La.	100
4:40	1210	**KIEM**	Eureka, Calif.	100
4:50	1310	**WROL**	Knoxville, Tenn.	100
4:50	1440	**KLS**	Oakland, Calif.	250
5:00	1370	**WRAM**	Wilmington, N. C.	100
5:00	1420	**KGIX**	Las Vegas, Nev.	100
5:10	1200	**WJBW**	New Orleans, La.	100
5:10	1320	**KGMB**	Honolulu, Hawaii	250
5:20	1310	**WAML**	Laurel, Miss.	100
5:20	1370	**KRE**	Berkeley, Calif.	100
5:30	1210	**WSIX**	Springfield, Tenn.	100
5:30	750	**KGU**	Honolulu, Hawaii	2500
5:40	1370	**KGAR**	Tucson, Ariz.	100
5:50	1310	**KCRJ**	Jerome, Ariz.	100
6:00	1100	**KGDM**	Stockton, Calif.	250

Have You Missed Something?

SOME of our readers may miss the RADIO PROGRAM FEATURE service that has been taking up four pages of the editorial space in RADIO NEWS during the past few months. There have been so many new feature articles that we wished to get into the magazine this month that we were forced to resort to this measure. Radio development is also going on at such a fast rate that we want to know what proportion of our readers want this feature and what proportion do not. Our future policy will depend upon the reader. Write in to the Editor immediately if you want this feature continued and also those who do not want it should let us know, for we will be guided by the actual vote on "yes" and "no."

JOHN McCORMACK

PRISCILLA AND ROSEMARY LANE

"DOC" ROCKWELL

BACKSTAGE *in* BROADCASTING

Samuel Kaufman

JOHN McCORMACK, world-renowned Irish tenor, recently launched his first extended radio series on the NBC. He is featured on the Wednesday night Vince program and is supported by a fourteen-piece orchestra conducted by William Daly. McCormack had made many guest appearances at American microphones, but this is his first weekly series. His repertory for the series is made up of songs which he used on world-wide concert tours and on phonograph recordings.

AGNES MOOREHEAD, the funny "Cousin Anna" of the Monday CBS "Evening in Paris" broadcasts, is a stage recruit who has been making good as a radio comic. She was born in Boston, the daughter of a minister, and spent most of her childhood in St. Louis. She studied drama and later appeared on Broadway in support of such luminaries as Gertrude Lawrence, Elsie Ferguson and Violet Heming. She has taken comedy parts on many network broadcasts and ranks among the leading female comedians on the air.

IT seems like the old days of radio to again see the name of Ipana Troubadours on program listings. But with the exception of the same sponsorship and name of the old series, the program is entirely new in make-up. The program, of a variety nature, stars Doc Rockwell, the comic, and Fritzi Scheff, the operetta singer. The program is heard over NBC on Wednesday nights. Doc Rockwell scored favorably on previous air assignments and his return to the air shows promise of a new hit program.

THE Lane Sisters—Rosemary and Priscilla—were introduced to air listeners less than a year ago by Fred Waring on the Old Gold program. Today they are one of the best-known sister acts in radio. Rosemary, eighteen, and Priscilla, seventeen, are natives of the little Iowa town of Indianola. They are the youngest of five girls in the family. Their real surname is Mullican, but the girls decided on the billing of Lane for their radio and theatrical work.

BING CROSBY'S decision to return to the air as star of the new Woodbury programs on CBS Monday nights was welcomed in many quarters largely through the songster's splendid talking picture work the past year. Bing's been quite a hit on the screen, and many persons think he's better in the talkies than he is on the air or stage. We hear that he's still much in demand in the Hollywood studios and for the time being his broadcasts will come from the West Coast, with his old friend, Lennie Hayton, wielding the orchestra baton.

HIS talking picture assignment completed, Jack Pearl—the Baron Munchausen—has returned to the air as star of the new Saturday night Lucky Strike programs on NBC. Cliff Hall—the famed "Sharlie"—is also in evidence and the program style, judging by the premiere, is the same as last season's. Pearl was expected to bring back some new program formula from his Hollywood sojourn. Some critics believe that this style, while entertaining, gets monotonous when listened to week after week. It is important for radio entertainers to hold the same audiences each week in addition to constantly attracting new listeners. Pearl won a tremendous audience a year ago.

JOHN MARTIN, noted author of children's stories, has been appointed juvenile director of the NBC. He was welcomed to the network by Mrs. Franklin D. Roosevelt, wife of the President, during a special broadcast from Washington. In speaking of Martin's appointment, M. H. Aylesworth, NBC head, stated that broadcasting enters into its greatest field of service in its contact with the youth of our country. Martin declared that radio is doing impor-

(*Continued from page 438*)

AGNES MOOREHEAD

LIE DETECTOR CATCHES "MUNCHAUSEN" IN FIB

BING CROSBY

THE TECHNICAL REVIEW

JOSEPH CALCATERRA

Radio Construction and Repairing, by J. A. Moyer and J. F. Wostrel. Fourth edition. McGraw-Hill Book Co., 1933. The aim of this book is to give an understanding and practical working knowledge of radio to the reader so that he can make his own receiver and can make repairs in the average factory-made receiver. Comparing the book with previous editions, we notice the added material on new models of tubes and a list of characteristics which is up-to-date enough to include the pentagrid tube. The chapter on repairing and trouble-shooting has also been modernized; further, a section on television has been added. Nearly one-half of the book is devoted to explaining the principles of radio, the action of tubes and their various uses, the working of the most popular circuits. Then follows a chapter containing constructional details on several receivers, including parts list, drilling templates, picture diagrams, etc. The short waves are represented by a description of a short-wave receiver. Chapters on eliminators, chargers, service work and television complete the volume. Amateur constructors and experimenters, beginners in radio, will find useful information in its pages. The serviceman should really know much more than what is given here. Also, some of the most important service adjustments are not discussed—aligning a superheterodyne, for instance. The book suffers from a considerable quantity of old material; for instance, in the chapter on the construction of sets there is not a single one employing a.c. tubes or shielding. All receivers described date from before 1926 and often employ parts which are no longer available. There is practically no discussion of automatic volume control and the index refers to pages where the subject is never mentioned.

The Art of Teaching by Radio, by C. M. Koon. Bulletin 4, 1933. Published by the U. S. Department of the Interior, Office of Education, Washington, D. C. This bulletin analyzes some of the forms educational broadcasts have taken and includes chapters on preparation and delivery of broadcasts and microphone technique. It seems that not alone the educator but also anyone planning to speak before the microphone can find some valuable information in the bulletin. There are six sections with the following titles: I, Introduction; II, Possible forms of Broadcasts; III, Preparation of Broadcasts; IV, Enlisting and Assisting Listeners; V, Presentation of Broadcasts; VI, Bibliography.

Advanced Electrical Measurements, by W. R. Smythe and W. C. Michels. Van Nostrand Co., 1932. This is a textbook on electrical measurements as performed in the laboratory, the equipment used, etc., intended mainly for the student of experimental physics or electrical engineering. Nearly every worker in the radio field, who has occasion to measure electrical quantities, can profit from a careful study of this textbook. Several useful instruments and methods are discussed which are not very well known in radio work. It begins by warning the reader against inefficient "jotting down" of observational data, stressing the importance of records which shall be clear to anyone at any time. The theory of errors is next in order. Measurement of resistance, current, potential difference, quantity of electricity take up one chapter each. The vacuum tube, measurement of its parameters and alternating current instruments and bridges follow. The remainder of the book treats electrical vacuum measurements, electrical thermometry, radiation measurements and electrochemical measurements. Under each head several methods are described. Units are defined, the theory of the measurement discussed; then the instruments are pictured and pointers on their manipulation given. References to other literature is given at the end of each chapter.

Introductory Acoustics, by G. W. Stewart. Van Nostrand, 1933. The improvement in fidelity of present-day receivers and amplifiers has made a knowledge of acoustics indispensable to the advanced experimenter, engineer and serviceman. Since most of the textbooks on the subject are highly technical, this elementary text, which uses no mathematics, will be welcome to many. The author depends entirely on every-day words to explain the fundamental principles of sound waves, reflection, absorption, acoustics of auditoriums, etc. Besides the discussion of sound waves and their properties, there are chapters on speech, musical sounds, audibility, binaural effects, musical scales, etc. Musicians and other artists as well will also find in the book much information of interest to them. As an example of the sort of material discussed, we learn, for instance, that man locates the direction of the source of sound, not by the difference in sound pressure at his two ears, but by the *difference in phase,* and that he has no way of telling how far away it is.

Review of Articles in the October, 1933, Issue of the Proceedings of the Institute of Radio Engineers

A Piezo-Electric Loudspeaker, by Stuart Ballantine. This paper describes an electrophone unit which is specially designed for reproduction of the higher audible frequencies and adaptable for use in combination with loudspeaker units which are efficient on the lower audio frequencies, to produce high overall response over any desired audio-frequency range.

A Compact, A.C.-Operated Speech-Input Equipment, by W. L. Black. The speech-input equipment described in this article is primarily intended for installation as studio equipment for local channel broadcast stations or for permanent installation at outside pick-up points frequently used by large broadcast stations.

Report of Committee on Radio Propagation Data. This report, prepared by the committee mentioned in the title, gives the results of careful studies made to permit the quantitative evaluation of the various parts of the frequency range, as to field intensities produced and as to the limitations imposed by atmospheric and man-made electrical noise and by fading, with regards to radio wave propagation.

Attenuation of Overland Radio Transmission, by C. N. Anderson. Data on the effect of land and water on radio transmission are given in this article and generalizations are made, chiefly in the form of curves, which enable one to make approximations of field strengths to be expected under various conditions of overland, overwater and overland and overwater transmission in the frequency range mentioned.

Audio-Frequency Atmospherics, by E. T. Burton and E. M. Boardman. This paper is the result of a study made to determine the various types of musical and nonmusical atmospherics occurring within the frequency range lying between 150 and 4000 cycles.

Review of Contemporary Literature

The Caesium-Oxygen-Silver Photoelectric Cell, by M. J. Kelly. Bell Laboratories Record, October, 1933. This article gives information on the construction and characteristics of a recently developed photoelectric cell which is more than fifty times more sensitive than the potassium-hydride-cathode type of photoelectric cell previously used for sound picture systems and the electrical transmission of pictures.

Electrical Leakage Over Glass Surfaces, by W. A. Yager. Bell Laboratories Record, October, 1933. This article points out the effect of such factors as chemical nature of the glass, the moisture and temperature conditions and the previous history of the glass used, on electrical leakage developed over the surface of such insulators with time.

The 80A Amplifier, by R. A. Miller. Bell Laboratories Record, October, 1933. This paper describes an amplifier designed especially to make up for the lower sensitivity of the moving-coil microphone when this type of microphone is used in place of the more sensitive carbon or condenser microphones.

An Improved D.C. Amplifying Circuit, by Lee A. DuBridge and Hart Brown. The Review of Scientific Instruments, October, 1933. This paper contains a description of a modification of Soller's circuit for balancing out fluctuations caused by changes in battery e.m.f. and in filament emission so as to obtain high stability and high sensitivity.

Loudness, Its Definition, Measurement and Calculation, by Harvey Fletcher and W. A. Munson. The Journal of the Acoustical Society of America, October, 1933. In this paper the factors which must be considered in determining the sound intensity of simple and complex sounds are explained and the method used to make sound measurements and comparisons are described.

Proposed Standards for Noise Measurement. The Journal of the Acoustical Society of America, October, 1933. This article

contains a statement of the standards for noise measurement adopted by the American Standards Association on Acoustical Measurements and Terminology.

Applications of the Dynatron, by M. G. Scroggie. The Wireless Engineer and Experimental Wireless, October, 1933. In this article, the characteristics and operating conditions of the screen-grid valve used as a dynatron are reviewed from a practical point of view.

A 200-Kilocycle Piezo Oscillator, by E. G. Lapham. Bureau of Standards Research Paper RP576. This paper describes a piezo oscillator specially designed for constancy over periods of a few hours.

Automatic Temperature Compensation for the Frequency Meter, by G. F. Lampkin. QST, October, 1933. This article gives a description of an automatic compensating condenser unit whose capacity varies with temperature to produce frequency changes of the opposite sense to those of the oscillator itself.

The External Loudspeaker and the Miniature Receiver, by Barnett S. Trott. Radio Engineering, September, 1933. This article presents a number of circuit arrangements by means of which external loudspeakers can be operated efficiently and economically from midget receivers.

Radio Retailing's Specifications, 1933-1934. Radio Retailing, October, 1933. A reference guide to new radio equipment, including broadcast, short-wave, automobile, phonograph combination and portable receivers, giving manufacturer's name, model number, price, type of cabinet, dimension, range in meters, power supply, number of tubes and type of tubes, and type of circuit.

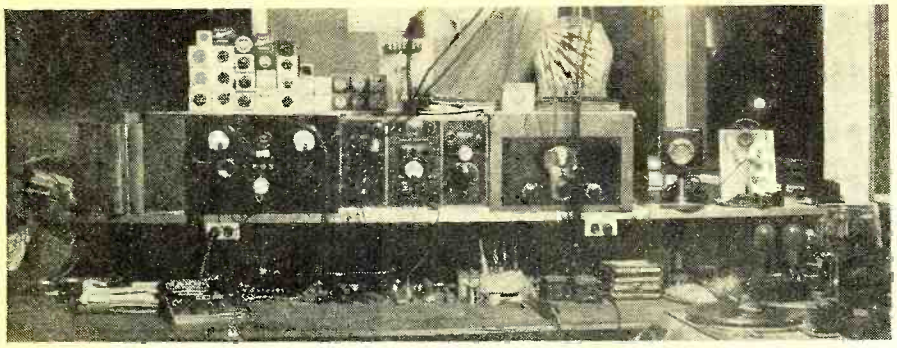
Free Technical Booklet Service

THROUGH the courtesy of a group of manufacturers, RADIO NEWS offers to its readers this Free Technical Booklet Service. By means of this service, readers of RADIO NEWS are able to obtain quickly and absolutely free of charge many interesting, instructive and valuable booklets and other literature which formerly required considerable time, effort and postage to collect. To obtain any of the booklets listed in the following section, simply write the numbers of the books you desire on the coupon appearing at the end of this department. Be sure to print your name and address plainly, in pencil, and mail the coupon to the RADIO NEWS Free Technical Booklet Service. Stocks of these booklets are kept on hand and will be sent to you promptly as long as the supply lasts. To avoid delay, please use the coupon provided for the purpose and inclose it in an envelope, by itself, or paste it on the back of a penny postcard. The use of a letter asking for other information will delay the filling of your request for booklets and catalogs.

