NEW RADIO PROGRAM

RADIO NEWS

and

Radio Call Book Magazine

and

Technical Review

JULY

25 Cents

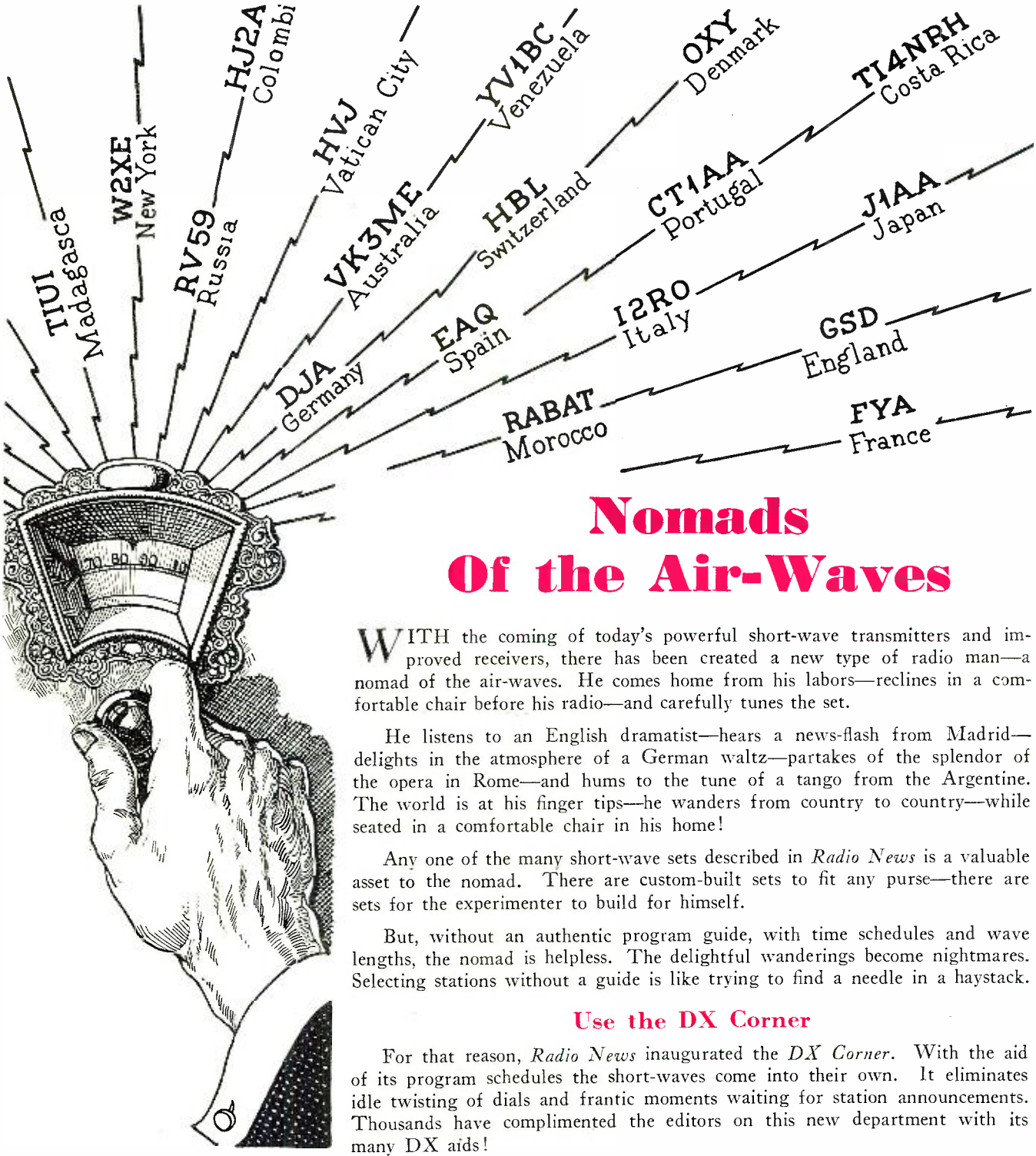
Take the Radio Road to Fame

A Publication Devoted to Progress and Development in Radio

Broadcasting
Service Work
DX Reception
Electronics

Set Building
Short Waves
Experimental Research
Industrial Application

Electrical Measurement
Engineering
Amateur Activity
Television



Nomads Of the Air-Waves

WITH the coming of today's powerful short-wave transmitters and improved receivers, there has been created a new type of radio man—a nomad of the air-waves. He comes home from his labors—reclines in a comfortable chair before his radio—and carefully tunes the set.

He listens to an English dramatist—hears a news-flash from Madrid—delights in the atmosphere of a German waltz—partakes of the splendor of the opera in Rome—and hums to the tune of a tango from the Argentine. The world is at his finger tips—he wanders from country to country—while seated in a comfortable chair in his home!

Any one of the many short-wave sets described in *Radio News* is a valuable asset to the nomad. There are custom-built sets to fit any purse—there are sets for the experimenter to build for himself.

But, without an authentic program guide, with time schedules and wave lengths, the nomad is helpless. The delightful wanderings become nightmares. Selecting stations without a guide is like trying to find a needle in a haystack.

Use the DX Corner

For that reason, *Radio News* inaugurated the *DX Corner*. With the aid of its program schedules the short-waves come into their own. It eliminates idle twisting of dials and frantic moments waiting for station announcements. Thousands have complimented the editors on this new department with its many DX aids!

In addition to the short-wave program schedule, *Radio News* now presents, in each issue, official feature broadcast programs—listed under the name of the programs—giving the sponsor, the hour and your local station. These two features alone guarantee many hours of enjoyment to our readers.

Assure yourself of the monthly receipt of *Radio News*—send $1 with the coupon on this page—and receive the next 6 issues—a saving of 50c over the newsstand cost. Act now—the next issue contains many more new features!

Keep Apace With Radio with

Radio News

RADIO NEWS
222 West 39th St.,
New York, N. Y.

Enclosed find $1. Send the next six issues of *Radio News*. If renewal, check ( ).

Name.....

Address.....

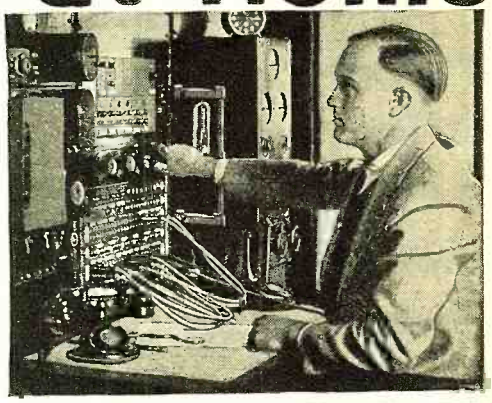
City.....State.....

(Canada and Foreign $1.50)

7A

w Tra n You at Home in your spare time to fill a GOOD JOB in Radio

Here's Proof



Get away from disagreeable jobs with no future. From skinny, little pay envelopes. From skimping along, just barely getting by, but not getting ahead. DON'T PUT UP WITH THEM ANY LONGER. Get into a field with a future. Act today to put yourself ahead. Mail the coupon for my free 64-page book that tells how you can train at home in your spare time to be a Radio Expert; about my course that doubles and triples the pay of many who take it. MAIL THAT COUPON NOW and take the first step toward a real future.

Free Book Tells How Mail Coupon!

Made $10,000 More In Radio

"I can safely say that I have made $10,000 more in Radio than I would have made if I had continued at my old job."

VICTOR L. OSGOOD, St. Cloud Ave., West Orange, N. J.

$120 a Month in Spare Time

"I'm servicing from 3 to 5 sets daily in spare time, and average $120 a month from my Radio work. I still hold my regular day job. I owe my success to N. R. I."

A. E. FARMER, 1012 Denison St., Muskogee, Okla.

Increased Salary $1,000 a Year

"Now I have under construction an up-to-date transmitter for Station WAMC, of which I am engineer. My salary has increased $1,000 per year since entering Radio, due to your splendid training."

JULIUS C. VESSELS, Radio Station WAMC, Anniston, Ala.

Real Opportunities Ahead in Radio for Trained Men

It's hard to find a field with more opportunity awaiting the trained man. Why in 1931—right in the middle of the depression—the Radio Industry sold $300,000,000 worth of sets and parts! Manufacturers alone employed over 100,000 people! 300,000 people worked in the industry. In 1931 broadcasting revenue jumped 20 per cent over 1930, and 1932 is even better. It's a gigantic business, even in the worst business years! And look what's ahead! Millions of sets becoming obsolete annually. 16,000,000 sets in operation that need servicing from time to time! Over 600 great broadcasting stations furnishing entertainment and news to 100,000,000 people. These figures are so big that they are hard to grasp! Yet, they are all true! Here is a new industry, just 12 years old, that has grown into a commercial giant. No wonder great business leaders predict a brilliant future for this great and growing business.