Review of Technical Booklets Available

2. *1933 R.F. Parts Catalog.* Complete specifications on the line of Hammarlund variable and adjustable condensers, r.f. transformers, sockets, shields and miscellaneous parts for broadcast and short-wave receiv-

(*Continued on page* 434)



THE SERVICE BENCH

ZEH BOUCK

SEND us service data on your pet sideline! Many radio servicemen are augmenting their incomes by poking screw-drivers into other types of equipment—washing machines, refrigerators, motion picture apparatus, both home and commercial. If any of this is up your alley, send us the dope! We'll pay you for it, and pass on the good word to the rest of the gang!

—The Service Editor.

Refrigerator Sales and Service

With the rapid extension of power lines into rural areas, the *sales* and *service* of electrical refrigerators offers an increasingly profitable sideline to the small-town radio service man. It is in appreciation of this fact that we are soliciting data from the field on refrigerator service work.

While most of the modern electrical refrigerators are built on the unit principle, whereby the electrical and mechanical parts are sealed in a single unit which is returned to the manufacturer in the case of trouble, many refrigerators of the open design are finding their way into small communities via second-hand markets, and thousands of them are still giving excellent service to their original owners. And refrigerators of this vintage and type are those that require the most consistent attention of the expert service man—for oiling, elimination of leaks, thermostat adjustment, new brushes or starting contacts and general repair. And even the unit type will often require attention, usually for adjustment of the thermostat.

Reducing Pump Vibration

Arthur Crosley, writing from Oswego, N. Y., describes the manner in which he has increased owner satisfaction with several of the open type refrigerators:

"The refrigerators in question were a 1928 model Kelvinator and a 1930 Copeland, both of which have open belt driven pumps in the bottom of the cabinet. The complaint in each case was excessive noise and vibration—one instance being so severe as to shake articles off the top of the refrigerator. The pumps in these refrigerators are driven by belts over large, spoked flywheels. I secured several ¼-pound lead sinkers, and tentatively wired one to different spokes until I discovered the position that provided the best counterbalancing. At this point I bolted the weight by drilling through the spoke.

"The results were quite satisfactory. It is conceivable that, in similar cases, it might be desirable to experiment with different weights at different radii. I fastened the weight as close to the periphery as possible."

Thermostat Adjustment

A dealer in both Majestic radios and refrigerators, Eddie Scribner, of Schoharie, N. Y., describes the major service operation associated with the latter:

"With only an occasional exception, all our refrigerator service calls have been in answer either to the complaint of excessive power consumption or slow freezing. The former trouble is accompanied with the necessity for frequent defrosting, and now and then food stuffs are partially frozen.

"Both categories of incorrect operation are of course due to improper thermostat adjustment. In servicing such cases, I first take the temperature of the storage compartment—top shelf, and about six inches from the freezing unit. In the case of the Majestic refrigerator, the speed of refrigeration is adjustable—for fast or slow freezing. In the "fast" position, the thermostat should turn on the motor when the temperature rises to 36 degrees F. With this adjustment, the contacts should close at 42 degrees F. on the "slow" position, providing there is nothing inherently wrong with the control mechanism.

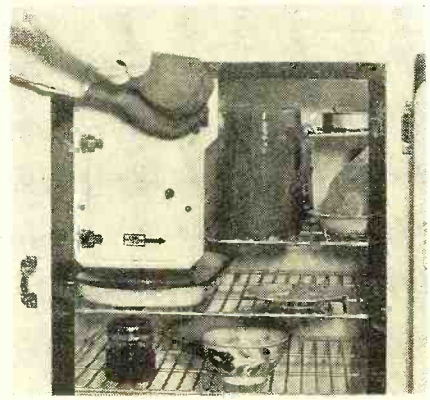


FIGURE 1

"The adjustments of the thermostats on the Majestic models 700 and 205 are shown respectively in photographic Figures 1 and 2. In the type 700 it is a relatively simple matter, the adjusting screw being automatically unlocked as it is pushed in with the screw-driver. In the 205 the name and control plate must first be removed. In each model turning to the left, or counter-clockwise raises the temperature at which the thermostat goes into action (turns on the motor)."

This Month's Service Shop

The R. A. Clayton Electric Shop, Hill City, Kansas (heading), provides an excellent example of what can be done with essential equipment and without superfluous apparatus. The unit at the right is a Kolster 6D revamped into a shielded r.f. oscillator, with three similtaneous broadcast frequencies modulated at 1000 cycles or with phonograph. The large baffle in the upper center is for speaker tests. Additional equipment includes a Supreme tube checker, oscillator and analyzer, and the usual array of volt and ammeters.

The letter head of the Clayton Electric Shop adds fuel to this month's editorial tinder. It declares:

"We service: Refrigeration, Generators, Mangles, Washers, Motors, Radios, Irons, Fans."

The Day's Work

The service man is gradually becoming convinced of the facts (which all old operators have long appreciated) that a good ground is essential to best reception, and that in many localities it is not an easy thing to obtain.

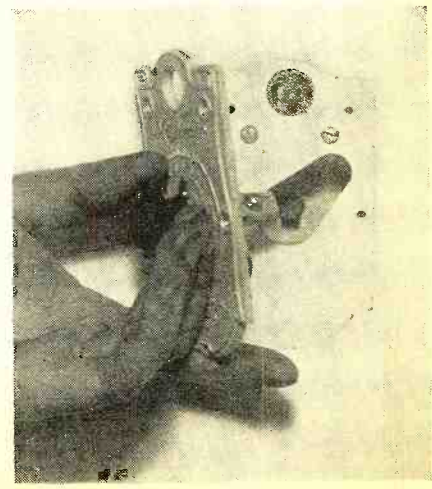
In solving the problem of the dry climate ground, Andrew Platco, of Brockway, Pa., calls into service a discarded hot water tank or boiler. The boiler should be planted as deeply as reasonable industry will permit, and filled with water, which will seep out through the usual openings. We'd suggest throwing a few pounds of copper sulphate and rock salt into the water.

The $CuSO_4$ and NaCl idea enters into the ground system suggested by F. E. Peters of Fresno, California. Three pounds of copper sulphate and five pounds of rock salt are required—in addition to three pounds of pulverized charcoal. An eight or nine foot length of iron pipe is driven into the bottom of a larger hole—the larger hole being as deep as it is possible to make it. The sulphate and salt are dissolved in five gallons of water. The hole around the pipe is then filled up with layers of earth and charcoal moistened with the solution and tamped down. According to Mr. Peterson, this ground, like many other good things, improves with age, and best results will be obtained after eight months have elapsed.

Majestics and Philcos

From Manchester, England, Mr. R. E. Blakely sends us the following data on the Majestic series 20 and 60: "One of the most common troubles with these receivers is what is usually interpreted as the breakdown of i.f. transformers. However, inspection, on opening the cans, will generally show a defective 0.1 mfd. condenser. A hint on how to get inside the can might be in order. Drill out the rivets, and then place the can on a stove until the bitumen is thoroughly molten, when the bottom can be readily removed. Service men in

FIGURE 2



America may be interested to know that a new intermediate-frequency unit costs about $6.00 in England, while the repair outlined above sets one back only about a shilling!"

Mr. Blakely continues, and points out an unusual trouble with the Majestic 60 and Philco 56E superhet. "In humid and moist climates, these receivers often display peculiar tuning troubles. The Majestic usually goes well out of calibration while the Philco will not tune over the full scale. The trouble is due to the cotton covered leads loading up with moisture, and can be corrected by rewiring all grid circuits with rubber covered wire. The English Philco people suggest retrimming, but surely this is a case of making two wrongs into a right!

"In looking over the Rogers-Majestic 8-tube superheterodyne, one would consider the gang condenser assembly to be fool-proof. However, I recently tracked down trouble on one of these receivers to the tuning unit. A tiny piece of solder had punctured the mica insulation on the trimmer, causing a short when it was adjusted."

Novel Screw Driver

Frank W. Bentley, Jr., of Missouri Valley, Iowa, uses a novel screw-driver in tight corners where even the shortest of the conventional type cannot go. It is made by filing down an iron bolt washer as shown in Figure 3. Considerable force can be exerted, even with the fingers, and in real stubborn cases the shank of a standard screw-driver can be inserted in the hole to provide additional leverage.

While on the subject of kinks, James M. Bruning, of Coatesville, Pa., considers the annoying problem of sticking meter pointers.

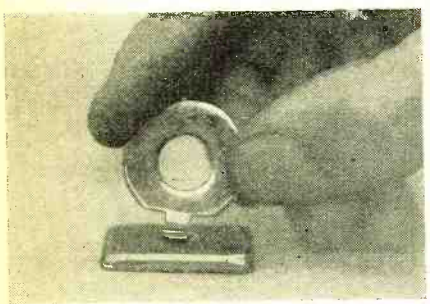


FIGURE 3

"Service men and experimenters are often troubled with a meter which has the habit of sticking. The needle or indicator having become stuck to the left of zero mark, it is found necessary to tap the meter to

(*Continued on page 446*)

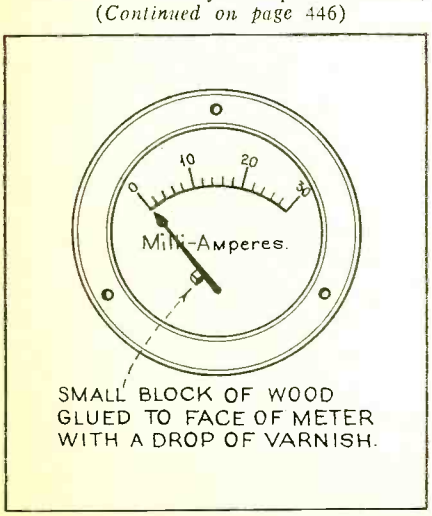


FIGURE 4

WITH THE EXPERIMENTERS

S. GORDON TAYLOR

Keeping Receivers Dry

Every experimenter knows the effects of dampness on his receiver. Here's a simple method of correcting this condition and eliminating many of the losses which are caused by dampness: At the rear of the chassis, inside the cabinet, mount a standard 110-volt electric lamp socket. During damp or rainy weather a 50-watt lamp should be placed in this socket and burned for perhaps an hour before the set is used. The heat from the lamp will cause the interior of the set to become quite dry. Another plan is to burn a smaller lamp continuously during damp spells.

If the set is small or if there is no room for a socket, a 50 or 100-watt lamp may be merely placed inside the set and then removed when the moisture has evaporated.

HARRY D. HOOTON,
Beech Hill, W. Va.

Input Transformer for Ribbon Microphone Amplifier

In the article by Earl R. Meissner appearing in the July issue, describing how to make a ribbon microphone, the caption accompanying the schematic diagram of a suitable pre-amplifier stated that information for revamping a standard audio transformer to serve as the input for this unit would be given in the text of the article. Through an oversight, this information was omitted and is quoted herewith from Mr. Meissner's original manuscript.

"The microphone transformer, T1, must match the low-impedance ribbon to that of the tube input. This is not an easy task, because of the high ratio between the two, the impedance of the microphone being only a fraction of 1 ohm.

"The author revamped an Amertran FA-8 audio transformer to serve the purpose. First the bottom of the case is pried off. Then the terminals are unsoldered and carefully noted. The transformer is then set on a "hot plate" until the sealing compound has melted, after which it is lifted out of the case and as much wax cleaned off as possible. After partially cooling, the wax between the outside of the winding and the core is dug out. There is approximately ⅛ inch between the two which allows plenty of room to pull through twenty turns of No. 22 enameled copper wire. This primary is wound directly over the secondary winding. While larger wire sizes can be used for this, it is not advisable to use smaller, as the d.c. resistance would be too high.

"The lead marked grid is connected to the lead marked plate so that the former primary and secondary coils form the new secondary. The lead marked B plus thus becomes the grid lead and the C minus remains C minus.

"After this 'operation' the transformer is put back into its shield case, care being taken to replace the fiber insulator so that the iron core and the case do not touch.

"The core of this transformer is quite sensitive to stray alternating current magnetic fields and hence it is advisable to provide additional shielding to that necessary for the rest of the amplifier. An iron or steel shield is found to be much more effective than a non-magnetic shield. One can easily be made from a piece of 2¾-inch outside diameter, ⅛-inch wall, steel tubing. This is slipped over the transformer and square end plates of the same material and thickness are held in place by means of two tie bolts. Three holes are bored in the steel case through which the leads are brought out, the primary being brought out one hole by means of a twisted pair. The steel case is grounded to A minus."

Pepping Up the Choke Input

Quite a number of receivers use an input system as shown in Figure 1, that is, the aerial is coupled to the grid of the first tube

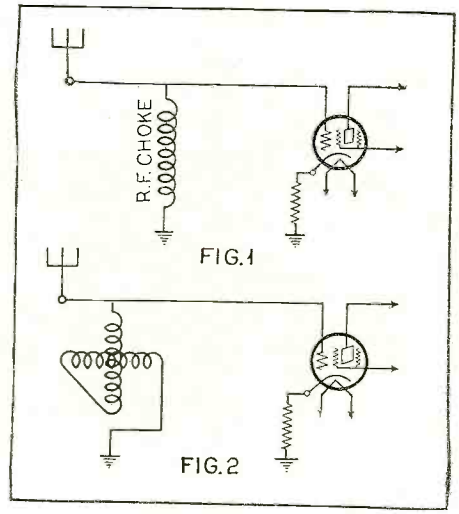


FIG. 1

FIG. 2

through a choke. Being a person to whom DX means more than single control, I set about some way of "pepping up" the old Silver model 30 and at a negligible outlay of cash. I secured a variometer as shown in Figure 2. The results are well worth the little time and trouble it takes to rig the affair up; volume being increased a great deal and selectivity sharpened somewhat. Since making this change I have discontinued using my outside aerial and am using a screen about 8 inches x 12 inches. Tube for tube I'll match the "ole set" against anything using a similar aerial.

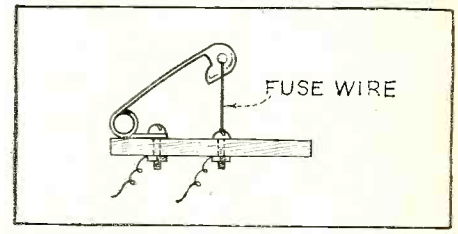
JOSEPH STOKES,
Swissvale, Pa.

Home-made Fuses

Fuses for high voltage require that the break be very abrupt and of reasonably great length so that excessive arcing will not take place. If arcing does occur, the fuse fails to protect the apparatus and there is additional danger of fire.

Fuses for high-voltage work of the order of so-called "grasshopper" type may be made from a safety pin. The pointed end is bent into a loop and bolted to a base of insulating material and the fuse wire fastened to the head of the safety pin. The other end of the fuse wire is then bolted to the base in such a manner that the wire is under tension. When the fuse blows, the safety pin will spring open, increasing the gap. Further, the open pin will act like a horn gap, tending to extinguish the arc.

Uses for the fuse are obvious. They are especially advantageous to protect the rectifier and power tubes of transmitters and power amplifiers, and they indicate the point of trouble. If a fuse of this type is placed in series with each filter condenser, when one of the condensers blows, the fuse will protect the rectifier and transformer, indicate which part is defective and allow the apparatus to continue to function, although with more



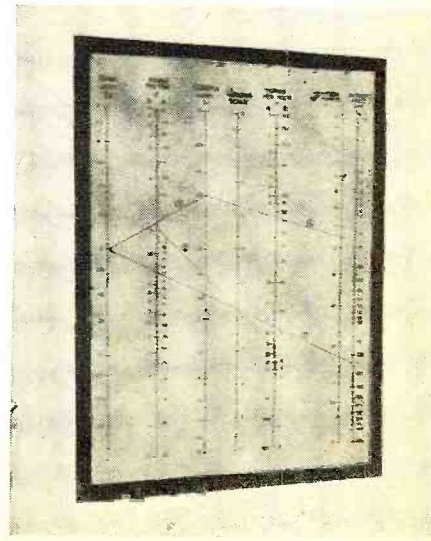
than normal hum. Tinfoil fuses may be made for low current uses of this type and may be made to blow on light loads if carefully made in small widths. For heavier loads regular fuse wire is best.

F. C. EVERETT,
Delta, Ohio.

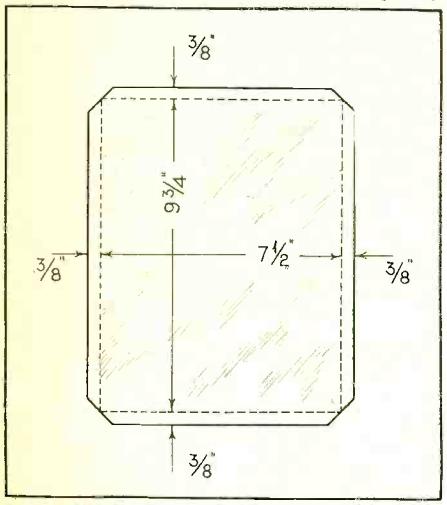
Mounting Charts

The series of charts that are printed in RADIO NEWS under the head of "Graphs and Charts" are very useful, but if left in the magazine are difficult to handle and if cut out soon get ragged and torn and eventually become useless.

The mounting for the charts that is described here does away with both of these disadvantages and makes them easy to find as well. They are made from sheet metal. It can be aluminum, copper or even thin sheet of steel, and are cut to the shape shown in the drawing. A sheet of celluloid is obtained and cut to the size of the chart. The chart should be cut with a ⅜ inch



margin on each side of the border. The edges of the sheet metal are then folded over with the chart and celluloid sheet in position and the chart is completely

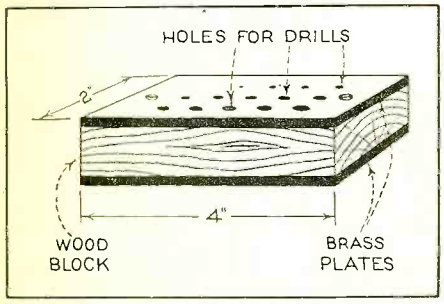


inclosed, ready for use. A transparent celluloid triangle is convenient in using this type of chart.

HARRY S. KENYON,
Berlin Heights, Ohio.

Inexpensive Drill Holder

A handy drill holder can be made from a piece of 2-inch by 4-inch wood 6 inches long. Plates of ⅛-inch thick soft brass are fastened on the two sides of the block by wood screws. Holes are drilled through the

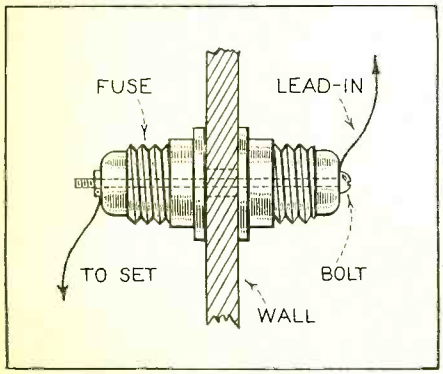


top brass plate and through the wood to, but not through, the bottom plate; and each drill is placed in the hole that was made with that particular drill (or the next larger one). Two or three rows of holes can be drilled, and the drill numbers scratched on the upper brass plate near the holes.

GEORGE MARK,
Los Angeles, Calif.

Neat Lead-in Insulators

For each insulator two burned-out plug type fuses and a long brass screw are needed.

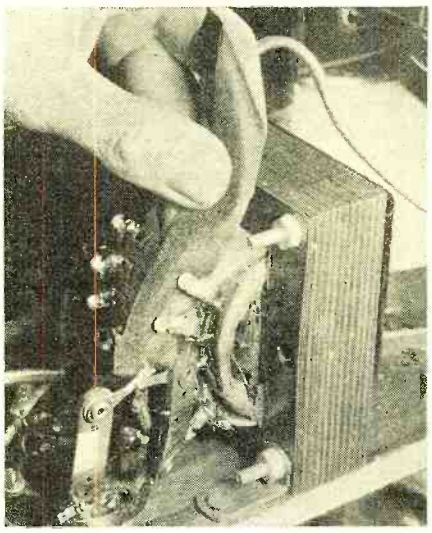


The metal rim is removed from the fuse, the contact screw is broken off and the end contact is drilled out. Then a long brass screw is run through as shown. This makes an inconspicuous and neat-looking job and is both simple and cheap.

HOWARD PATTERSON,
Ganett, Ind.

Avoiding Shorts and Shocks

Frequently, in radio set building, all terminals of a power transformer are not used.



Accidental short-circuits or shocks can be avoided by wrapping friction tape around the unused terminals. The illustration shows a power transformer with the unused lugs being taped as a safety precaution.

WALTER E. BURTON,
Akron, Ohio.

Auto Radio Noise

(*Continued from page* 410)

Several well-known makes of auto radio and several roof and undercar antennas were chosen and their impedances measured. Figure 4 shows the average values obtained. That is, Z'_1 is the average impedance between the antenna and ground posts of several auto radios, while Z_1 is the average impedance of several car antennas. Z'_1 and Z_2 show how nearly the filterizer system, consisting of a shielded lead and a matching transformer, as shown schematically, can be made to match the impedances looking both into the antenna and the radio set.

With a shielded lead-in and a carefully designed transformer it is possible in many cases to increase, rather than decrease, the volume of the signals received.

There is also a psychological effect after the filterizer has been installed. Signals actually seem louder. The reason is apparent. The noise has decreased.

A few practical suggestions on installing the interference reducing devices described may be timely. Ground the shielded lead-in which comes down from the antenna proper to the frame of the car in as many places as possible. Don't just ground it at one place and let it hang so that it will slap against the car chassis. Be sure that the lead from the transformer is shielded all the way to the antenna post of the receiver. If splices are made in shielded lead-in always connect the two shields together. Be sure your auto radio is completely shielded.

If a roof antenna is used put a Filterette on the dome light, while if an under-car antenna is employed as the pick up, filter the tail light. If a proper installation is made the devices will, in practically all cases, reduce car noise to such a point that it is no longer noticed.

RADIO PHYSICS COURSE

ALFRED A. GHIRARDI

Lesson 25
Induction

WE found by experiments that it is possible to induce a voltage in a conducting circuit by means of a magnet. It is also possible to induce a voltage in one conducting circuit by means of current flowing in another separate circuit, as we shall now show.

From our previous considerations of electromagnetic induction, we know that when a current is sent through coil No. 1, a magnetic field is produced within and outside of this solenoid. Because coil 2 is placed near it, at least part of the field of coil No. 1 will link with the wire of coil No. 2 as shown at (A) of Figure 1. When the field of coil No. 1 varies due to a change in current, this induces voltage in coil No. 2 just as a bar magnet plunged in and out of it would do.

Now close the switch. Notice that even though a steady current is flowing through coil No. 1 (possibly the wire will get hot), no voltage is induced in coil No. 2. The magnetic field around coil No. 1 is now steady and since no lines of force are either linking or unlinking with coil No. 2, no voltage is being induced in it.

Quickly open and close the switch several times. Notice that you can produce a varying current almost continuously. If you had some mechanical means (a vibrator or interrupter) for quickly opening and closing this circuit, you could induce voltage and current in coil No. 2 continuously. Also if you were to send an alternating current through coil No. 1 (the 110-volt a.c. electric light line could be connected to coil No. 1 with a 100-watt incandescent lamp in series to keep the current down to about one ampere for this purpose) the magnetic field around it would be changing rapidly and would induce an alternating voltage in coil No. 2. The galvanometer will not indicate a 60-cycle alternating current, but the needle will seem to vibrate or shiver about the zero mark on the scale. This is the principle on which transformers used so very extensively in radio and electrical work of all kinds operate.

The winding into which the current is sent is always called the *primary* (coil No. 1). The winding in which the voltage is induced by electromagnetic induction (coil No. 2), or which delivers the *energy*, is called the *secondary* coil. The primary may have the same number, more turns, or less turns than the secondary, as we shall see later.

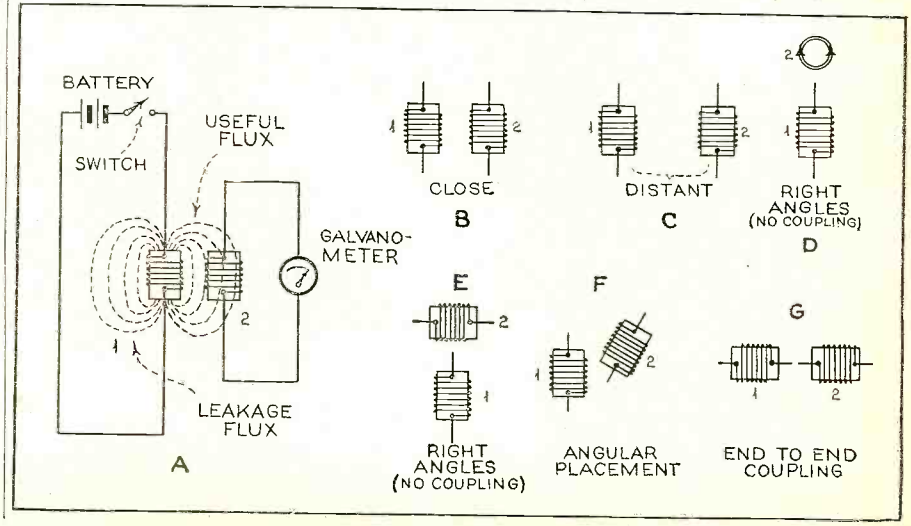
Now place coil 2 in various positions around coil No. 1, as shown at (B) to (G) of Figure 1, and in each case close and open the switch quickly and notice the amount of deflection of the galvanometer needle. The deflection is a measure of the voltage induced in coil No. 2. Notice that the induced voltage depends on the distance of coil No. 2 from coil No. 1 and its relative position to it. When they are parallel and close together, as at (B), the induced voltage is high because a large part of the lines of force of coil 1 link through coil No. 2. Another way of looking at this is that the forces produced by the electron orbits in coil No. 1 are then very effective (since the distance is short) in affecting the electrons in coil No. 2, and making them flow around through the wire of coil No. 2.

When they are placed so their central axes are mutually at right angles and coincide, as at (D) and (E), no effective induced voltage is obtained, for the induced voltage set up in each half turn of coil No. 2 is exactly equal and opposite to that set up in the remaining half turn, as shown at (D), so the voltages cancel each other. This is called a *zero coupling* position. As we shall see later, when discussing radio-frequency amplifiers, this fact is made use of in the mounting of radio-frequency coils mutually at right angles to each other to prevent magnetic coupling between them. Notice that the coil No. 2 must be exactly centered about the axis of coil No. 1 to get zero coupling. If it is moved one way or the other, a resultant voltage will result in a direction depending on which side coil No. 2 is moved to.

In these simple experiments we have succeeded in transmitting electric energy across space from one coil to the other by means of the magnetic field. This is really somewhat similar to the phenomena occurring between the transmitting aerial and the receiving antennas in radio reception, although several modifications must be made in practical transmission to produce electromagnetic radiations that will travel over long distances.

It is evident that since only part of the lines of force set up around coil No. 1 link through coil No. 2, not as much voltage is induced in coil No. 2 as there would be if we could make all of the lines of force of

Figure 1. Mutual induction between two coils placed in various positions



coil No. 1 go through it. The lines of force of coil No. 1 which do not link with coil No. 2 but go around through the air by some other path (see (A) of Figure 1) are called *leakage lines of force* or *leakage flux*. Since they do not contribute in producing induced e.m.f., it is important to keep the leakage flux in a transformer as low as possible. This is accomplished in the practical commercial transformers by winding the two coils on a core of some highly permeable magnetic material such as soft steel. Two advantages result from this construction. First, the leakage flux is greatly reduced, since practically all of the magnetic field will now be within the core and will therefore thread through the secondary coil. Also, since the iron core is a good magnetic material, a much stronger magnetic field is now available for the same current and number of turns of wire in the primary, since the magnetic forces of the electronic orbits in the steel are now made effective and add to the effect of the electron flow or current in the primary winding. Some lines of force may leak directly across the air space in the iron core, as shown, if it is made too long or too wide. This results in a lower induced e.m.f. in the secondary than there would be if there were no leakage. Also the leakage flux induces an opposing or counter e.m.f. back into the primary. The effect is the same as though a resistance (or reactance) were placed in series with the primary winding so as to reduce the available primary current and so reduce the induced voltage in the secondary. This is called *leakage reactance*. It is easier to look at the effects of magnetic leakage as a reactance reducing the primary current, because it is impractical to try to find out just how many lines of force are leaking across, whereas it is easy to measure with a voltmeter just how much lower the reduced voltage is than the calculated value, and then express this as a voltage drop due to a certain amount of "leakage reactance."