Get Into This Field With a Future

There's opportunity for you in Radio. Its future is certain. Television, short wave, police Radio, automobile Radio, talking movies, public address systems, aircraft Radio—in every branch, developments and improvements are taking place. Here is a real future for thousands and thousands of men who really know Radio. Get the training that opens the road to responsibility, good pay, and success! Send me the coupon now, and get full particulars on how easy and interesting I make learning at home. Read the letters from graduates who are today earning real money in this fascinating industry.

Turn Your Spare Time Into Money

My book also tells how many of my students made $5, $10 and $15 a week extra in spare time, soon after they enrolled. I give you plans and ideas that have made good spare-time money—$200 to $1,000 a year—for hundreds of fellows. My course is famous as "the one that pays for itself."

Money Back If Not Satisfied

I am so sure that N. R. I. can train you satisfactorily that I will agree in writing to refund every penny of your tuition if you are not satisfied with my Lessons and Instruction Service upon completion. You'll get a copy of this Agreement with my book.

64-page Book of Information Free

Get your copy today. It's free to all residents of the United States and Canada over 15 years old. It tells you about Radio's spare-time and full-time job opportunities; it tells you all about my course; what others who have taken it are doing and making. Find out what Radio offers YOU without the slightest obligation. MAIL THE COUPON NOW.

J. E. SMITH, President
National Radio Institute, Dept. 3GR
Washington, D. C.

Special Free Offer

Act now and receive in addition to my big free book, "Rich Rewards in Radio," this Service Manual on D.C., A.C. and Battery operated sets. Only my students could have this book in the past. Now readers of this magazine who mail the coupon will receive it free. Overcoming hum, noises of all kinds, fading signals, broad tuning, howls and oscillations, poor distance reception, distorted or muffled signals, poor Audio and Radio Frequency amplification and other vital service information is contained in it. Get a free copy by mailing the coupon below. ACT NOW!

SPECIAL Radio Equipment for Broad Practical Experience *Given Without Extra Charge*

My course is not all theory. I'll show you how to use my special Radio equipment for conducting experiments and building circuits which illustrate important principles used in such well-known sets as Westinghouse, General Electric, Philco, R. C. A., Victor, Majestic and others. You work out with your own hands many of the things you read in your lesson books. This 50-50 method of training makes learning at home easy, interesting, fascinating, intensely practical.

I have doubled and tripled the salaries of many. Find out about this tested way to BIGGER PAY

Get a Job with a Future

FILL OUT AND MAIL THIS COUPON TODAY

J. E. SMITH, President
National Radio Institute, Dept. 3GR
Washington, D. C.

Dear Mr. Smith: I want to take advantage of your Special Offer. Send me your manual "Trouble Shooting in D.C., A.C. and Battery Sets" and your book "Rich Rewards in Radio," which explains Radio's Opportunities for bigger pay and your method of training men at home in spare time. I understand this request does not obligate me. (Please print plainly.)

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

Address.....

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

"M"

The Famous Course That Pays For Itself

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Technical Editor

William C. Dorf
Associate Editor

John M. Borst
Ass't Tech. Editor

RADIO NEWS

Howard S. Pearse
Associate Editor

Samuel Kaufman
Broadcast Editor

Jos. F. Odenbach
Art Editor

Edited by Laurence M. Cockaday

VOLUME XV | July, 1933 | NUMBER 1

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(*Cover Design by Morey*)

RADIO CALL BOOK SECTION

DEPARTMENTS

Published Monthly by **Teck Publications, Inc.,** *Washington and South Avenues, Dunellen, N. J.*

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222 WEST 39th STREET, NEW YORK CITY, N. Y.

25c a Copy, $2.50 a year, $3.00 in Canada, $3.50 in Foreign Countries. Subscribers are notified that change of address must reach us five weeks in advance of the next day of issue.

Mr. E. H. Scott is shown here aboard the R. M. S. Maunganui, en route to New Zealand. On this 20,000-mile cruise to the South Seas he made constant tests of broadcast band reception under greatest difficulties.

Consistent, clear reception with loudspeaker volume of stations all over the U. S. A. is the definite, verified record of Mr. Scott's spectacular test, which included shipboard operation under most trying circumstances.

From All Over the World Comes MORE AND MORE PROOF of SCOTT Superiority

IN FAR-AWAY SIAM

From Lakon Lampang, Siam, Mr. George Wyga tells of natives who called priests to expel devils which they believed kept his SCOTT silent when it had two faulty tubes. He is "pleased with the set."

A FAMOUS BAND LEADER

Columbia Chain listeners all know Frank Westphal and his music from Chicago's WBBM. He says of his SCOTT, "Such marvelous tone quality is a delightful revelation . . . it not only rivals nature, it *is* nature."

WHEN A RECEIVER consistently, day in and day out, year after year, receives the universal acclaim of owners scattered from one end of the globe to the other for the most startling spectacular performance in all radio history . . . THAT MEANS SOMETHING!

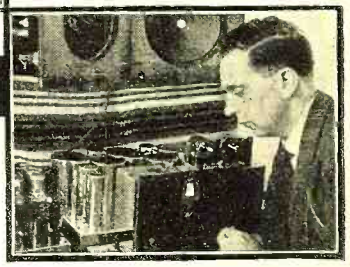
Upon the world-wide, unassailable, documentary endorsement of the legion of written, verified reports of SCOTT ALL-WAVE Deluxe owners everywhere . . . this receiver rests its case.

The few expressions reproduced here are typical of those which pour in upon us continuously. They give an inkling of how this laboratory-precision custom-built receiver stands with its owners.

World-Wide Reception Guaranteed

Because the SCOTT ALL-WAVE Deluxe is constructed by skilled engineers to give the very brand of performance reported . . . fidelity of reproduction, sensitivity almost beyond measurement, selectivity to conquer the congestion of broadcast the world around . . . it carries the strongest guarantee ever offered. It is guaranteed to receive daily, with loud speaker volume, short wave broadcasts from stations 10,000 miles or more distant . . . and its every part (except tubes) is warranted for five years.

E. H. SCOTT RADIO LABORATORIES, Inc.
4450 RAVENSWOOD AVE., Dept. N-73, CHICAGO, ILL.



IN CENTRAL MEXICO

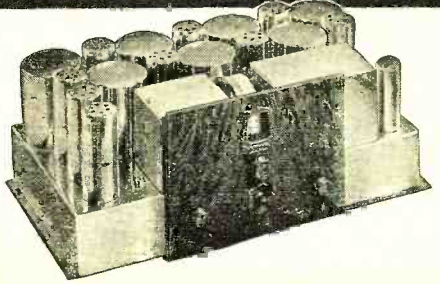
Baron v. Turckheim reports daily reception of broadcasts from Germany, France, Spain and Australia. "The tone is faultless," he writes from Mexico City, and then adds, "This is my first *great* radio."

IN THE PHILIPPINES

U. S. Army Sergeant Frank Sublette, Fort Mills, Cavite, P. I., says, "Russia, England, France come in just wonderful. Will never buy any other receiver but a SCOTT." . . . And tropic reception is "tough."

SEND COUPON AT ONCE FOR COMPLETE INFORMATION

The SCOTT ALL-WAVE Deluxe gives perfected performance on all wave bands from 15 to 550 meters. It incorporates every worthwhile development of radio engineering, including Automatic Volume Control, Visual Tuning, Static Suppressor, etc. For all technical data, price quotations, and performance PROOFS, send coupon.



E. H. SCOTT RADIO LABORATORIES, INC.
4450 Ravenswood Ave., Dept. N-73, Chicago, Ill.
Send me at once, without obligation, complete information regarding the SCOTT ALL-WAVE Deluxe, including performance PROOFS, technical data, etc.

Name .....
Address .....
City ..... *State* .....

The Editor–to You

WITH the summer here and vacation time approaching, many radio fans are thinking of a holiday tour by automobile. And this year as never before they can take a radio with them and enjoy its benefits on the road, in camp or at their summer cottage. For automobile radio is now an established fact, and the manufacturers are showing new models at prices that everyone can now afford. And what an improvement these latest models show over all previous types. No longer does one have to keep his hand on the volume control to prevent the signal from fading out altogether or coming in so loud that the reproduction is distorted. The new receivers are easy to install and are equipped with the latest design of automatic volume control that keeps signals at a constant volume. Also, the newest sets have a reproduction ability to give the same high standard of quality as a year ago was expected only from an expensive and complicated set at home. The newest models can be fitted to practically all makes of cars, and thousands of dealers and servicemen are now ready to make complete installations for their customers in short order.

* * *

ON page 19 of this issue will be found a description of a number of the newest motor-radio models. Our readers may take advantage of these new sets and insure for themselves a great quantity of radio enjoyment during their holiday. Any serviceman can install a separate loudspeaker plug with a long extension cord so that a second loudspeaker can be attached and run out of the car to a tent, camping ground or bungalow. Automobile radio therefore is the answer to the radio hobbyist's problem of enjoying radio while he is at ease during the summer period.

* * *

THE photograph reproduced on this page shows the radio room of the Soviet icebreaker "Siberiakov" which navigated the Northeast Passage in a single season. The ship left Archangel, and in six weeks time reached Yokohama Japan. It kept in constant radio communication with land stations during the entire expedition. Once while in difficulty, radio was the only means of communicating with another vessel to help the icebreaker out of the ice, after three propeller blades had been broken. The radio crew recently returned to Moscow and were given a demonstration and official praise for their untiring work and success in establishing emergency communication.

* * *

ON page 60 of the current issue will be found the RADIO NEWS Index to articles covering the period from January to June 1933 inclusive. This will be of value in locating the page numbers of articles in any of these issues. The first index was run in the July 1932 issue, covering the period from January to June 1932 inclusive. The second index ran in the January 1933 issue and covered articles during the period of July to December 1932 inclusive. In the future these indices will follow once every six months in the January and July issues.

* * *

As promised last month, the leading article in this issue, entitled "Radio's Road to Fame," is a survey of the conditions confronting a new recruit, seeking a "spot" on the air, in broadcasting.

Maybe you have an idea that would make a big hit. The article tells you how to go about it.

* * *

THE second article of the series describing new types of marine equipment for the benefit of ship radio operators appears on page 10. It is entitled, "Harbor Radio," and describes equipment for telephone operation from harbor-craft to shore.

* * *

SERVICEMEN should find great interest and utility in the new oscillator described on page 14. It is a piece of equipment that will be found worth owning by any serviceman or experimenter.

* * *

WOULD you like to own a ribbon microphone? You can build one yourself at only nominal cost by following instructions given in the article on page 20.

* * *

How can American broadcasting be improved? Read the two proposed outlines on pages 24 and 25 under the title "What Our American Broadcasting Needs."

WOULD you like to own a handy, portable, short-wave receiver? Bernard J. Montyn describes a simple one, using the famous RADIO NEWS circuit, familiar to our readers as the "Junk Box."

* * *

ARE you using our new radio program feature service? Turn to page 30 and notice that here is given, nightly, a complete enjoyable program for the four weeks period from June 10th to July 10th. Take it home to your folks, your wife, your mother, who will be able to use it anywhere in the United States, as it lists your local chain stations.

* * *

COMING over the Editor's desk this month are a number of letters of encouragement and suggestion which the Editors appreciate. There follow a few excerpts.

* * *

"I WISH to express my appreciation and approval of your policy in presenting articles dealing with modern commercial radio equipment. The article by Arthur K. Ransom on 'Marine Radio' was an ideal start along that line.

"During the course of a Dinner-Dance given by the Veteran Wireless Operators' Association I mentioned this to several members, and their interest was quite apparent. May we look forward to more features of this type." — Herman H. Parker, Port Chester, N. Y.

* * *

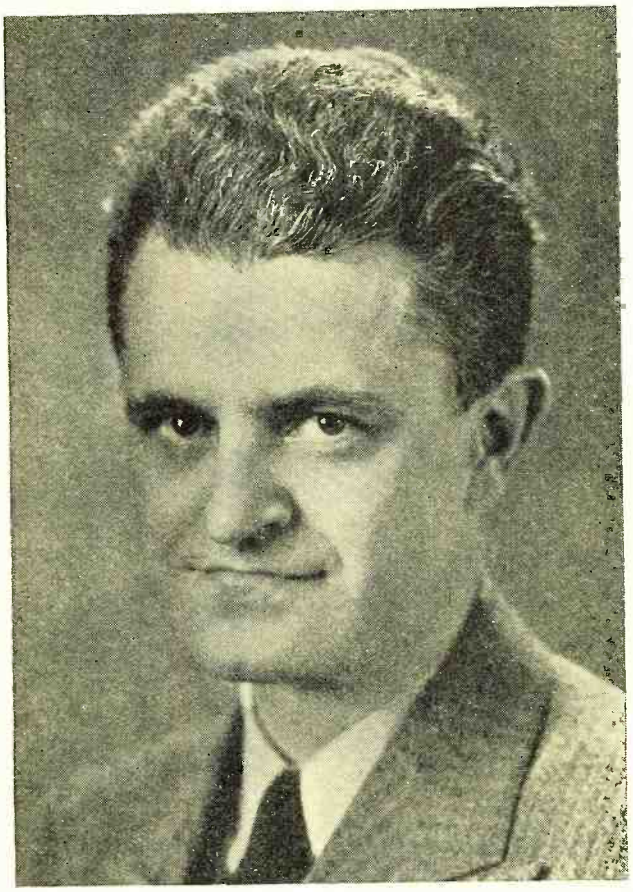
"I HAVE been a reader of your excellent magazine for at least six years and never before expressed my opinion as to its merits or defects. I cannot say there are any defects. I enjoy every article in every issue, particularly those dealing with the more technical side of radio."—L. F. Wagner, Radio Sales, Engineering Service, Palmyra, Pa.

* * *

"YOUR excellent magazine gives me so much more worthwhile dope that all European magazines are empty when compared with it. 73's."—Peter Dowbor Musnicki, Poland, Europe.

* * *

"DURING my past four years as a radio operator on shipboard, I am pleased to say I have been a constant reader of RADIO NEWS, which I find both interesting and instructive. We greatly appreciate the QRD column."—Jack Warren, Halifax, N. S., Canada.



$11,550 in Business from an $80.64 Advertisement

"We thought you would be interested to know of the gratifying results secured from a small ad we ran in a recent issue of RADIO NEWS. *To this ad we were able to trace the sale of seventy (70) latest model Webster portable public address outfits. These units list at $165, so you can see it was a very nice order. The units were ordered by International Grocers' Alliance, a progressive retail store association who are using them in connection with special sales work that is proving to be of great benefit to their members. The same ad brought us also a good new distributor. So if anyone wants to know whether or not advertising in* RADIO NEWS *really 'pulls,' our experience would indicate that it certainly does if you just keep at it a while."*

(Signed) John E. Evans

The Webster Company

Discovering Tomorrow's Radio Stars

The "audition" is really a tryout for newcomers to the microphone. It is made in a regularly equipped broadcasting studio in front of a radio microphone while listening experts in a control room hear the aspirant's vocal efforts in the same manner that they would be heard if it were a regular broadcast. The applicants above are Thelma Marsh, Jane Barnes and Josie Walton trying out for a role in "The Magic Voice"

Radio News

VOLUME XV July, 1933 NUMBER 1

RADIO'S ROAD TO FAME

A popular survey of a fertile field of endeavor which, although widely used in our everyday affairs, has remained comparatively undeveloped and is seeking new recruits. The article contains a constructive outline of the opportunities in broadcasting, but should not be regarded essentially as a treatise on vocational guidance

By Samuel Kaufman

THE powerful medium of broadcasting, constantly benefited by great technical strides in transmission and reception, has shown but slow progress in program offerings. Broadcasting stations, nation-wide networks, program companies, commercial sponsors and advertising agencies are ever on the alert for new program ideas and talent which may tend to attract mass radio audiences.

For the really talented person with a new idea, the field of broadcasting is indeed a lucrative one. Regardless of what trade or profession you may have been engaged in up to now, if you can produce the type of material broadcasters are seeking and the harassed radio public has long deserved, there is a profitable job waiting for you behind the microphone.

The writer does not intend telling you how to create ideas or develop talent. The talent must be there to start with. He will show you practical roads to follow to obtain maximum returns for your broadcasting efforts. For several years he has observed the tremendous and rapid growth of the radio industry from the vantage point of a journalist continually assigned to cover the nation's leading broadcasting studios. Throughout this long and intimate association with the industry, he has observed many successes and failures behind the microphone. Through his close friendships with radio stars and executives, he has discovered much important information for the novice's welfare. In these ensuing paragraphs he will endeavor to impart such data.

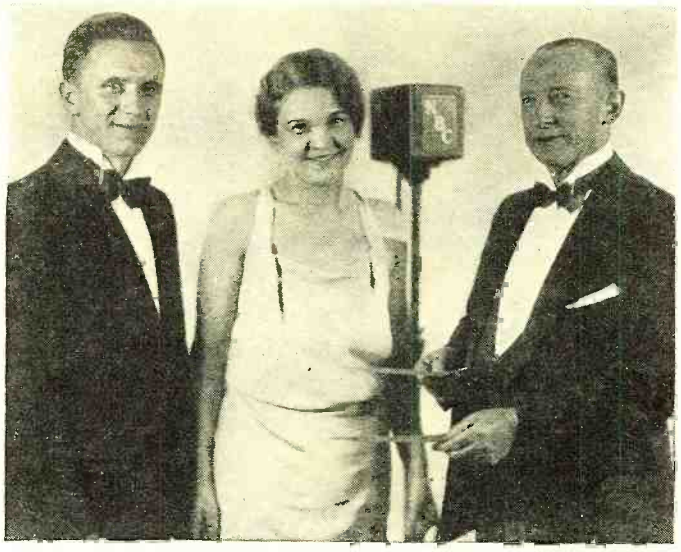
Most persons engaged in creative fields dislike to follow iron-bound formulas. That is as it should be. Originality, in a radio program, would indeed be lacking if the presentation was designed from a standard table of rules. Therefore the reader is urged to accept this article as a survey or outline of possibilities in the greatest form of entertainment—radio.