* Radio Technical Pub. Co. Publishers, Radio Physics Course.

Getting Acquainted with Short Waves

(*Continued from page* 419)

The skip-distance effect is a reflection phenomenon caused by an ionized stratum of rarified air—possibly a hundred or so miles up. It is known as the *Kennelly-Heaviside layer*, after the American and British scientists whose research demonstrated the manner in which these effects are produced.

The term *ionized* describes an electrified condition of a gas or liquid. The state of ionization can be produced artificially in many ways, and the red neon light signs are an example of its commercial application. In the upper strata of our atmosphere it is thought to be induced by solar radiation, and often becomes visible as the Aurora Borealis. The Kennelly-Heaviside layer acts as a *reflector* of radio waves—sending them back to the earth at a point far beyond the local area serviced by the ground wave. The earth itself functions as a mirror to a high-frequency signal, shooting it skyward again for another skip—the phenomenon being repeated until the wave is attentuated into oblivion (dies out). Only the first two, three or four skips are usually of communication utility.

The drawing of Figure 2 presents a graphic conception of the skip-distance effect. A signal starting at point P_1 fans out, after the manner of any radiated wave, entering the Kennelly-Heaviside layer between points (P_2 and P_3). The spreading effect is increased during reflection, due to the fact that reflection is diffuse rather than sharp—being gradual as the signal enters the layer. The signal returns to the earth and may be heard between points P_4 and P_5. The phenomenon is repeated and the signal may again be received over an increased area limited by P_6 and P_7.

It is obvious that the higher the point of reflection the greater will be the skip distance. In other words, the skip distance is a function of the depth to which the signal penetrates the layer before being sent back to the earth, which in turn depends upon the frequency or wavelength. Variation in penetrating power with wavelength is a familiar optical phenomenon. For instance if we increase *light* frequency sufficiently, far beyond the visible portion of the spectrum, we have the X-ray which passes readily through opaque substances.

Below 10 meters, the penetration is so great, that the radio signal *passes through* the ionized layer. There is then no reflection and communication seems to be ordinarily limited to the range of the direct ground wave.

It is obvious that the skip distance will be influenced by the height and density (or thickness) of the Kennelly-Heaviside stratum. As this is the result of solar emanation, it follows that its characteristics will change from day to night and with seasonal variations, accounting for the difference in reception *before* and *after* dark, and between *summer* and *winter* results.

At night the earth's shadow prevents the ionization of the lower part of the layer. Thus the layer is much thinner and its average height is increased. The very high frequencies that were reflected over great distances during the day now penetrate through the layer into interstellar space and are lost as far as earthly reception is concerned. But the lower frequencies, which were relatively ineffective in day time, now skip across the continent by virtue of the higher reflector, as shown in Figure 3.

The skip-distance effect contributes its greatest utility below 60 meters (5 mc). At 50 meters (6 mc) the ground range, day and night skip distances are all about 50 miles. At 40 meters (7.5 mc) the ground range is approximately 40 miles, the day skip distance is 150 miles and the night skip is about 300 to 400 miles. Dropping to 30 meters (10 mc), our ground range is limited to 35 miles, the day skip distance has jumped to 250 miles and the night span to 500 miles. At 20 meters (15 mc) we are at the tail-end of night reflection, but we have a day-time skip distance of around 550 miles and a ground mileage of 25 or thereabouts. Just above the ultra-short-wave region, the local range is 10 miles and the sun-light skip distance well over 1,000 miles. There is, of course, no night reflection.

Summing it all up, our best short-wave reception will be had between 10 and 30 meters (30-10 mc) during the day, and between 30 and 50 meters (10-6 mc) at night. As may be imagined, the Kennelly-Heaviside layer is in a state of more or less constant motion (agitation), resulting in slow and rapid shifts of the reflected beam, giving rise to the phenomenon we know as *fading*.

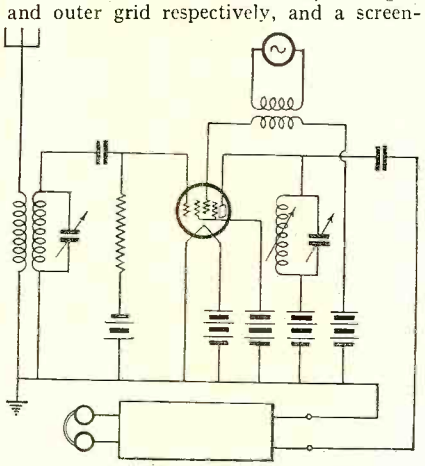
In the next article we shall consider just what there is to listen to on the short waves, the entertainment value of short-wave fare and the simplest methods of sampling it and learning something about its characteristics.

LATEST RADIO PATENTS

BEN J. CHROMY*

1,896,780. MODULATING DEVICE. FREDERICK B. LLEWELLYN, Montclair, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a Corporation of New York. Filed Mar. 2, 1931. Serial No. 519,304. 6 Claims.

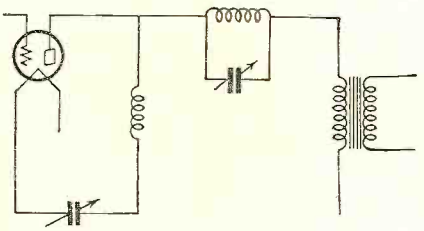
1. A heterodyne detector comprising a space discharge device having a cathode, an anode, an inner grid and an outer grid, circuits individual to said anode, inner grid and outer grid respectively, and a screen-



ing system interposed between said anode and outer grid and between said outer grid and inner grid, said screening system being positively polarized at a potential intermediate the anode and cathode potentials whereby electrostatic coupling between every pair of said individual circuits due to interelectrode capacity is substantially eliminated.

1,899,025. RADIO RECEIVING SYSTEM. MILTON MERWIN EELLS, Chicago, Ill., assignor, by mesne assignments, to William Turnor Lewis, Racine, Wis. Filed Nov. 11, 1926. Serial No. 147,698. 5 Claims.

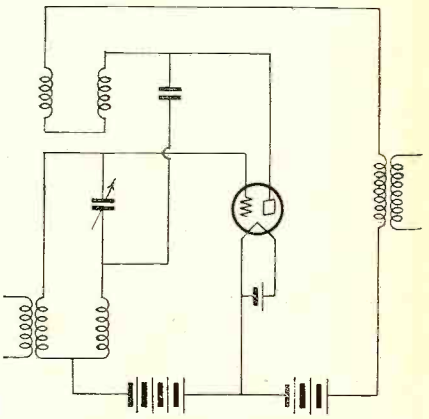
1. In a radio receiving system, the combination of a plurality of tubes having



the plate circuit of one tube coupled to the grid circuit of the succeeding tube, one of said circuits having a tuned resonant impedance interposed therein to prevent the passage of radio frequency energy to the grid of the succeeding tube, said impedance being tuned to the frequency of the received energy and a bypass from the filament of one tube to one of said circuits, said bypass permitting the free passage of radio frequency energy.

1,899,758. AMPLIFYING SYSTEM. KENNETH W. JARVIS, Cincinnati, Ohio, assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania. Filed July 17, 1926. Serial No. 123,211. 9 Claims.

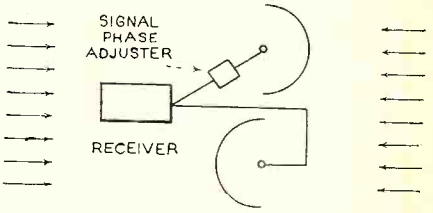
9. In an inherently oscillatory thermionic-tube amplifier, feed-back means for preventing self oscillation over the range of frequencies for which said amplifier is



designed and additional feed-back means for preventing self-oscillation at frequencies above said range, one of said feedback means being capacitive and the other inductive in character.

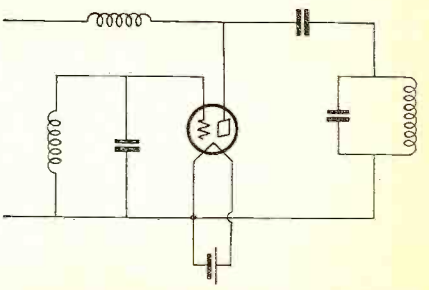
1,899,493. RECEIVING SYSTEM. OTTO BOHM, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie, m. b. H., Berlin, Germany, a Corporation of Germany. Filed Jan. 30, 1929, Serial No. 336,112, and in Germany Mar. 31, 1928. 2 Claims.

1. A receiving system, especially for



short waves comprising two antennæ or antenna systems, each of which is furnished with a reflector, the reflector of one of said systems being mounted upon a side opposite the reflector of the other system, said two antennæ or antenna systems being associated with a joint receiver responsive to all of the signal energy collected upon the two antennæ or antenna systems.

1,899,939. ARRANGEMENT FOR RADIO CIRCUITS. WERNER BUSCHBECK, Berlin, Germany, assignor to Telefunken Gesellschaft für Drahtlose Telegraphie m. b. H., Berlin, Germany, a Corporation



of Germany. Filed Dec. 28, 1928, Serial No. 328,876, and in Germany Dec. 31, 1927. 4 Claims.

1. In an electrical system, means for preventing high frequency energy from

* Patent Attorney, Washington, D. C.

passing into any desired branch thereof, comprising a choke coil connected in series with the desired branch and means for coupling said choke coil with another coil connected to any other part of the system passed by the high frequency energy and means controlled thereby for setting up in said choke coil an electromotive force of such a value that the electromotive force caused by any alternating current energy in said choke coil is neutralized.

Utility-Plus Service Tester

(*Continued from page* 409)

at the top, the black in the center and the green at the bottom. The black jack for the ground is connected at the right. Next the a.c.-d.c. switch is mounted at the left, and the 5000 ohm rheostat with its knob at the right. The various other switches may be mounted in any convenient order as desired. Care should be taken to refer constantly to the photographs and to the schematic diagram, although it should be noted that the arrangement of terminals of SW2 and SW3 has been altered in Figure 1 to simplify the circuit drawing, and the order is therefore not the same as engraved on the panel.

The tester is now ready for the wiring. A good grade of wire should, of course, be used.

The following procedure is recommended: First, start with all the sockets, and complete this wiring as far as possible. Second, start with the selector switch and complete the wiring from this switch. Do the same thing with each switch and component until the entire job is completed.

The last thing to be done is to mount the small 6 inch by 3 inch Bakelite panel on the three right-hand posts of the meter. The shunt and multiplier resistors will be supplied already mounted on this small panel. Also mount the Littlefuse clip and a metal case .5 mfd. filter condenser on the small panel. This, after being tested, completes the wiring. The shunts must be connected directly to the switch with heavy wires, making the leads as short as possible, and the opposite leads must be connected to the bus-bar. All wires going to the bus-bar must be connected directly and not to some other wire leading to the bus-bar; otherwise there is a possibility of introducing harmful resistance.

The external cable is colored according to the R.M.A code, and is connected to the various points on a switch as indicated on the schematic diagram. Note that the 100 ohm fixed resistor is soldered directly to a terminal of the 5000 ohm rheostat. The 13500 ohm series resistor is soldered directly to the ohmmeter switch terminal without using any other form of mounting. The analyzer cable comes in from the left-hand side, and is carried around close to the meter, entering at the approximate center line of the panel, following around the meter and being wedged in place so that it needs no additional anchoring.

The meter used is a 50 millivolt a.c.-d.c. type with 5 volts as its lowest a.c. range. This instrument is particularly interesting, since it is the very latest Hickok meter equipped with a new type knife-edge pointer, which renders it possible to make all readings with an unusually high degree of accuracy. The meter dial has five different scales. The use of this single universal type meter permits voltage readings of various ranges in five positions and current readings of various ranges in the other five positions. The voltage ranges are 0-5 volts, 0-10 volts, 0-50 volts, 0-250 volts and 0-1000 volts. The current ranges are 0-1, 0-10, 0-25, 0-100 and 0-500 milliamperes. These are obtained through the use of four separate shunts.

It will be noted that a one ampere instrument Littlefuse is used. This tiny protective device is of extreme importance in the protection of the meter and of other delicate parts of the tester.

A special quartered oak cabinet has been constructed for the "Utility-Plus" Tester. This cabinet is made up of ⅝ inch thick wood so that it furnishes real protection for the tester. Nevertheless, it is surprisingly light, attractive and compact. In addition to housing the tester, it contains a compartment for tools, adapters, tubes, etc.

Anyone who can assemble and wire a simple radio receiver will have no trouble whatsoever in completing the tester. The job when finished, however, will give the serviceman a real professional instrument, capable of taking care of any type of radio servicing likely to be encountered.