Program ideas and microphone ability must come from yourself. However, the endowment of unusual ability for successful radio presentation is apt to lie dormant and unrecognized in many persons. A spark must be set to kindle that faculty in order to gain a true test of its worth. If the spark ignites, the bright glare of your talent will shine forth attracting attention everywhere. If the spark fails to ignite, there will be no flame to attract notice to your unsuccessful effort.

To put it briefly, the time and effort you invest in testing your own broadcasting ability will result in lucrative returns if you succeed and in virtually no loss if you fail. From the practical business viewpoint, therefore, everything is in your favor when you start.

WINNERS OF THE A. K. 1932 CONTEST

A. Atwater Kent, the sponsor of the contest, presenting two checks for $5,000 to the winners, Wilson Angel and Lydia Summers



PAUL WHITEMAN CONDUCTING NOVEL AUDITION

He is seated blindfolded between two contestants while the third does her bit before the microphone. Mr. Whiteman claims that performers should be chosen by their voices alone and not by appearance

There is everything to gain and nothing to lose.

Talent, as applied to broadcasting, is vastly different than its application to any other field of entertainment—particularly the stage and screen. In radio, talent is secondary to the *idea behind the program!* Air performers' abilities are limited to the themes of their broadcasts. If the idea succeeds, so does the cast supporting it. Of course, a good program scheme can be ruined by poor performers, but not more easily than a performer, with undiscovered ability, can remain disregarded on account of a bad program idea.

Broadcasting calls for talent but not art; broadcasting is not any more esthetic than your morning newspaper. It is wrong to call radio performers "artists" unless their activities, away from the microphone, warrant the use of the title. Many persons will readily associate "talent" with "genius." A novice is usually too unassuming to term himself a genius and consequently refuses to believe in his talents.

Broadcasting, rather than being an individual art, industry or science is, in reality, an amalgamation of all other arts, industries and sciences. Broadcasting is an audible encyclopaedia touching, or being capable of touching, any extant subject. Instead of presenting enacted reflections of life as in stage and screen programs, radio presents real life events *as they are taking place!* In advantages and rewards, radio offers its recruits much more than the stage and screen proffers newcomers. Musicians, actors and others can find far greater opportunities "on the air" than in the concert, theatrical and talking-picture fields.

Wanted—New Ideas

The chief asset to a broadcast is originality. A good program idea that will hold the interest of mass audiences and satisfy their longings for something new in radio fare stands an excellent chance for great monetary returns. The original idea, backed by careful casting and common-sense procedure, stands a good chance for acceptance. Remarkably special aptitude in the artistic sense is not always essential.

Turn to your local radio program listings. The day starts with weather reports, news announcements and setting-up exercises. The daytime hours are dominated by programs of especial interest to women. Recipes, pure-food talks, beauty hints and similar topics of feminine import are in abundance. Interviews of timely interest are scheduled. Various types of musical and dramatic programs stud the stations' schedules. The evening hours after 6 P. M.—the choicest hours because they command the largest audiences—feature a variety of musical, dramatic, novelty and composite presentations.

In addition to such regularly featured presentations, you will often find special event broadcasts among the program listings. These broadcasts cover a wide variety of news events ranging from play-by-play accounts of sports contests to campaign orations by politicians.

At a glance, the program schedules reveal the versatility of radio. With broadcasting embracing an unlimited number of fields, the world is literally *yours to work with* in the creation of a radio presentation. It may be truthfully said that an effective radio program requires a degree of skill for perfect presentment. But, with unlimited resources at your command, you have the privilege of adapting an idea to your skill rather than your ability to an idea.

Let us consider the types of talent demanded by radio. A good, clear speaking voice is one of the best assets. Although most programs are read from manuscripts as they go on the air, a thorough knowledge of grammar and rhetoric is essential. This must supplement a constructive and authoritative background in the field represented in the subject of your program. The *personality* behind the voice is an important factor towards the program's success.

Broadcast performers specializing in dramatic and dialogue programs must have the essential histrionic ability to read their lines, plus the important and more difficult knack of

FAMOUS JUVENILE ARTISTS

Alfred Price, 11-year-old impersonator and at right Baby Renee Brandeis, 5-year-old song bird

audibly acting their roles. The writing of dramatic continuities for the air is the most important contribution to the success of such offerings. However, much depends upon the cast to properly enunciate and emphasize the lines in order to compensate for the absence of visibility.

In the field of music, all good types of talent are prospects for satisfactory radio presentations. Although basic musical talent and knowledge must be obtained from outside sources, it must always be remembered that the singer or instrumentalist should carefully study microphone technique before going on the air. Superior musical artistry, backed by long careers of concert hall and operatic engagements, may be shattered by incorrect use of the tiny device known as the microphone. Despite its inconspicuous size, the microphone is the most vital link between the radio performer and his audience.

Broadcasting, in its universal scope, is open to all types of suggestions. Do not take the attitude that your chances are small because there are so many experienced broadcasters to compete with. The fact is, that broadcasting itself is inexperienced to this day, on account of its brief period of existence. Much of the established talent in radio has been drafted from other fields. Broadcasting did not show material profits until a short time ago, the earlier years being spent in experimentation. Now, with broadcasting's solid aspect as an established industry, it is constantly looking for new ideas and talent.

Auditions and Sustaining Programs

To the numerous persons who have written to me asking for advice as to how to begin, I have always advised that they should stay in their home town for their early training. It is to their advantage to gain "small" station experience before applying to a "network" or "clear-channel" station in a large city. Do not, under any circumstances, come to New York or other key city with the sole purpose of getting a berth on a "network." The chances are about 98 percent against you, *providing that you have talent!* Only about 2 percent of persons who apply to the networks for auditions get microphone assignments. The best way is to work yourself to the big-time bookings via the "small" stations.

Both the National Broadcasting Company and the Columbia Broadcasting System conduct regular audition periods for new talent. Applicants must write in to the program managers requesting audition appointments. They are permitted to select their own material for the audition and the station supplies an accompanist, when necessary. The same system also applies with most of the individual stations throughout the country, although the audition dates are usually wider apart on the smaller stations.

Few stations *pay anything at all* for sustaining program talent. Usually, fees are paid on non-commercial programs for established radio names. However, stations constantly endeavor to interest some sponsor in taking over one of the sustaining periods. And when the program goes "commercial," the performer comes into his own. Many talented persons interested in a radio career sometimes are not interested in giving their services gratis in this manner until they can get a commercial sponsor. But, after all, they are not giving away anything! The station, in fact, is giving them a "break" by permitting the performers to go on the air and build up names for themselves. The experience gained thereby and the publicity derived through such microphone appearances are sufficient payment until the period can be sold. It is a usual procedure for the commercial department of the station to try to sell their sustaining features. In addition, it is a wise move for the entertainer, himself, to solicit the attention of advertising agencies and clients who might be interested in his program. By being "on the air," he can urge them to listen to his offering and judge for themselves. Sometimes, this method leads to quicker and more substantial results than in trying to obtain a special audition for the particular agency or account.

CONTEST WINNER MADE GOOD

Donald Novis, the Atwater Kent winner of 1928 achieves fame on the air

The successful radio entertainer knows that he cannot do everything himself and yet scale the heights of stardom. He should have a good manager to take care of his business affairs, continuity experts to supervise his scripts, and a publicity man to contact the press. The beginner, of course, cannot afford all of these. He should remember, however, that he should not begrudge these expenses when he can afford them.

There are several short-cuts to radio fame. Various contests and auditions bring loads of publicity and, as in other forms of entertainment, publicity is one of the best aids when in quest of stardom. Such auditions as those conducted each year by the Atwater Kent Foundation, in which the entire country is scoured for exceptional young singers, offer great opportunities.

Some outstanding radio performers—Paul Whiteman for example — conduct auditions at regular periods for new talent.

(*Continued on page* 54)

THREE CLEVER YOUNGSTERS

Baby Rose Marie (below) youngest "blues" singer. At left, Bobby Jordan and Florence Halop with Ray Knight

A Telephone System for HARBOR RADIO

This is the second of the series for radio operators describing marine radio equipment of various designs for use in ship-to-ship and ship-to-shore communication

By W. K. St. Clair

LAND TERMINAL EQUIPMENT

Figure 1. Operator at control bay of shore receiver. In the background can be seen the shore transmitter

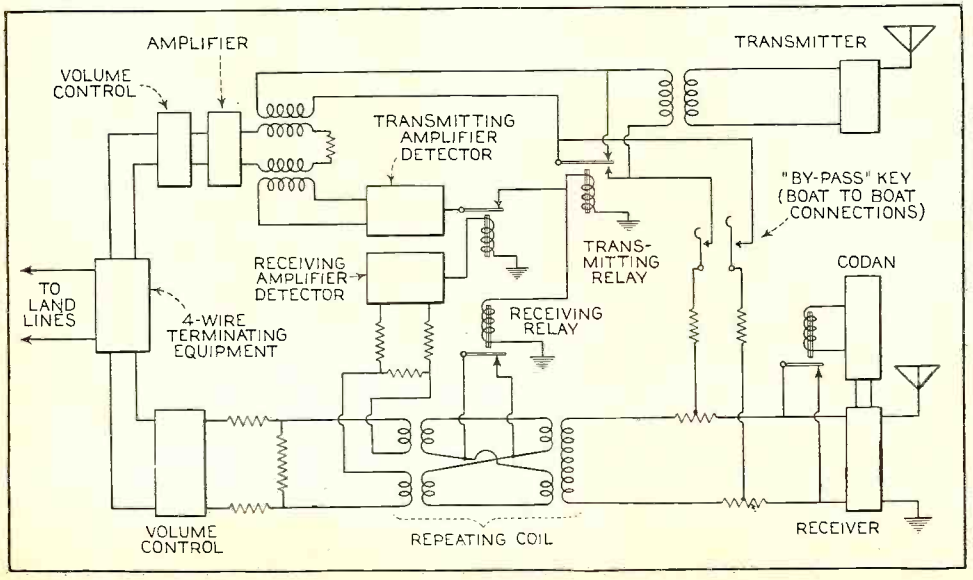
IN the past when a captain of a tug boat or other craft left his dock to proceed on assignment, he immediately severed communication with shore, and might proceed on a long trip which changing conditions made useless or be ignorant of the need for his presence in an emergency occurring at another place. It is, of course, possible to equip such boats with radio telephone to permit conversation between harbor craft and shore or from craft to craft. Several of the Telephone Companies are contemplating the inauguration of shore-to-ship radiotelephone service in some of the large harbors of both the Atlantic and Pacific Coasts. At Boston, the New England Telephone and Telegraph Company has opened its station on a trial basis, largely for the benefit of the fleets which operate in nearby waters. It is expected, for instance, that fishing fleets through this service will be able to concentrate where the fish are running and that the companies may keep in touch with the boats, advising them when to run in to port to take advantage of favorable price conditions.

The equipment aboard ship shown in Figure 5 and consisting of a standard transmitter and receivers is simple and requires no special skill or knowledge for its operation. At the shore station is equipment similar to the ground-station transmitter and receiver used for airplane communication but modified somewhat to meet the special requirements of harbor service, and to provide for connecting the radio circuit to the land lines of the telephone System. A photograph of the transmitter with its associated rectifier for power supply, the antenna tuning unit, and the antenna switch is shown in the background in Figure 1. The receiver, grouped for operating convenience with the voice-frequency control equipment, is shown in Figures 1 and 2. This control equipment has the same general functions as that employed for the transatlantic telephone service, but is much simpler. Through land lines to the toll office, the radio link is connected to the local and long-distance telephone system.

A simplified schematic of the shore station is given in Figure 3. Speech to be transmitted to a boat passes from the land circuits through a volume control for regulating the input to the radio transmitter, through an amplifier, and then through a hybrid coil. Here the main speech channel passes through the front contact of a relay to a transformer, which couples the circuit to the radio transmitter. When the relay is unoperated, the transmitter is blocked through a back contact, but part of the voice current passes from the hybrid coil to the transmitting amplifier-detector which operates the transmitting relay so that transmission may take place. This amplifier-detector is a vacuum tube and relay device arranged to be more sensitive to pulsating currents, like speech, than to disturbances like line noise which have a comparatively unvarying envelope. At the same time that the transmitting amplifier-detector operates the transmitting relay, and so permits transmission, it also operates another relay which blocks the receiving

SCHEMATIC CIRCUIT FOR LAND TRANSMITTER

Figure 3. General layout employed at the land end of the new harbor radio equipment



circuit, making the latter inoperative.

Incoming speech, from the radio receiver, passes through a repeating coil combination and then through a volume control for adjusting the speech to the land lines. Part of the incoming speech, however, is shunted from the repeating-coil combination to a receiving amplifier-detector. This is a voltage-operated trigger device, using a gas-filled detector tube, and designed to be fast and positive in its operation. At the first impulse of incoming speech this apparatus operates a relay which opens the circuit to the two relays already mentioned, so that the transmitter remains blocked and the incoming circuit clear. When speech is not being transmitted, the transmitting circuit remains blocked, to prevent re-radiation, and the receiving relay is closed so that incoming signals may be heard.

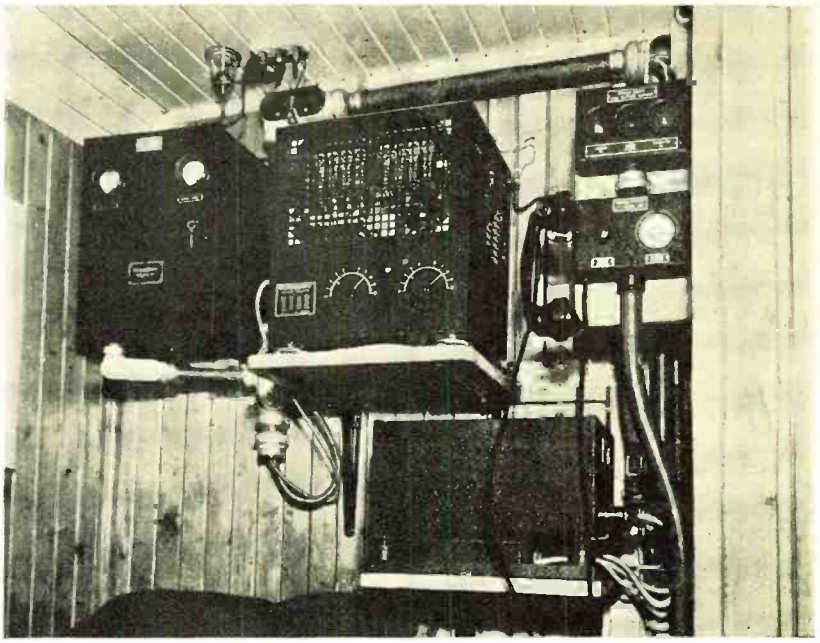
AVC and Noise Suppression

The receiver is equipped with an automatic gain control which adjusts the amplification according to the level of the incoming carrier. When no carrier is being received this control raises the gain to its maximum value, thus greatly magnifying all incoming noise. To avoid transmitting this noise over the land lines a piece of apparatus known as the "codan"—made from the initial letters of the words indicating its function "carrier-operated device, anti-noise"—is used to insert a large loss in the receiver circuit when no carrier is being received. By the use of this device, practically no radio noise is received at the amplifier-detector or at the subscriber's station when the distant carrier is off.

Provision is made to enable a ship to talk with another ship as well as with the land station. Such communications must pass through the shore station, however, because two frequencies are employed for harbor communication; one for transmitting from shore to ship, and one, from ship to shore. All ship transmitters, the circuit of which are shown in Figure 4, are tuned to one frequency and all ship receivers to the other. To make possible ship-to-ship communication a key-operated transfer circuit is provided at the shore station, which permits the incoming voice currents to be by-passed directly to the radio transmitter. This connection is under the control of the technical operator.

The control apparatus, mounted on a panel in front of the technical operator, includes attenuators for regulating the transmitted and received volumes and the sensitivity of the amplifier detectors, a direction indicating meter to show whether speech is being transmitted or received, a volume indicator available for either received or transmitted speech, as well as a meter for plate voltage, and keys for starting the transmitter and for talking and monitoring on various parts of the circuit.

The shore transmitter, type 9-C is designed to deliver 400 watts of carrier power at any frequency between 1500 and 6000 kc., and will maintain its frequency to better than .025 percent. This equipment may be located at some distance from the control and receiving station, or it may be in the same building. If in a separate building, a short-wave radio receiver at the control station is (*Continued on page 57*)