List of Parts

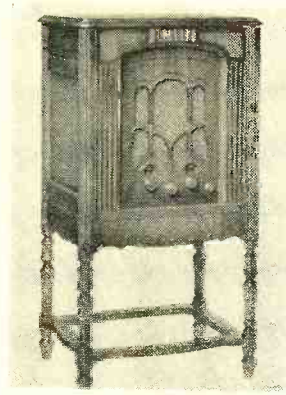
SW1—1 Yaxley 3-pole, 10-position switch, type 1630, non-shorting
SW2, SW6—2 Yaxley double-pole, 10-position switches, type 1620
SW3 — Yaxley single-pole, 10-position switch, type 1610 non-shorting
SW4—1 Yaxley 3-pole, 3-position switch, type 1633
SW5—1 Yaxley single-pole, 6-position switch, type 55
1 Yaxley single-pole, double-throw push button switch, type 2003, non locking
1 Yaxley single-pole, double-throw push-button switch, break contact locking type (condenser switch)
1 Yaxley single-pole, single-throw push-button switch, break contact non locking type (safety switch)
1 Double-pole, double-throw toggle switch, nickel plate (reversing switch)
1 Alden 4 prong socket, type No. 424
1 Alden 5 prong socket, type No. 425
1 Alden 6 prong socket, type No. 436
1 Alden 7 prong, medium base, socket, type No. 437
1 Alden 7 prong, large base, socket, type No. 437A
4 Alden insulated tip jacks (one red, one green, two black)
1 Alden insulated screen grid cap and lead
1 Frost 5000 ohm potentiometer, type No. 6141
1 Kit of multipliers, (1—5000 ohm, 1—4950 ohm, 1—45000 ohm, 1—245000 ohm and 1—750000 ohm)
1 Kit of 50 mv. shunts (1—10 ma., 1—25 ma., 1—100 ma., 1—500 ma.)
1 Small bakelite mounting strip for shunts and multipliers
1 Alden eight wire cable, 6 ft. long with Alden analyzer plug, type No. 907, WLC.
1 Alden set of 4 adapters, type No's. 977 DS, 976 DS, 975 DS and 974 DS
1 13000 ohm, 1 watt resistor, for continuity tests
1 Yaxley 100 ohm, wire wound resistor, type 8100
1 Hickok a.c.-d.c. meter, flush type model 49X, 50 millivolt
1 4000 ohm, ½ watt resistor, in C battery circuit
1 Littlefuse 1 ampere instrument fuse, type No. 1008 with mounting clip type No. 1010
5 Instrument knobs
3 Burgess 7½ volt C batteries, No. 5540
1 Eveready flashlight cell, 1½ volts, type No. 935
1 Hardwood cabinet, 15¼ inches by 10⅛ inches by 5⅜ inches high
1 Drilled and engraved bakelite panel, 9 inches by 10 inches by ⅛ inches
Bus-bar, hookup wire and hardware

WHAT'S NEW IN RADIO

WILLIAM C. DORF

Console and Midget Receivers

Description—The new line of RCA Victor receivers comprising eight different models, includes a compact table-size radio phonograph combination, four consoles,



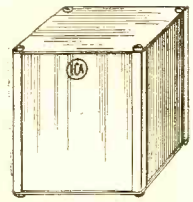
two midgets and one compact style receiver. The Model Duo 310 console radio phonograph combination is a five-tube superheterodyne equipped with variable tone control, vernier tuning and illuminated volume control. The cabinet measures 37¼ inches high by 20½ inches wide. The second illustration covers the model 110 receiver, a five-tube superheterodyne 14¼ inches high, by 11⅞ inches wide by 8⅛

inches deep. Both receivers employ the following type tubes: One 57, one 58, one 2A7, one 2A5 and one -80 type rectifier. They cover police signals in addition to the regular broadcast wavelengths.

Maker—RCA Victor Company, Inc., Camden, N. J.

Metal Boxes, Shields and Panels

Description—This company announces a complete line of aluminum and electralloy

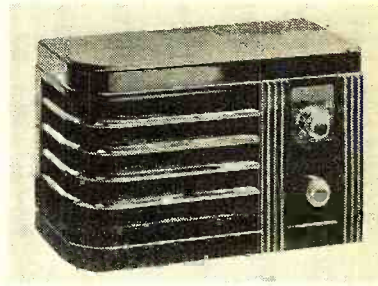


cans and panels in standard sizes. They are equipped to meet special requirements in metal boxes, panels and all types of radio chassis. The electralloy material is a non-corrosive and non-magnetic sheet metal, finished in dull silver and supplied in 16 gauge thickness. The aluminum sheet metal has a bright silver finish and is available in various thicknesses.

Maker—Insuline Corp. of America, 25 Park Place, New York City.

An Attractive Table Type Receiver

Description—The new Wurlitzer Lyric model M-4-LI is a striking-looking mantel type set with its ebony finished, hand rubbed cabinet, set off with buffed aluminum grille bars. This receiver is a four-tube superheterodyne, featuring automatic volume control and a reflex dynamic type speaker. It employs the following type tubes: One 6A7, one 43, one 6B7 and one



25Z5 voltage double tube. The set measures 10¼ inches long by 7 inches high by 4¾ inches deep. The Lyric 1934 radio series includes a full line of consoles and table model sets and is complete with a motor car receiver.

Maker—Rudolph Wurlitzer Mfg. Co., North Tonawanda, N. Y.

High-Frequency Loud Speaker

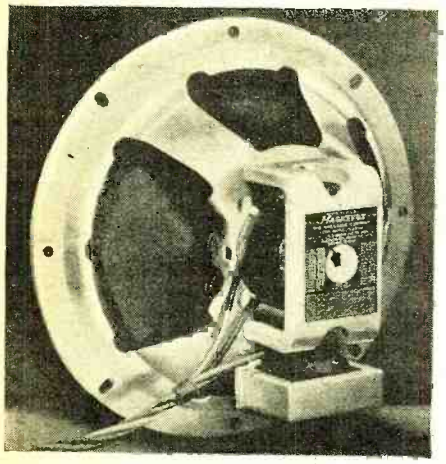
Description—Announcement is made of the new Bud high-frequency reproducer designed for the new wide range sound reproducing equipment and especially adapted to theatre sound installations. The manufacturer states, with the addition of this new high-frequency speaker unit to the old type sound installation, it

is possible to obtain frequencies up to 9,000 cycles. The speaker employs a specially designed coupling unit and the miniature trumpet is made of aluminum. An outstanding feature of this new reproducer is its adaptability. With its simplified coupling unit, the speaker can be hooked up with any standard electro-dynamic type speaker without the use of a filter network.

Maker—Bud Speaker Co., 1156 Dorr St., Toledo, Ohio.

Six-Inch Dynamic Type Speaker

Description—The new Magnavox Model 136, six-inch size dynamic type speaker is especially adapted to the midget and compact type of receiver and also to the motor-

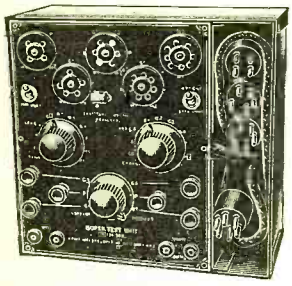


car set, due to its rugged construction. The manufacturer claims, for a speaker of its size, it has fine tone quality plus unusual sensitivity.

Maker—The Magnavox Co., Ltd., Fort Wayne, Ind.

Analyzer

Description—The Radio City Products, model 500 testing unit is designed for use with their model 401 multitester or any other multiple-reading meter. The tester is provided with a 10-wire analyzer cable and the switches are equipped with additional points to take care of any new tubes that may be introduced in the future. A selector switching arrangement provides resistance and voltage measurements between any two



points and the instrument is designed with a relative mutual conductance tube test. The tester is available either as a kit or completely assembled, ready for use.

Maker—Radio City Products Co., 48 West Broadway, New York City.

Transformers

Description—The new line of Kenyon universal replacement power transformers featuring an insulating slip cover are designed to supply filament and plate voltages

to over two thousand standard radio receivers. The insulating cover slips into the side of the transformer after installation is made, thereby covering all live contacts and at the same time providing the unit with a finished appearance. The five types available are made for use with the following type tubes: -71, -45, -47, -10 and -50. The transformers are made with a universal type of mounting.

Maker—Kenyon Transformer Co., 122 Cypress Ave., New York City, N. Y.

Remote control for Automobile Sets

Description—A recent announcement was made of the new Crowe model 101 airplane type motor car remote control. This control is designed for receivers using 6 to 1 in 360 degree geared variable condensers and where the volume control is mounted on the radio chassis. The tuning and volume controls are available in clockwise or anti-clockwise movement. The manufacturer calls attention to the collet type of flexible shaft and casing attaching devices. The steering post bracket is designed for easy attachment and the control can be placed in any desired position. Special clamps can be

supplied for fastening the control to the dash or instrument panel.

Maker—Crowe Name Plate & Mfg. Co., 1749 Grace St., Chicago, Ill.

Shadow-dial

Description—The Westinghouse visual tuning shadow-dial is designed to show when the receiver is properly tuned. This tuning indicator consists of a light aluminum vane mounted on the instrument movement and

so arranged as to intercept the light from a miniature lamp. A shadow of the vane is cast on the translucent dial and the best tuning adjustment is indicated by the narrowest shadow cast by this vane. The mechanism used in this shadow tuning dial is known as the polarized vane type. It has no moving coils, springs or jewels.

Maker—Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

Technical Review

(*Continued from page 423*)

ers, complete short-wave receivers and transmitting variable condensers.

4. *A 15 to 200-Meter Superheterodyne.* A description of the features of the Hammarlund-Roberts high-frequency superheterodyne designed especially for commercial operators for laboratory, newspaper, police, airport and steamship use.

5. *A 1934 Volume Control, Fixed and Variable Resistor Catalog.* Data on standard Electrad and special replacement volume controls, Truvolt adjustable resistors, vitreous wire-wound fixed resistors, voltage dividers and other resistor specialties and public-address amplifiers (using new tubes).

7. *Rich Rewards in Radio.* Valuable information on the growth of radio and the opportunities existing in the field of radio manufacturing, radio servicing, broadcasting, talking pictures, television, public-address systems and commercial station operation on land and sea, for men who are trained to fill the many jobs created by the radio and allied industries. This book, which is published by the National Radio Institute, is available only to the RADIO NEWS readers who are over 16 years of age and who are residents of the United States or Canada.

9. *Catalog of Fixed, Metallized and Precision Resistors.* Specifications of the International Resistance Co. 1933 line of metallized, wire-wound and precision wire-wound resistors, motor-radio suppressors, handy servicemen's kits, valuable technical data and list of free bulletins available on the building of servicemen's test equipment.

16. *R.M.A. Standard Resistor Color-Code Chart.* A handy postcard-size color-code chart designed by the Lynch Mfg. Co. to simplify the job of identifying the resistance values of resistors used in most of the standard receivers.

18. *Volume Controls, Fixed Resistors, Motor-Radio Spark Suppressors and Power Rheostats.* A 1933 catalog containing descriptions, specifications and prices of the line of Centralab standard, special and replacement volume controls for receivers, amplifiers, public-address systems and talkie installations, fixed resistors, motor-radio spark suppressors, wire-wound rheostats and potentiometers.

25. *Noise-Reducing Antenna Systems.* This folder describes two types of noise-reducing systems perfected by the Lynch Mfg. Co. for both broadcast and short-wave reception.

34. *Serviceman's Replacement Volume-Control Guide.* A booklet containing a list, in alphabetical order, of all old and new receivers showing model number, value, of control in ohms and a recommended Electrad control for replacement purposes.

41. *How to Build the "Economy Eight."* Constructional information, diagrams, list of parts, etc., of an efficient 8-tube receiver which can be built from a kit which sells for $13.75.

42. *How to Build Useful Servicing and Testing Instruments with Simple, Standard Meters.* Complete data, with diagrams, showing how any meter—preferably a low-range milliammeter—can be used to measure amperes, volts and ohms over any desired range through the use of proper shunt and series resistors. The bulletin has been prepared by the Lynch Mfg. Co.

43. *How to Modernize Old Set Analyzers.* This valuable folder describes in detail the new set analyzer remanufacture plan perfected by the Supreme Instruments Corp. for the conversion of obsolete set analyzers such as the Jewell Pattern 198, 199, 408 and 409 analyzers; Weston model 537, 547, 565 and 566 set testers; and Supreme 99-A, 400-A and 400-B diagnometers into efficient, up-to-date testing equipment, at low cost.

44. *How to Add a Remote Control Unit to Any Receiver.* A descriptive folder published by Wholesale Radio Service which shows how any single tuning control receiver can be converted into a remote control and station selector set at a total cost of only $12.50.

52. *The Servicer.* A monthly house organ published by the International Resistance Co. It contains very helpful information designed to help the serviceman do better work and make more money doing it.

53. *Practical Training for Radio Servicemen.* This book, prepared by the Radio Training Association of America, gives an outline of their course of instruction for radio servicemen—a course that is endorsed and recommended by more than thirty leading radio manufacturers and trade associations.

56. *Servicing and Testing Instruments.* Complete descriptions of a new line of Supreme low-priced analyzers, set testers, tube testers, ohmmeters, capacity testers, oscillators and universal meters. Complete information is also given on the new Supreme model 55 tube tester and the new Supreme master diagnometer which employs the "free reference point system of analysis."

57. *How to Build a High-Quality Microphone.* This circular describes the microphone kit and instruction sheets with which it is possible to build, quickly and easily, a high-quality microphone. The kit is made

January, 1934

RADIO NEWS Free Technical Booklet Service
222 West 39th Street
New York, N. Y.

Gentlemen: Please send me, without charge, the booklets or folders I have filled in below:

Numbers.....
.....
.....

My occupation or connection in radio is checked off below.

- ☐ Serviceman Operating Own Business
- Serviceman Employed By:
  - ☐ Manufacturer
  - ☐ Jobber
  - ☐ Dealer
  - ☐ Servicing Organization
- ☐ Dealer
- ☐ Jobber
- ☐ Radio Engineer
- ☐ Experimenter
- ☐ Laboratory Technician
- ☐ Professional or Amateur Set Builder
- ☐ Licensed Amateur
- ☐ Station Operator
- ☐ Public Address Work
- ☐ .....

I am a ☐ subscriber ☐ newsstand reader.

I buy approximately $..... of radio material a month. (Please answer this question without exaggeration or not at all.)

Name.....

Address.....

City.....State.....

PLEASE USE PENCIL AND PRINT IN FILLING IN COUPON

by the Bruno Division of the Amperite Corp.

58. *Sound and Public-Address Equipment Catalog.* A catalog issued by the United Sound Engineering Co. covering its line of portable public-address systems, power amplifiers, loudspeakers, phonograph turntables, transformers, microphones and intercommunication systems.

59. *The I.R.C. Volt-Ohmmeter.* A folder describing the characteristics and uses of the International Resistance Co. volt-ohmmeter, a combination voltmeter and ohmmeter specially designed for the point-to-point method of trouble-shooting.

A Laboratory Superheterodyne

(*Continued from page* 416)

On the higher wavelengths, and particularly in the broadcast band, the use of the band spread dial tends to upset the alignment to an extent which would reduce both the sensitivity and selectivity in the receiver. For this reason tuning on the upper wavelengths is accomplished with the main tuning control only, leaving the band-spread control set at 100. This limitation of band-spread tuning is, of course, not important, as this feature is not at all necessary in the broadcast band.

The lower left-hand control is the manual control of audio output. Its operation is smooth and gradual—particularly gradual in the range from zero to approximately half volume, which includes the range usually required in home operation.

The second knob from the left is the tone control, arranged to give a strong predominance of bass when set at the extreme left, and full, sharp definition with plenty of highs when set at the extreme right, the transposition being gradual as the knob is rotated.

The beat-frequency oscillator, which is turned off and on by the toggle switch at the bottom center of the front panel, is a distinctly valuable feature, particularly for DX enthusiasts, because it permits distant stations to be tuned in by the beat method and then, when exactly tuned, the oscillator is cut off, leaving the station tuned "right on the button." For the reception of amateur or commercial code transmission the beat oscillator is, of course, a necessity. The inclusion of this feature, plus the band spreading arrangement, makes this receiver a very useful one for the "ham."

The third knob from the left permits the sensitivity of the receiver to be reduced to the best usable degree permitted by local noise conditions. In other words, this is an interstation noise suppressor system that the operator can regulate to his own requirements.

The knob at the extreme right is the band change switch. This switch knob has four colored sectors, the colors agreeing with the four colored strips on the calibrated tuning dial. Thus if one desires to tune in a given range, it is simply necessary to find that range on the tuning dial and turn the wave change switch to the position where the sector of the same color is uppermost.

The antenna requirements of the receiver apparently are not critical. Antennas of 25 and 100 feet were tried, with good results on both. Where the receiver is operated in close proximity to powerful broadcast stations, an antenna of 30 feet or thereabouts would probably be best. Where there is no problem of nearby interference, one can use any antenna that happens to be convenient.

QRD? QRD? QRD?

CONDUCTED BY GY

THAT brave, adventurous Rady Bischak has but recently returned from the wilds of Colombia, S. A., where he took part in the war drama staged there as an intrepid wireless op and machine gunner. With the rating of Teniente and a snappy uniform (including the Sam Brown belt), he installed equipment in the planes, taught radio operating to all who would listen and repaired all the ancient apparatus brought before him. The only trouble he had down there was to get someone at the other end to copy his stuff, he sez, and he'd rather dodge bullets down in them thar hills than taxis and street cars in the big city here. A long scar in the craw of his right hand testifies how he handled those hot, burning guns. Of course, he was not interested in the $250 per month, at least, not while up in a plane fighting with the enemy. He is expecting to return shortly, he sez, for radio business. . . .

RCA laboratory engineers have been working on a tiny vacuum tube which they have dubbed "shoe button" because of its midget size, which is only one-half inch in height. They state that it has most all of the characteristics of the larger tubes and can be used as an effective amplifier or detector, but at the present writing it is not available for ordinary general commercial use. It gives great promise of being able to be used for the ultra-short-wave channels with which amateur experimenters have been playing since the success of Marconi and other experimenters in these bands. Marconi says he was able to communicate a distance of one hundred and sixty miles on the 60-centimeter band without the slightest interference from atmospherics. He states that in these low bands static, fading and all the other evils of the higher frequencies are unknown. It is just a question of time and effort before these numerous bands may be open for general business with a reduction in the crowded conditions now existing in the higher bands.

The broadcast code came up for its hearing before the Administration in Washington, and Mr. Haddock, president of the A.R.T.A., was on deck to present his data on the operators' side of it. There was a bit of difficulty with the I.B.E.W. at the opening of the session, as they insisted that they should represent the operators and not the A.R.T.A., as the I.B.E.W. had more members than the latter. They even went so far as to have a few outlying stations wire into the Board, protesting the A.R.T.A. representative. But the A.R.T.A. prevailed and remained as the representative of the broadcast ops. In addition to Mr. Haddock stating the operators' angle, Mr. E. H. Rietzke, president of the Capitol Radio Engineering Institute, presented the Board with a comprehensive statement of facts on the education, the cost and the necessity for continual study plus the acquired experience essential toward the making of a good radio operator. Final decisions have not been made as yet, but great hopes are being entertained by the operating profession who attended this hearing. They know that their rights will be observed. One op, on arriving at his home, sent the following msg. to Mr. Haddock: Quote Arrived home safe and in somewhat better spirits after the showing you made at the hearing and after I saw and heard the works in Washington unquote.

The St. James Hotel, 87 Third Street, San Francisco, is now the established headquarters of the A.R.T.A. on the West Coast and all ops, when in that port, are encouraged to go there and meet the rest of the gang. Just a spot for the gang to foregather and chat whilst reclining in soft, easy chairs. Rooms have been set aside for this purpose and a cosy interior has been fixed up for the purpose. And something else to cheer the inner man is the announcement of the United Fruit Company raising the pay of all ops and adding an additional three men for their fleet. Hurrah for the NRA!

Up in the F.R.C. offices they are putting on the war paint for a tussle with those bootleg stations who insist on cluttering up the air in that huge territory of Texas. Originally there were about sixty of them, but since the edict of the F.R.C. about fifty-five have shut down, the remaining few continuing to defy the commission. They did try to form an organization to battle the F.R.C. in the courts, as they insist that their power was so small they could not be heard outside of the state and therefore it was intrastate traffic and not national, but the F.R.C. could not see their viewpoint. The department is also taking under advisement an SOS radio system for land use in cases of emergency, to be developed on the same lines as those now being used for ships at sea. This would take the place of amateurs, who have been of great help during hurricanes, earthquakes, etc., in the devastated areas when communication lines have failed to bring help because of their being put out of commission by the elements. Just another job for radiomen, what!

Quite a few organizations who must have emergency equipment are falling in line with the new trend toward radioizing their trucks for quicker and more efficient operation of their service. The Brooklyn and Queens Transportation Company of New York have applied to the F.R.C. for a license for this purpose. It is stated that if this proves practicable, other transit systems in the large cities will follow suit, which means that trained ops will be in demand. Also, the Broadway Maintenance Corp. of New York is contemplating doing the same thing with their fleet of eighteen light trucks.

George Stano, whose ship went down from under him, just can't get enough of it, and after a short breathing spell on the beach is now tickling the ivories on the *Amapala*. We hope he has the same luck as Lew Destacey, who had three wagons hit the bottom from under him before he decided to stick to *terra firma* and the broadcasting station of WMCA. Then there is Harry Schlesinger, who must have found some great attraction in Africa, 'cause he again is on his way there on the *West Isleta*. Orville Alexander writes in to advise us that he is now on the air through W9KCG and is holding his own in the local Rotary of Cairo, Mo., while from Detroit we hear from Charlie Leonhardt, who is still the big freshwater sailor of the lakes. Which goes to prove that to him who waiteth he getteth, but the only trouble is the waiteth. So with everything perking up again, new broadcasting stations raising their voices and with Marconi telling us that we have only started in this great industry, it should make the old smile come back in view, so cheerio and 73 . . . ge . . GY.

S.W. DX Corner

(*Continued from page* 414)

Mass.; L. L. Corby, Rochester, N. Y.; W. E. Hanson, West Haven, Conn.; William Dixon, Plainfield, N. J.; R. W. Evans, Lima, O.; F. G. Hehr, Sayville, L. I.; W. A. Jasiorkowski, Milwaukee, Wis.; Dr. G. C. MacDiarmid, Thames, North Island, N. Z.; E. R. Wickham, Bloomingdale, N. J.; Luis Garcia, Puerta de Tierra, P. R.; E. F. Orne, Cambridge, Mass.; H. Adams, Jr., Baltimore, Md.; E. C. Lips, Pittsburgh, Pa.; A. B. Coover, Union City, Ind.; C. K. Skatzes, Delaware, O.; W. H. Coleman, Oakland, Calif.; A. N. French, Ancon, Canal Zone; G. E. McJenkin, Kansas City, Kan.; C. W. Lewis, Jr., Wellesley Hills, Mass.; A. F. Thesen, Knysna, South Africa; J. Bews, Revelstoke, B. C., Can.; H. K. Miller, Northampton, Mass.; J. J. Whaling, Norfolk, England; E. T. Miller, Bloomington, Ill.; A. G. Taggart, Reedy Creek, Man., Can.; I. H. Kattell, Binghamton, N. Y.; R. L. Weber, West McHenry, Ill.; J. Thompson, Bethlehem, Pa.; J. E. Brooks, Montgomery, Ala.; G. G. Field, Montreal, Can.; Melvin Hill, San Francisco, Calif.; W. F. Buhl, Newark, N. J.; W. C. Jackson, Hinckley, Ill.; J. W. Smith, Baltimore, Md.; Alan Barber, Lancashire, England; M. L. Thrun, Winona, Minn.; H. Johnson, Big Spring, Tex.; Dr. J. P. Watson, Hazelhurst, Miss.; J. Shaps, Los Angeles, Calif.; N. C. Smith, Kent, England; F. C. Balph, Indianapolis, Ind.; M. Kruger, Umtata, Transkei, South Africa; W. C. Couch, Asheville, N. C.; C. H. Long, Winston, Mo.; C. T. Sheaks, Turtle Creek, Pa.; W. M. Hardell, Rhinelander, Wis.; D. W. Parsons, Roanoke, Va.; J. A. Leininger, Reading, Pa.

The Editors acknowledge with thanks the assistance of public-spirited readers who have thus cooperated to make these columns so successful and helpful. Let us urge our readers, one and all, to continue, in even a larger way, to send in these reports. We would be grateful if every reader who hears even a single station would send it in to us with just the data as to its wavelength, the time which it was heard, etc. Of course, we would prefer to get more information, including the Best Bets in each listener's locality, as well as definite logs of stations, their wavelengths and times of transmission. Readers will also help by stating what type of receiver they use in logging these stations.

Needed Inventions

(*Continued from page* 405)

modifications of this fundamental automatic volume-control circuit, not one has as yet given a *perfect* and *permanent* automatic control of the volume that has eliminated fading completely. This type of control should really be termed a sensitivity control because it does not take into account the percentage of modulation.

Would an audio stage acting back upon a radio frequency grid circuit of an earlier tube be the solution of this problem if the total arrangement is coupled with the carrier-wave control? Or will the invention of entirely new principles be necessary?

Only the future can tell, but one thing is certain—a perfected *real* automatic volume control that entirely eliminates fading is certainly one thing that radio needs most urgently, and rich rewards await the inventor who solves this and many other waiting problems.

S.W. Super

(*Continued from page 417*)

ground all shields of cables and all shields of each section to one common No. 6 copper wire bus that runs from top to bottom at the back of the frame. Run the filament leads in No. 10 duplex rubber and lead-covered electric light cable and ground these lead sheaths.

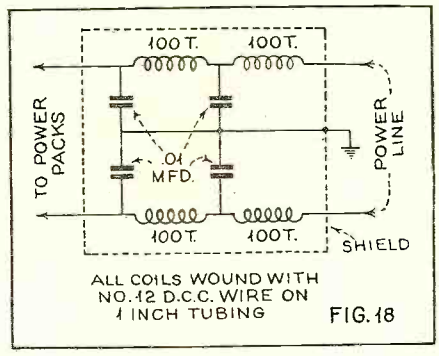


FIG. 18

Backstage

(*Continued from page 421*)

tant work in supplementing the conscientious work of school teachers. A constantly growing number of early afternoon and evening programs are devoted to children. In the past, the juvenile programs of various

JOHN MARTIN

Radio News Technical Information Service

The Technical Information Service has been carried on for many years by the technical staff of RADIO NEWS. Its primary purpose is to give helpful information to those readers who run across technical problems in their work or hobby which they are not able to solve without assistance. The service has grown to such large proportions that it is now advisable to outline and regulate activities so that information desired may come to our readers accurately, adequately and promptly.

Long, rambling letters containing requests that are vague or on a subject that is unanswerable take up so large a portion of the staff's working time that legitimate questions may pile up in such quantities as to cause a delay that seriously hinders the promptness of reply. To eliminate this waste of time and the period of waiting, that sometimes occurs to our readers as a consequence, the following list of simple rules *must* be observed in making requests for information. Readers will help themselves by abiding by these rules.

Preparation of Requests

1. Limit each request for information to a single subject.
2. In a request for information, include any data that will aid us in assisting in answering. If the request relates to apparatus described in RADIO NEWS, state the issue, page number, title of article and the name of the device or apparatus.
3. Write only on one side of your paper.
4. Pin the coupon to your request.

The service is directed specifically at the problems of the radio serviceman, engineer, mechanic, experimenter, set builder, student and amateur, but is open to all classes of readers as well.

All questions from subscribers to RADIO NEWS will be answered free of charge, provided they comply with the regulations here set forth. All questions will be answered by mail and not through the editorial columns of the magazine, or by telephone. When possible, requests for information will be answered by referring to articles in past issues of the magazine that contain the desired information. For this reason it is advisable to keep RADIO NEWS as a radio reference.

Complete information about sets described in other publications cannot be given, although readers will be referred to other sources of information whenever possible. The staff cannot undertake to design special circuits, receivers, equipment or installations. The staff cannot service receivers or test any radio apparatus. Wiring diagrams of commercial receivers cannot be supplied, but where we have published them in RADIO NEWS, a reference will be given to past issues. Comparisons between various kinds of receivers or manufactured apparatus cannot be made.

Only those requests will be given consideration that are accompanied by the current month's coupon below, accurately filled out.

JANUARY, 1934

Technical Information Coupon
RADIO NEWS Laboratory
222 W. 39th Street
New York, N. Y.
Gentlemen:

Kindly supply me with complete information on the attached question:

☐ I am a regular subscriber to RADIO NEWS, and I understand this information will be sent me free of charge.

☐ I am not yet a subscriber to RADIO NEWS.

☐ I wish to become a subscriber to RADIO NEWS, and enclose $2.50 to receive the magazine regularly for one year, and to receive this valuable technical information service free of charge.

Name.....

Address.....

stations have been criticized by individuals and groups. Mr. Martin's designation as juvenile director of the NBC is a move that will tend to keep the standards of children's programs high.

Sound System

(*Continued from page 398*)

cluded a sound recording equipment so that the student, a singer for instance, could make a recording of his voice and by hearing it exactly as others hear it, apply corrective technique to further their musical progress.