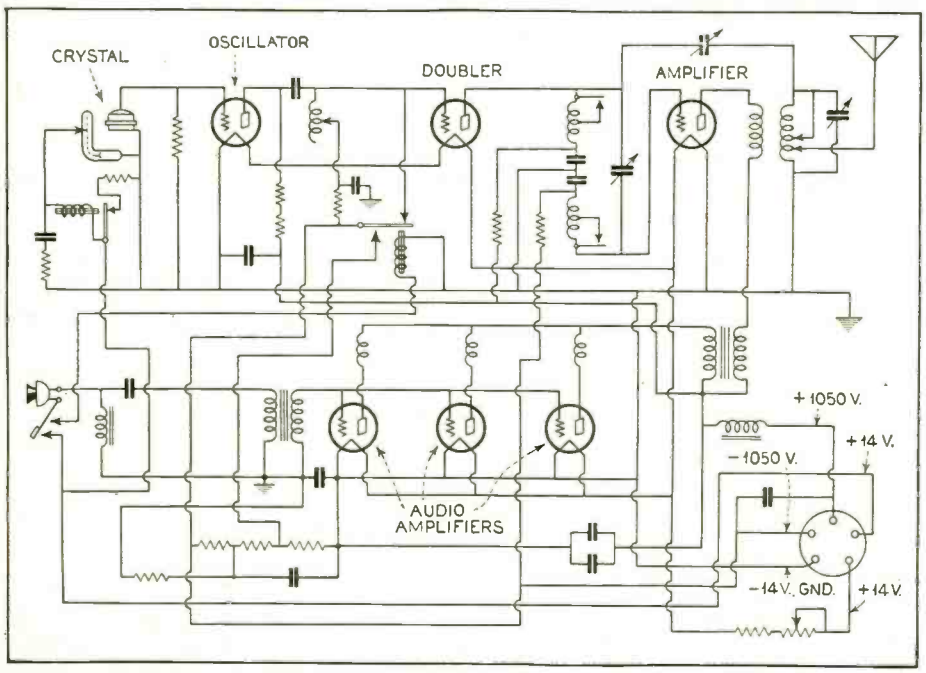


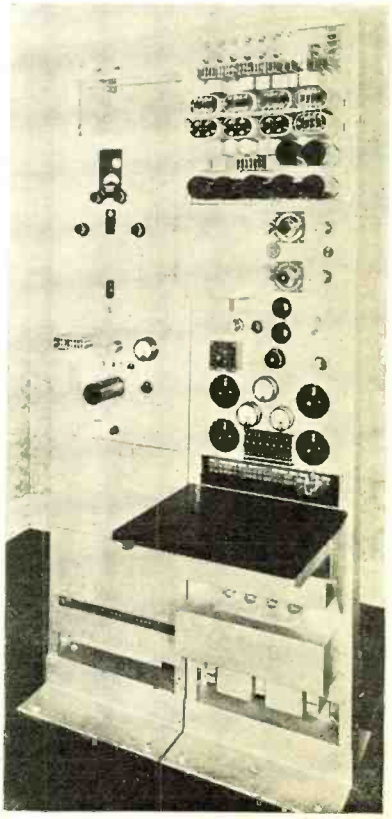
INSTALLATION ABOARD SHIP

Figure 5. This is a view of the Western Electric marine radio telephone equipment installed in the captain's cabin aboard the Trawler Flow of the Bay State Fishing Company's fleet

THE SHIP TRANSMITTER

Figure 4. Below. This is a schematic wiring diagram of the type of transmitter used aboard harbor craft. Figure 2, at right, is the front view of the receiver and control bay for the shore end





TYPE –41

TYPE –42

TYPE –43

TYPE –44

CHARACTERISTICS AND CIRCUIT DATA FOR FOUR PENTODES

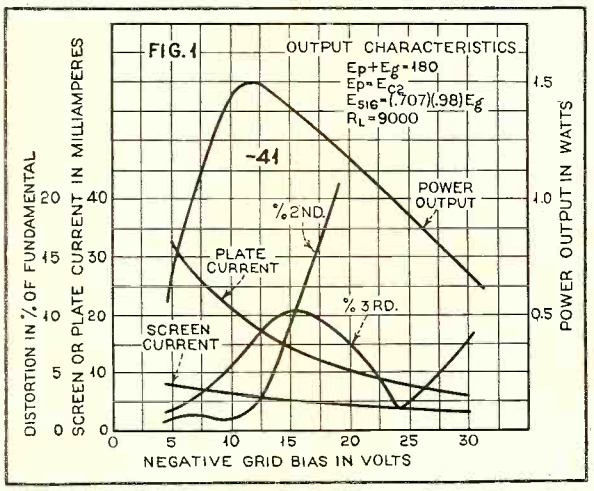
By J. van Lienden

THE present multiplicity of tubes is bewildering to the trade—to say the least. The many types now on the market forces dealers to keep a very large number in stock. Some manufacturers have brought out a line of tubes requiring a filament potential of 6.3 volts, either a.c. or d.c. and which are suitable for a.c., d.c. or automobile receivers. This makes it possible to reduce the number of types employed in various receivers.

Consistent with this policy, Sylvania now manufactures three new tubes which are similar in characteristic to the types –38, –47 and –39 but with a 6.3 volt filament which will stand a.c. and other improvements. These tubes have been given the type numbers –41, –42 and –44 respectively. A fourth tube, the type –43, is intended for use as an output power pentode in d.c. receivers. It has a 25-volt heater, which takes a heater current of 300 ma. An output of .9 watt is possible with but 110 volts plate supply.

Type –41

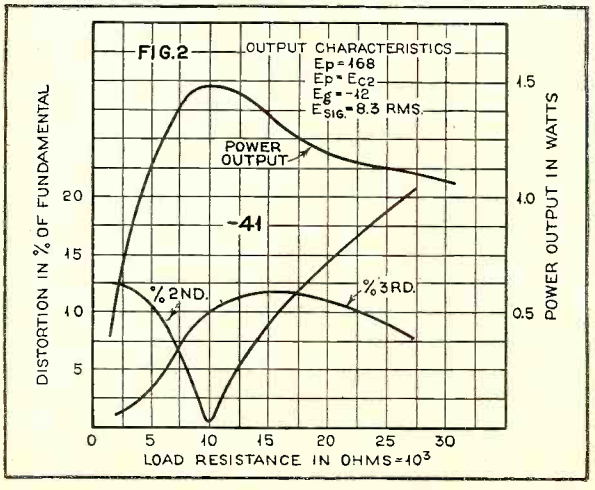
This is a 6.3 volt cathode-type, power-output pentode designed especially for automobile receivers, d.c.-line receivers and any other applications where considerable output is desired at not more than 180 volts.

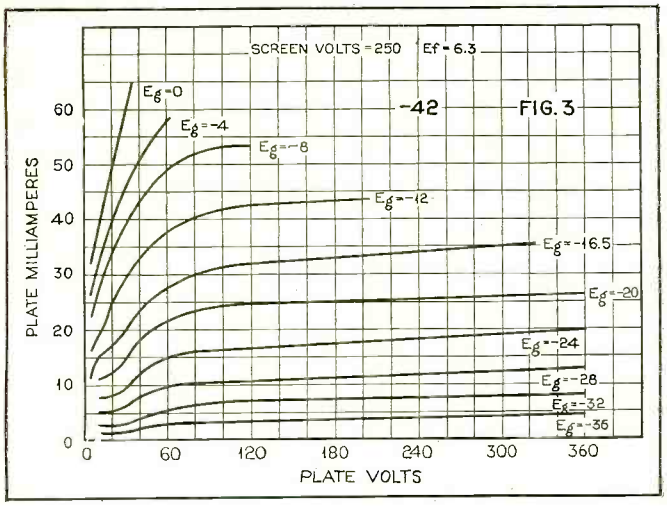


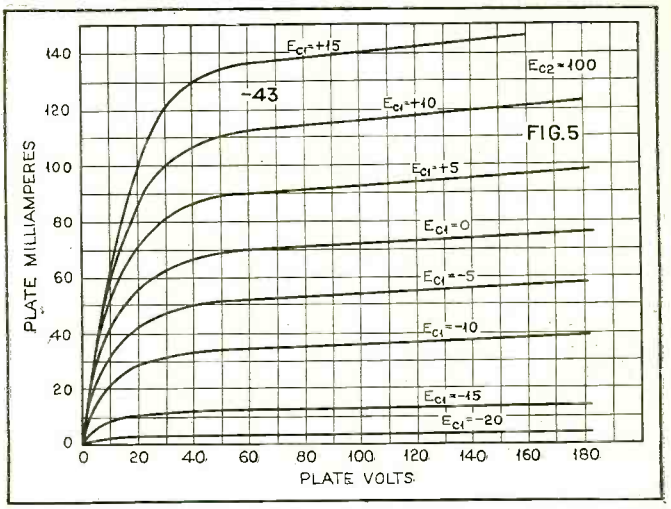
The characteristics of this pentode tube are to be found in the accompanying Table. Figures 1 and 2 show curves of the power output, the second and the third harmonic distortion, plotted against grid bias in Figure 1 and against load impedance in Figure 2.

The type –38 tube cannot be replaced by the type –41 without making some changes. In the first place, the socket must be changed, which necessitates some alteration in the wiring also. Then the voltage requirement are somewhat different, especially the grid bias. Last, but not least, the tube requires a load resistance of 10,000 ohms which is below that for the type –38. Consequently, an output transformer designed for the –38 type causes a mismatch with the resulting loss of power and quality. When two tubes are used in push-pull as a Class A amplifier, the second harmonic is cancelled and in that case somewhat lower third harmonic distortion can be obtained when the load is made smaller than the recommended value. If the signal is applied to the grid of the tube, through resistance coupling, the grid leak must not be larger than 500,000 ohms and that only when the bias is obtained by a resistor in the cathode lead. If the bias is fixed or partially so, the grid

	41		42	43		44				
E_f	6.3		6.3	25.0 D.C.		6.3				VOLTS
I_f	.4		.65	.3		.3				AMPERES
E_p	167.5	180	250 MAX	135 MAX	95	90	135	180	250 MAX	VOLTS
$E_{sg.}$	167.5	180	250 MAX	135 MAX	95	90	90	90	90MAX	"
$E_{cc.}$	-12.5	-14.0	-16.5	-20	-15	-3.0	-3.0	-3.0	-3.0MIN	"
μ	205	215	220	—	90	152	257	426	630	—
R_p	120,000	120,000	100,000	—	45,000	150,000	250,000	410,000	600,000	OHMS
G_m	1,700	1,800	2,200	—	2,000	1,010	1,030	1,040	1,050	MICROMHOS
G_m -10V BIAS	—	—	—	—	—	275	275	275	275	"
G_m -40V. "	—	—	—	—	—	11	11	12	12	"
G_m -50V. "	—	—	—	—	—	1	1	1	1	"
I_p	16.5	19.0	34.0	—	20.0	6.0	6.25	6.4	6.5	M.A.
$I_{sg.}$	3.5	4.0	6.5	—	6.0	1.55	1.5	1.4	1.4	M.A.
R_L	10,000	10,000	9,000	—	4,500	—				OHMS
P_o	1.25	1.5	3.0	—	.900	—				WATTS
C_{g-p}	.5		.5	—	—	.007				MMFD
C (INPUT)	6.0		7.5	—	—	3.7				"
C (OUTPUT)	8.5		8.6	—	—	9.6				"
LENGTH	4 3/16"		5 5/8"	5 5/8"		4 3/16"-4 11/16"				—
DIAMETER	1 9/16"		2 5/16"	2 5/16"		1 9/16"				—
BULB	ST-12		S-11	ST-17		S-12				—
BASE	SMALL 6-PIN		MED. 6-PIN	MED. 6 PIN		SMALL "Y"				—





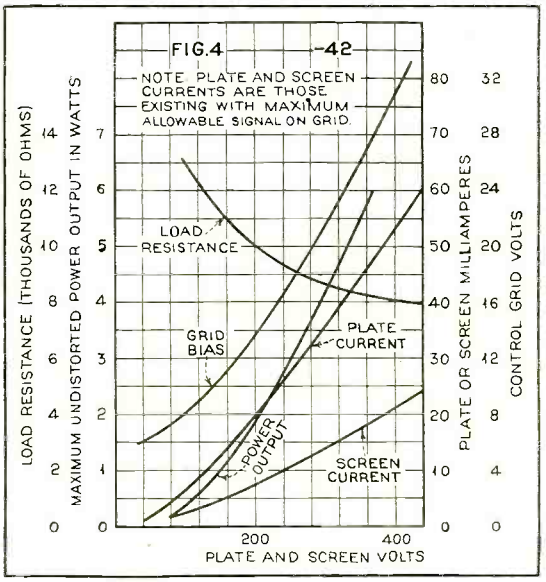


leak should not be more than 250,000 ohms.

The Type -42 Tube

This type is a new cathode-type, power pentode with a 6.3-volt heater. It is similar in characteristics to the popular type -47 pentode tube. However, it has considerable improvements over that type: the most important of which is the cathode heater. A considerable reduction in hum is to be expected from its use. The maximum undistorted output is three watts, which is another improvement over the -47 type.

The hook-up for either a -41 or -42 type tube is the same. The difference in the circuit for the two tubes is in the applied voltage and the values of resistors or load impedance only. Curves of the pentode are shown in Figures 3 and 4. Figure 4 is unusual and should be valuable for reference. For a given plate and screen voltage one can find from the curves all other constants necessary. When the tube is used in a resistance-coupled circuit, the grid leak should not exceed ¼ megohm when the tube is operated self-biased. It should not be more than 100,000 ohms when fixed bias is employed. When two tubes are employed in push-pull in a class A circuit a somewhat lower load resistance than normal will give less third harmonic distortion.



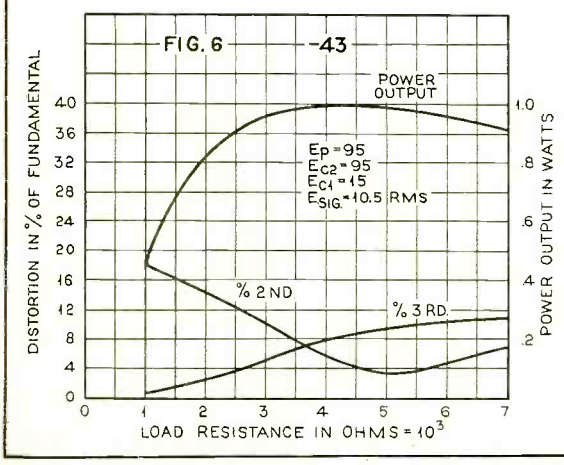
Type -43

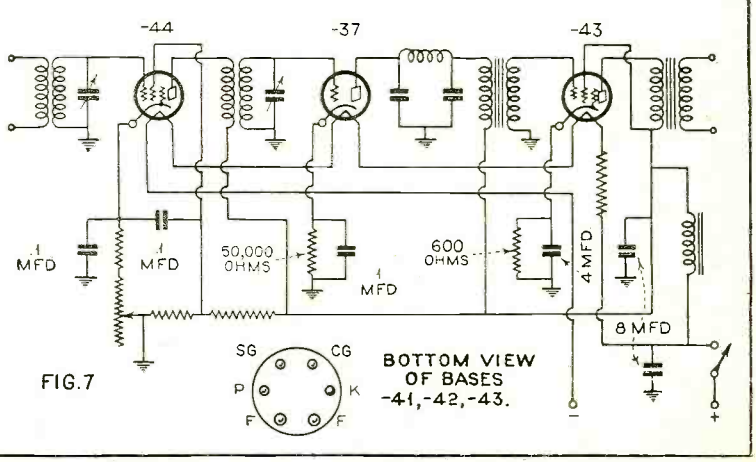
Receivers to operate on 110 volts d.c. have always been hard to design for the lack of an output tube which will deliver enough power with a plate voltage of but 100 volts. The -43 type pentode is intended especially for that purpose. It is of the cathode type; the heater requires a potential of 25 volts and a current of 300 milliamperes. Since all other tubes in the series for d.c. operation require the same filament current they can be connected in series and the high filament voltage becomes an advantage as it reduces the size of the series resistor. It is claimed also that such a circuit reduces the time of warming up. The heater may be biased, positive or negative with respect to the cathode, by no more than 90 volts. When the heater has a high bias this may cause leakage current of up to 200 microamperes. When designing the circuit this should be taken into consideration.

Curves of the type -43 are shown in Figures 5 and 6. The characteristics are in the table. Figure 7 shows the circuit for a -43 as an output tube with a type -37 tube as detector. The radio-frequency stages could be one or more stages employing the type -44 tube. All filaments are connected in series. According to the advice of the manufacturer, resistance coupling must not be used with this tube. Impedance or transformer coupling may be employed.

Type -44

The -44 type tube is a super-control, radio-frequency pentode. The term "super-control" is used to indicate that the tube is similar to the variable-mu (*Continued on page* 56)





A. C.—D. C. Line Operated

TEST OSCILLATOR

For the Serviceman

[*By* Kendall Clough]

THE writer was recently called upon by the service department of a large receiver manufacturer to design an oscillator for service work on receivers of recent production. The result of the work has produced a unit which it is felt should be of great interest to service men generally.

At the outset, it appeared that an oscillator of the ordinary garden variety would not suffice for the testing of modern receivers due to the complexity of modern circuit design. Automatic volume control, inter-station noise suppression, special intermediate frequencies requiring accurate pre-setting for proper performance of the receiver, etc., have all called for better equipment for the service man and the suppliers have been slow in answering the demand. Point to point testing and similar methods have all been an aid in handling the more complicated types of receivers but every service man has had to handle circuits in which the actual equipment used for the measurements upset the circuit to such an extent that results are not always final and conclusive.

No matter what method of testing is used to locate the precise source of trouble in a receiver, there are two vital characteristics of every receiver, which, if they could be determined by the man doing the work, would give perfect assurance that the original trouble had been located, the proper repairs made, and the receiver in shape for delivery to the customer with assurance of satisfaction. These two characteristics are sensitivity and selectivity, the ability to receive distant or weak signals, and the ability to discriminate between a desired signal and an interfering signal.

Service Oscillator Requirements

After conferring with several men actively engaged in the service end of the industry, and after experimenting with several ideas in the laboratory, the conclusion was reached that the following characteristics were desirable in a service test oscillator and could be embodied in a well built design that would be in keeping with the appropriations for equipment of the average shop. These characteristics will be outlined and discussed.

The service oscillator should be capable of operation from any 110 volt commercial line, whether direct current or alternating current, of any commercial frequency. Power operated oscillators have not been very favorably regarded by service men in the past, for two reasons—because the designs offered were usually for operation on only one kind of current and because most of such designs fed a signal back into the power circuit from which point it entered the receiver under test via the power cord to the set.

Considerable effort has been devoted to this problem of feed back in the line with the result that in the present design it has been completely solved and line operation of the device is not unattractive as in the past.

With this difficulty out of the way the desirability of eliminating batteries from the service oscillator is apparent. Renewal of batteries is costly and in addition, the calibration of a battery operated oscillator is not apt to remain particularly accurate.