The illustration at the top of the article shows the complete equipment and Professor Karapetoff is shown about to play an aluminum recording. While the apparatus, designed for portability, fits in five fiber carrying cases, the complete sound system, of course, can be easily installed for permanent installation. For ease of identification, the photograph is shown with designating letters and the following paragraphs will be devoted to the characteristics and specifications of the various equipment.

The recording mechanism (A) is dual speed, 33-1/3 and 78 r.p.m and is equipped with a 1/20 horse-power motor. The motor uses a rubber pulley drive and is mounted and suspended in such a way to prevent vibration of the motor being transmitted to the recorder.

The cutting head is carried and moved radially across the turntable on a horizontal driving shaft, which is rotated by the action of a gearing mechanism. It is this gearing arrangement which determines the number of lines per radial inch of recorded surface.

The playback equipment (B) comprises a phonograph motor turntable, high impedance pick-up and the remote control units.

These controls are coupled to individual 21-volt a.c. operated motors. The motors have a double field, enabling them to rotate in either clockwise or counter-clockwise direction. The extension cables for the control units are shown housed in the case cover.

The pre-amplifier (C) is a two-stage battery-operated job employing type –864 tubes. It is self-contained with the batteries housed within the pre-amplifier case. The amplifier is equipped with a switching arrangement which permits the use of either one or both stages of amplification.

The ribbon microphone (D) has an impedance of approximately ⅜ of an ohm and is coupled to a matching transformer, mounted directly on the microphone stand. This transformer has an output impedance of 200 ohms to match the input pre-amplifier circuit.

The output of the pre-amplifier is in turn connected to the control box (E). This control panel has provisions for two 200-ohm impedance lines, a high impedance pick-up and for a radio tuner output.

The main amplifier (F) is a three-stage, dual-push-pull, class A circuit with a fixed "C" bias and using –56 and 2A3 type tubes. This high-power audio amplifying system is capable of delivering a total output of 15 watts. A rectifier type output meter is connected in the amplifier output circuit and is used as a monitor for speaker or recording mechanism.

The carrying case (G) houses the Jensen auditorium size 30-watt peak a.c. dynamic type speaker.

The schematic circuit diagram covers the complete sound reproducing system.

Cathode Tubes

(*Continued from page 397*)

$$R_x = R_s \left(\frac{\left(\frac{D}{D_m}\right)}{1-\left(\frac{D}{D_m}\right)} \right), \text{ S on B}$$

$$= R_s \left(\frac{1-\left(\frac{D}{D_m}\right)}{\left(\frac{D}{D_m}\right)} \right), \text{ S on A}$$

where D_m is the maximum deflection obtained, and D is the deflection when the test prongs are applied to the unknown impedance.

When Z_x is a pure capacitance or inductance, the value of its impedance at 60 cycles will be given by the formulas:

$$Z_x = R_s \left(\frac{\left(\frac{D}{D_m}\right)}{\sqrt{1-\left(\frac{D}{D_m}\right)^2}} \right), \text{ S on B}$$

$$= R_s \left(\frac{\sqrt{1-\left(\frac{D}{D_m}\right)^2}}{\left(\frac{D}{D_m}\right)} \right), \text{ S on A}$$

If Z_x is a condenser and the frequency is 60 cycles, the formulas become:

$$C_{x\ mfd.} = \frac{2660}{R_s} \left(\frac{\sqrt{1-\left(\frac{D}{D_m}\right)^2}}{\left(\frac{D}{D_m}\right)} \right), \text{ S on B}$$

$$= \frac{2660}{R_s} \left(\frac{\left(\frac{D}{D_m}\right)}{\sqrt{1-\left(\frac{D}{D_m}\right)^2}} \right), \text{ S on A}$$

If R_s is made 1 megohm and $\left(\frac{D}{D_m}\right) = \frac{1}{2}$, C_x would be .0015 mfd. Thus this system is suitable for measuring small capacities difficult to measure with ordinary meters, as well as larger capacities with a smaller value of R_s.

Roughly, iron-core coils can be treated as pure inductances. For this case and for 60 cycles, the formulas become:

$$L_{x\ hy.} = .00266\ R \left(\frac{\left(\frac{D}{D_m}\right)}{\sqrt{1-\left(\frac{D}{D_m}\right)^2}} \right), \text{ S on B}$$

$$= .00266\ R_s \left(\frac{\sqrt{1-\left(\frac{D}{D_m}\right)^2}}{\left(\frac{D}{D_m}\right)} \right), \text{ S on A}$$

If R_s is made 10,000 ohms, and $\left(\frac{D}{D_m}\right)$

$= \frac{1}{2}$, L_x would be 46 henries. This apparatus will measure common inductance values as well as much higher inductances if R_s is increased. It is not suitable for inductances too low to stand 60 volts or so of a.c., if good deflection is to be obtained.

Using the above formulas, calibration scales can be made up on celluloid strips for resistances, inductances, and capacitances, for various values of R_s. If the transformer voltage V and the anode voltage are held constant, the maximum deflection D_m can be measured and will remain constant. The unknown quantity can then be found simply by placing the scale in front of the screen and reading off the value, for deflection D.

If transformer voltage V is made about 650 volts, good deflection can be obtained when $\left(\frac{D}{D_m}\right)$ is less than one-tenth. Then, within 1% accuracy, the following approximate formulas can be used:

$$C_{x\ mfd.} = \frac{2660}{R_s}\left(\frac{D}{D_m}\right), \text{S on A.}$$

$$L_{x\ hy.} = .00266\ R_s\left(\frac{D}{D_m}\right), \text{S on B}$$

Also, with 10% accuracy, the following approximate formula holds good for impedances in general, not necessarily pure reactance or resistance:

$$Z_x = R_s\left(\frac{D}{D_m}\right), \text{S on B}$$

Linear scales are then possible for inductances, capacitances, and general impedances. However, in the capacitance measurement, about 600 volts a.c. would be impressed on the condenser, which may be above its rating. In inductance measurement, about 60 volts would be impressed on the inductance, for normal deflection, but there is a possibility of applying more voltage. The previously given exact formulas resulting in non-linear scales, obtained with lower transformer voltage, are to be preferred for general work.

In the applications so far given, no sweep circuit has been required, and the deflection was only along one line. One of the main advantages of a cathode-ray tube is that it permits deflection in two directions. An important application of this sort is in observing wave forms, using a sweep circuit to provide deflection proportional to time.

In radio servicing, it is useful to observe distortion occurring in various parts of the circuit. A cathode-ray oscilloscope is very useful here. Where the voltage to be observed is fairly large, across the output of an audio power amplifier, for example, it can be applied directly to the deflecting plates of the cathode-ray tube for examination of its wave form. By using a distortionless audio voltage amplifier in conjunction with the cathode-ray tube, small audio voltages can be observed equally well. A general arrangement for observing audio amplifier distortion is shown in Figure 6. A practically sinusoidal voltage is to be applied to the audio amplifier to be observed. The testing arrangement is provided with an amplifier and gain control so that various stages of the audio amplifier under measurement can be observed. Departure of voltage output of any stage from sinusoidal shape indicates distortion in or ahead of that stage, and the wave shape usually indicates what steps should be taken to correct it. Figure 7 is a similar arrangement for observing the overall distortion of an entire receiver.

Applications given in this article are those of chief interest to the serviceman. The next article of this series will deal with applications of great interest to amateur experimenters and engineers.

South Pole Calling!

(*Continued from page* 395)

broadcasting equipment also included a 200-watt transmitter which will be set up on the expedition outpost nearest the South Pole. From this outpost, Byrd will take off, some time during the expedition, on a flight over the South Pole. His Curtiss-Condor plane will carry a 50-watt transmitter and he will make an attempt to speak to listeners in the United States while he is over the Pole. His utterances will be relayed by the 200-watt outpost transmitter and, in turn, by the 1000-watt KJTY to Buenos Aires for further relaying to American network listeners. If the messages are clear enough, the 200-watt station will drop out and the Admiral's voice will be relayed first by KJTY. Even if the Admiral is forced down on the ice, he will continue broadcasting, with power supplied by a gasoline generator in the plane.

The radio transmitter aboard the plane is a standard aircraft transmitter which has been especially modified to serve a wider band of frequencies. Two other planes with the expedition, a Fokker and a Fairchild, are also equipped with 50-watt transmitters.

Every form of conveyance used on the ice will utilize a radio transmitter of some sort to contact the rest of the expedition party. Even the dog sleds will be equipped with 1-watt, 5-meter phone transmitters, in addition to receivers. Although these ultra-short-wave units are limited in range, it is believed that they will be invaluable in contacting the expedition bases.

Cohan predicted that the broadcasts from the Antarctic will be received in the United States with a 75 percent degree of intelligibility—a sufficient degree, he says, to warrant rebroadcasting over the network. He pointed out that one scientific branch of the expedition will make a study of magnetic disturbances. All data relating to magnetic storms will be made available to the radio engineers and will be useful in timing the broadcasts for suitable periods only. Cohan stated that magnetic storms occur at 27-day intervals and it is possible to determine definite forecasts a week ahead with 75 percent accuracy.

Prior to leaving the United States, Admiral Byrd made many preliminary broadcasts during which he announced details of the expedition. An elaborate program was broadcast from Norfolk shortly before his departure, with many Government officials participating.

The short-wave transmitting station of the General Electric Company, W2XAF, at Schenectady, New York, will send special entertainment programs to the South Pole Expedition on Saturday nights from 11 to 12 o'clock (Eastern Standard Time). After midnight, W2XAF will read letters addressed to members of the expedition from relatives and friends. From time to time, relatives and friends will be invited to talk to the members of the expedition. The entertainment programs will originate not only in Schenectady, but also in various Eastern centers such as Boston, New York, Washington, Albany, Rochester, Richmond, Va. (Byrd's home city), and other points. Special provision has been made to receive these special broadcasts from W2XAF, which will be transmitted on a frequency of 31.48 meters. The station broadcast successful programs to Byrd's first Antarctic expedition during 1928, 1929 and 1930. The station is still equipped with the directional antenna employed in the first Byrd expedition broadcasts. The antenna was designed by Dr. E. F. W. Alexanderson, radio consulting engineer of the General Electric Company. The effect of the antenna is to increase the signal volume in one direction about twenty times. The normal power of W2XAF is 20 kilowatts.

It was pointed out that the Byrd broadcasts from Schenectady may start before the expedition reaches Little America. The National Broadcasting Company will convey the special W2XAF programs to network listeners.

Arrangements were made for a committee of leading physicians and surgeons to act in a consultative capacity with Dr. Guy O. Shirey, medical officer with the Byrd Expedition, during the long sojourn in the Antarctic. During any serious illness, Dr. Shirey will be able to contact the American physicians for consultation by the CBS short-wave radio equipment accompanying the expedition. A powerful American short-wave transmitter will be employed by the CBS to respond to Dr. Shirey's messages.

Never before has an expedition offered so many radio opportunities to broadcast listeners, short-wave experimenters and amateurs. Here is a rare opportunity to share in the reception of actual broadcasts from the "bottom of the world"!

Aviation Radio

(*Continued from page* 401)

to effect in midair. Therefore, he remained on the day frequency until he reached the nearest airport, where he landed and the radio operator made the adjustment. However, our engineers developed a device known as the "Rube Goldberg," a quick-change device to shift radio-telephone equipment from one frequency to another simply by the turn of a switch. The pilot is advised by the nearest ground station at the time when the change should be made to a different frequency, and he merely turns a switch, which accomplishes a task that previously required him to land and necessitated several minutes of work on the part of a radio operator.

So successful was this installation that a modification of it was adopted for the various ground stations. Previously it required twenty minutes to change from one frequency to another at the ground station, and now the "Rube Goldberg" does it instantaneously when the operator presses a lever.

This two-way, plane-ground radio communication system is regarded as one of the most important aids to efficiency and dependability for commercial aircraft operations and a special communications engineering laboratory is maintained for the purpose of developing new devices for its radio system and improving present equipment.

Every care was taken to make sure the radio installation on the 60 new Boeing transports of United Air Lines would be of the highest standard, and results have shown that since these planes were placed in operation on the New York-Chicago-Pacific Coast and other airways of the company, the care which was taken in this project was entirely justified. The addition of more frequent schedules as well as faster service with these new planes has made it necessary for the ground stations of the company to operate on a split-second schedule, regulated by a master electric clock system. Eleven round trips are flown, daily, between Chicago and New York alone, and as all planes are on the same frequency it is necessary that they report exactly on their individual schedules to avoid interference.

Electron Coupling

(*Continued from page* 403)

greatly simplifies the design of superheterodynes and apart from the advantage of eliminating one tube, it will also simplify the design of the oscillator circuit since the r.f. voltage of the oscillator is no longer critical. Radiation from the oscillator has been reduced so that no interference will be created in other receivers in the neighborhood. The efficiency of such a type circuit is expressed by a factor, called "conversion-transconductance," also called "conversion-conductance". It is defined as the ratio of the alternating current at the intermediate frequency of the mixer output-circuit to the radio-frequency signal voltage applied to grid number four. Another new term employed with this circuit is "translation gain". It is the ratio of the intermediate-frequency output voltage (e, in Figure 8) to the signal voltage applied to grid four. The translation gain obtainable with the circuit shown in Figure 8 can be as much as 60, with ordinary transformers. If special low-loss equipment is employed, it is possible to obtain a translation gain of 100.

The four-electrode section of the pentagrid is a variable-mu tube. This has the advantage that the translation gain can be controlled, simultaneously with the gain of the other I.F. tubes, through an automatic volume-control system. Curves, showing the gain for different bias voltages, are shown in Figure 9. These curves are reproduced through the courtesy of RCA and Cunningham.

The types 2A7 and 6A7 employ 7-pin bases. The diameter of the pin circles is ¾ of an inch (this base is different than that of the type -59). The arrangement of the prongs is shown in Figure 10. Characteristics of the three types of pentagrid tubes are shown in the table.

A Low-Cost Super

(*Continued from page* 407)

the possibilities of errors to a minimum. Considering the number of small fixed resistors and condensers used in the Air-Marshall, very little wiring is necessary. This is due to the fact that each part is soldered as close as possible to the socket or other part with which it functions.

List of Parts

C1—Mica condenser, .0001 mfd.
C2, C3, C5, C6, C7, C12, C27—Condensers, .1 mfd., 200 volts
C4—Paper condenser, 1 mfd., 400 volts
C8, C9, C10, C11—I.F. tuning condensers, 75-150 mmfd.
C13—Filter condenser. .004 mfd., 600 volts
C14, C16, C17, C18—Condensers, .01 mfd., 400 volts
C15—Mica condenser, .001 mfd.
C19, C20—Electrolytic condenser, 8 mfd., 500 volts
C21—Power line by-pass condenser, .01 mfd., 600 volts
C22, C23, C24—Variable condenser, 3-gang, respective capacities, 350, 365, 365 mmfd.
C25—By-pass condenser, .5 mfd., 200 volts
C26—Mica condenser, .0005 mfd.
L1, L2—Oscillator coil secondary
L3, L4—Preselector coil
L5, L6, L7—Second preselector
L8, L9—First i.f. transformer
L10, L11—Second i.f. transformer

R1, R11, R13, R16—Resistors, 100,000 ohms, ⅓ watt, carbon
R2, R10—Resistors, 1000 ohms, ½ watt, carbon
R3, R19—Resistors, 40,000 ohms, ½ watt, carbon
R4—Resistor, 20,000 ohms, 1 watt, carbon
R5, R20—Resistors, 150 ohms, ½ watt, carbon
R6, R15—Resistors, 500,000 ohms, ⅓ watt, carbon
R7—Resistor, 250,000 ohms, ½ watt, carbon
R8, R17—Resistors, 1 megohm, ⅓ watt, carbon
R9—Resistor, 10,000 ohms, ½ watt, carbon
R12—Volume control with switch, 500,000 ohms
R14—Tone control, 500,000 ohms
R19—Resistor, 20,000 ohms, 2 watts, carbon
R21—Resistor, 2000 ohms, ½ watt, carbon
T1—Power transformer
T2—Output transformer on speaker
T3—Field on speaker, 2500 ohms
VT1—R.F. amplifier tube, type -58
VT2—First detector tube, type -58
VT3—I.F. amplifier tube, type -58
VT4—2A6 diode detector and first audio tube
VT5—2A5 power pentode tube
VT6—Rectifier tube, type -80
VT7—Oscillator tube, type -56

Carbon Anodes

(*Continued from page* 393)

generated in the anode is rapidly transferred to the glass envelope which may run somewhat hotter but is always designed for rapid dissipation of heat to surrounding air.

Second, the increased heat dissipation of the anode means that heavier loads can be handled safely. In a given size, it means a greater output is possible, without serious strain to the tube. If operating at the rated load for a tube of a given size, it means easier and longer life. If the size can be altered, it means smaller tubes for given output ratings.

Third, because of the greater dissipation of heat at the anode, the grid runs cooler in operation, resulting in low primary and secondary emission as well as freedom from escaped gas from a hot grid.

Fourth, graphite anode tubes under accelerated life tests indicate a considerably longer life than with corresponding or molybdenum plate tubes, and especially a marked uniformity of characteristics throughout life.

Results in the field have been so encouraging that our graphite elements may soon displace still other metal components in tubes both large and small. This development may well be considered another milestone in the evolution of the vacuum tube from a laboratory plaything to a most practical mechanism of vast commercial significance. It is the first major advance in this field in recent years. The results being obtained from the graphite anode tubes are daily proving this fact.

Balloon Aerial

(*Continued from page* 399)

are being carried on under the direction of R. I. Harmon, general engineer of the Westinghouse broadcasting department."

Amateur experimenters of the old school may well remember that many experiments were made with a somewhat similar scheme to this in the early days of radio; that is, the use of kite antennas where a

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light flexible wire was used in place of the ordinary string of the kite. Some of the old timers may remember the exceptionally loud results produced with such an elevated aerial; signals from a thousand to two thousand miles distant coming in like locals even though the old-fashioned crystal detector was used with the receiving sets in those days. The main difficulty of these old kite antennas, however, was that someone had to stay and guide the kite during the reception. When the wind lulled the kite antenna had to be hauled in and of course reception was ended.

In the new experiment the blimp would be self-sustaining and its operation would be much more stable in the air. One of the accompanying photographs shows the electric motor drive for the reel for hauling down the blimp or for adjusting it to the correct height. This is a great improvement over the old hand-operated kite antenna.

It is quite probable that this idea may serve as an inspiration to groups of amateurs throughout the country who would like to renew these old experiments, using a small spherical balloon in place of the old time kite. Such a device might also be found exceptionally useful for short-wave DX reception, when trying for the present DX World Championship. Certainly this idea may prove worth trying, by experimenters, for long-distance transmission and reception.

All-Wave Super

(*Continued from page* 415)

runs from 850 to 2000 meters and covers European broadcast stations. In America these waves are utilized by marine and aviation direction-finding services, weather reports, beacons, ships and state police. The second, or "A" band covers the American broadcast band from 530 to 1500 k.c. The third band is known as the "L" band; it covers from approximately 1550 to 4500 kc. Police stations, amateurs, airports and broadcast "relay stations" employ these waves. The fourth, or "M" band is, no doubt, the short-wave range of most interest. It covers approximately 4.2 to 12 megacycles, or from 70 to 25 meters. Three different broadcast bands are contained in this range: the 50-meter, the 30-meter and the 25-meter bands. The word *Foreign* is right under the section where one finds 50-meter broadcast station (between 6.0 and 6.5 mc) so that no one need experience any trouble finding it. The last, fifth, or "H" band covers from 12 to 33 megacycles (9-25 meters) extending down to the ultra short waves.

The controls are simple. The right-hand knob is a combination on-off switch and tone control; turn it to the right for brilliance, to the left for low notes. The upper middle knob is the main dial control with the wave switch below it. The left-hand knob is the volume control. The latter varies the volume after the signal has passed the detector. It has nothing to do with sensitivity, since that is controlled automatically. The automatic sensitivity control (a.v.c.) allows one to set the knob for the desired volume, then, tuning through the dial other stations will be heard at about this same volume. It should be noted that the circuit for the automatic control is unusual. An extra 6B7 tube is employed which first amplifies the signal in its pentode section and then rectifies it for the control of the bias on the i.f. stages. This method gives a greater degree of control.

The statomit tube serves to make the

receiver silent "in between" stations. As long as no signal comes in, the first a.f. tube is biased beyond the cut-off, so that no signal can come through (See the circuit diagram). As soon as a signal is of a certain minimum strength the bias of the statomit tube is changed which cuts its plate current down to zero and the bias of the first audio stage becomes normal again.

The minimum strength necessary for a signal is adjustable and can be varied by a control knob at the rear of the chassis. When this knob is turned to the left the statomit circuit operates, allowing only local stations to come through, with no noise in between. When it is turned all the way to the right, there is no statomit control; the set will then act as any receiver with automatic sensitivity control only. Intermediate positions can be determined, which will just allow the reception of all the more powerful distant stations while cutting out the noise between them.

The output stage of four –45's in push-pull, class A, delivers ample power to the dynamic speaker, while the quality can be controlled to suit the taste by means of the tone control.

It is recommended that a short antenna, of approximately twenty feet, be employed for reception of stations in the American broadcast band. For short-wave reception an outdoor antenna, as high as possible, will give best results.

The receiver was first set up in the laboratory and tuned through all wave-bands to see that all was in good working order. Then it was moved to one of the listening posts for test during the week-end of October 21, 1933. On Friday night, Saturday and Sunday various long and short-wave stations in America and Europe were tuned in. There was, for instance, that interview of Wolfgang von Gronau on DJC on Sunday night. A symphony concert from Europe was received for two hours without interruption. There was an opportunity of checking up on the accuracy of calibration. While this is not exactly "on the dot" for the short-wave bands, it is close enough to be of use. One must remember that it is difficult to make these dials in production and have them check exactly. The maximum deviation on the "M" band was approximately 200 k.c. at 6 megacycles (50 meters). EAQ came in right on the dot.

On the broadcast band, a long list of semi-distant and distant stations could easily be picked up. Many of the stations that are fairly powerful and not too far away can be gotten with reasonably good quality. The police band netted some exciting moments when we heard the various scout cars in New York, Philadelphia, Cleveland, etc., being ordered to chase law breakers.

The Service Bench

(*Continued from page 425*)

dislodge the pointer where it "freezes."

"This may be easily overcome by cutting a small block of wood about ⅛ inch cube. With a drop of varnish or shellac this block is attached to the meter face as close as possible to the pivot so that when the pointer indicates zero it will just rest against the wooden stop."

(It will probably be a little safer to mount the stop block—which may also be cut from a rubber eraser—about half way up the pointer. There will be less tendency for the needle to bend.—*The Service Editor.*)

Radio in 1934

(*Continued from page 392*)

tually become critical of tone quality and demand circuits that will faithfully reproduce signals as they originate at the input, without the introduction of a large percentage of harmonic distortion. They will not listen to ridiculous claims of efficiency, nor claims of power output far in excess of that for which tubes were designed. This clearly indicates the efforts of the design engineer will be devoted to perfecting the Class A type of amplifier rather than spreading his energies over several different systems, none of which is as basically

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sound from the standpoint of quality. **Arthur Moss**, Pres., Electrad, Inc.

THERE seems to be a distinct trend in the further development of the dynamic reproducer (generally referred to as loudspeaker) toward wider range and more rugged construction, with particular emphasis placed upon reliability of operation. The future reproducer will undoubtedly be moisture-proof and entirely dust and filing-proof. Along with these very desirable characteristics it will probably be of such construction as to eliminate or make very simple any adjustments necessary. The dynamic reproducer will probably remain in its place of prominence for some time to come, as there seems to be nothing in the immediate foreground capable of giving equivalent results. **D. H. Wright**, Wright-DeCoster, Inc.

INCREASED labor and overhead cost, combined with shorter working hours, are placing an increased emphasis on the value of laboratory measurement and shop testing, and the expense and delay incident to spoiled or substandard product looms larger than ever. Testing equipment is being overhauled and modernized, with particular attention being paid to speeding up of tests, so that increased production can be handled in shorter hours. **H. B. Richmond**, Treasurer, General Radio Co.

AS the radio public becomes more and more discriminating in its demand for better radio reception, the requirements of the progressive set manufacturer for parts of higher quality and greater dependability become more exacting. This is reflected in a growing need for resistors of greater accuracy, greater dependability, lower noise level and longer life under all service and climatic conditions. It therefore follows that the resistor manufacturers who will be among tomorrow's leaders are those who today recognize the importance of maintaining capable engineering staffs and well-equipped laboratories to keep their products abreast of the times and in line with changing demands. **Ernest Searing**, Pres., International Resistance Co.

THE most important recent development in the parts field has been the introduction of noise-reducing antenna systems for the broadcast band as well as for short waves, and it is gratifying to observe that nearly all of the large receiver manufacturers are introducing combination models this year as a result of the improved performance which, otherwise, antenna systems make possible in the short-wave field.

There is a very definite trend on the part of manufacturers and servicemen to supply customers with high-grade replacement parts. **Arthur H. Lynch**, President, Lynch Mfg. Co.

THE early obsolescence of radio service equipment has proven unavoidable with the complicated switching mechanisms formerly used in most such devices to connect the metering circuit into the various circuits to be tested. Obviously, as the tests to be made change with new tubes and new circuits, the functions of the switching arrangement must be altered to conform. The present trend in the design of radio service equipment is toward the elimination of such switching. Future service equipment will consist largely of metering units designed to indicate in fundamental units—volts, milliamperes, ohms, or microfarads. Such devices will contain range-changing switches only, all other switching being done by the operator, as the unit is connected into the circuit being tested. **H. L. Olesen**, Weston Electrical Instrument Corp.

THE present-day radio receiver equipped with modern types of high-gain tubes, and with many additional special circuits designed for their operation, is requiring the use of a highly developed scientific instrument, with special arrangements of meters and calibrated oscillators, in order to diagnose its proper operation. All manufacturers of new testing equipment are experiencing an imperative demand for an all-purpose instrument which may be used in the new stage-by-stage elimination methods, combined with the point-to-point voltage analysis, as well as the point-to-point analyzer method incorporating the r.f. and i.f. calibrated oscillators, output meters and ohmmeters, in addition to the regular voltage and current meters. The serviceman's degree of success in the servicing of modern receivers with these scientific instruments depends largely upon a thorough radio training and broad experience. J. E. Smith, President, National Radio Institute.

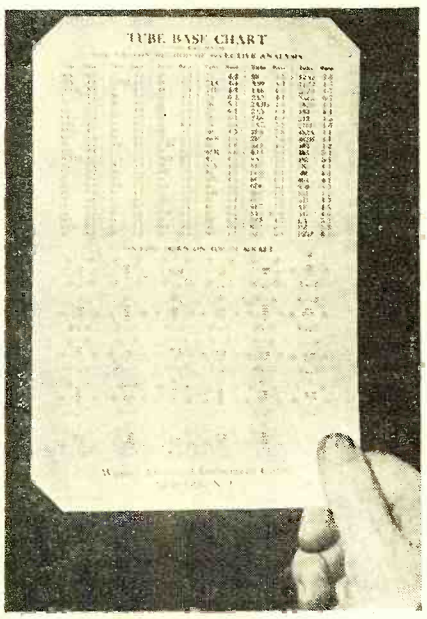
What About Television, Electronics?

THE future trend of television development will be directed towards increasing the efficiency and fidelity of cathode ray pickup and reproducing devices for the televised image. Mechanical scanning systems will become obsolete, as the development of purely electronic devices progresses to its ultimate goal. The iconoscope, or electric eye, promises to be one of the outstanding elements in manifold applications to both wired and radio television. The conversion of the energy of an electron beam into light, with high efficiency, will be the subject of intensive research. V. K. Zworykin, R.C.A., Victor Co.

(To be continued next month)

Handy Tube Base Chart

The Weston Electrical Instrument Corp. has just brought out a tube base chart which should prove extremely useful to the serviceman and radio dealer for making selective analysis of radio receivers. The chart illustrated in the accompanying photograph gives the tube symbols and a top



TUBE BASE CHART

view of the socket connections for 144 different type tubes. The chart measures 8¼ inches by 5¼ inches, making a convenient size for mounting over the service bench or attaching to the analyzer or tube checker.

Any of our readers desiring this chart should write in to RADIO NEWS, Dept. W, 222 West 39th St., New York City, and we will see that it is sent to them.