The manner of providing current in this new oscillator will be best understood from the circuit diagram, Figure 1. The filaments of the three tubes are operated in series with a 300 ohm resistance directly from the power line. All three tubes are of the 6.3 volt, 0.3 ampere type, making a power of 27 watts to be dissipated in the line resistor. It was found impossible to dissipate that amount of power as heat within the case of the oscillator without affecting the frequency stability so a cord of the resistance type is employed with the result that all heat from this source is dissipated outside the case proper. The resistance wire in the cord is served with asbestos insulation and the surface is sufficiently great so that the heat is well radiated.

The first tube of the series is a type 37 with the plate and grid tied together to form a two element rectifier when the operation is from an a.c. line. When operation is from a d.c. line. the current is passed continuous y from the cathode to the plate of this diode, similar to the function of the popular a.c.-d.c. receivers. It has been found possible to choose the value of the smoothing choke, L1, so that the resulting voltage applied to the oscillator tube is substantially the same whether operation is a.c. or d.c.

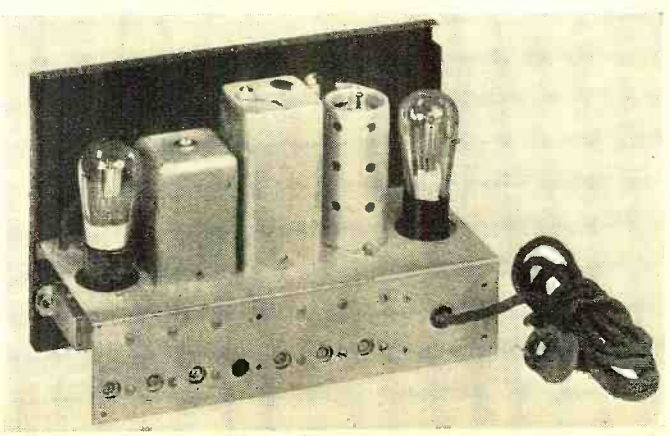
The choke, L1, is an iron cored filter choke of sufficient inductance so that, with the 10 mfd. condenser, C10, all the ripple either a.c. or d.c. operation is smoothed and a perfectly hum free current is supplied to the oscillator and 1000 cycle modulator tube.

The r.f. filter is comprised of the condensers, C4 and C5 (.25 and 1. mfd. respectively) and here it was found that the size was not as important as the method of grounding their midpoint to the frame and circuit of the instrument. This was determined experimentally and so successfully that it is possible to operate the oscillator from the same socket with the most sensitive receivers available without being able to detect the oscillator signal in the receiver.

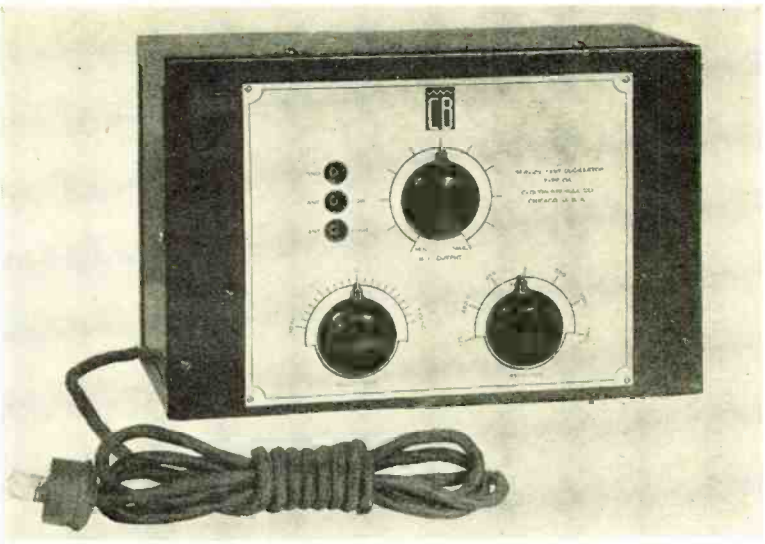
The complexity of the modern receiver demands that the satisfactory service instrument be accurately calibrated in manufacture and that it be stable in operation. After investigation of several circuits available, it was concluded that the electron coupled type of circuit was definitely superior for its marked stability. Of the several variations of that circuit available, the cathode tap type was chosen for stability and for circuit conveniences. (This is a further point in favor of line operation, for a cathode type screen grid tube is not available with sufficiently small power consumption to be practical with battery operation.) A type 36 tube was chosen for this function. It will be seen in the circuit drawing that the screen of this tube is brought to ground potential (r.f.) by the condenser C3. It is supplied with operating voltage through the resistor R4, which reduces the potential to proper operating value, as well as isolating the modulator and power circuits from r.f.

AN INSIDE VIEW

The layout is severely simple. Coil groups are separately shielded and the line supply is filtered to prevent undesirable coupling to a receiver under test



currents. The cathode and the grid form, with the inductance and capacity arrangement shown, the oscillating portion of the circuit. Due to the well known shielding property of the screen in this type of tube and the fact that the screen is grounded in operation, it is apparent that the plate of the tube is electrically isolated from the rest of the circuit and derives its power only from bombardment by electrons from the field of the oscillating element. Thus, theoretically, at least, the plate voltage as well as the nature of the plate load will have no effect on the frequency of oscillation of the other elements. This was found to be the case in practice. For example, it was found that variation of the plate voltage from 0 to 200 volts affected the frequency of the carrier only 40 cycles at 1500 kilocycles.



THE NEW TEST OSCILLATOR

This new service unit measures approximately 10 inches long, 7 inches high and 5 inches deep, and weighs only 6½ pounds

The above test made it immediately apparent that the plate was the proper place to supply the 1000 cycle modulation current, if frequency modulation was to be avoided. If the broadcast signal is to be truly imitated by the test oscillator, it is important that the modulation effect be purely a waxing and waning of the amplitude of the carrier rather than a shifting back and forth of the carrier frequency, the latter being known as frequency modulation. When modulation of the latter type is present in a signal generator or test oscillator, it gives rise to spurious and confusing responses and is to be avoided for that reason. It is apparent that if the plate of the oscillator in this design can be shifted from 0 to 200 volts by means of a test battery without shifting the carrier frequency appreciably, the shifting in plate voltage can be done over a narrower range 1000 times per second without giving frequency modulation of the output.

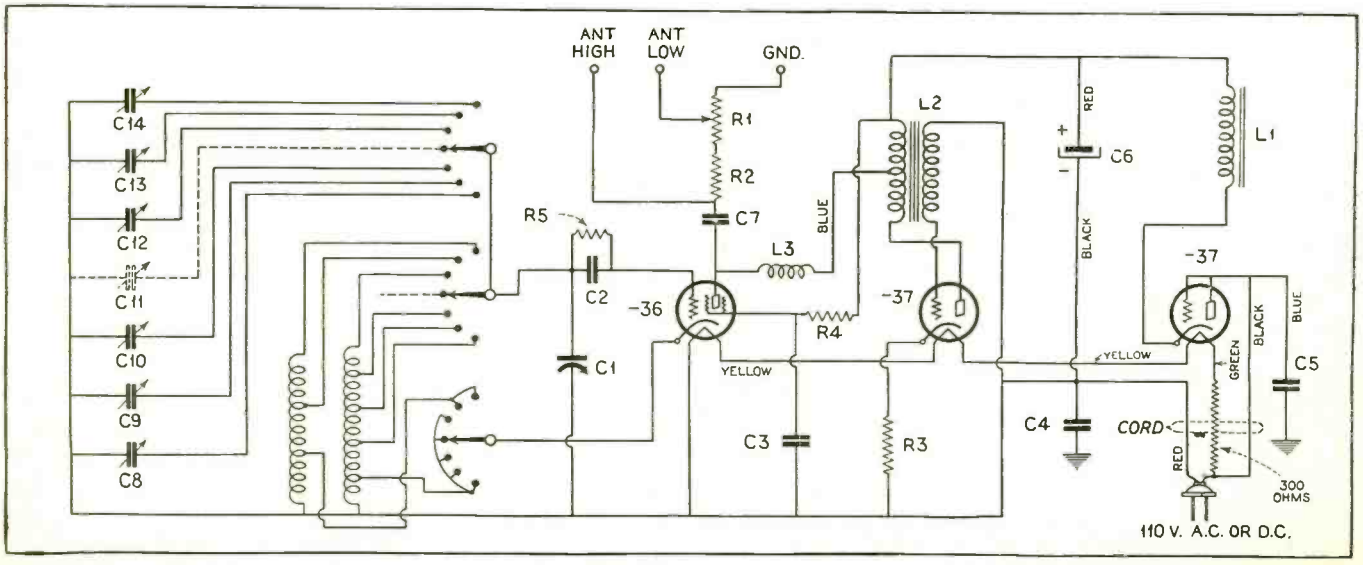
Separate 1000-Cycle Modulator

The 1000 cycle modulator current used for this purpose is produced by a type 37 tube and the small iron cored transformer, L2. The secondary of the latter is tapped to supply the plate of the e.c. oscillator with the correct 1000 cycle voltage to give an amplitude modulation of about 30% to 40%. R.F. currents are prevented from passing into the modulation transformer and other parts of the circuit by the choke, L3.

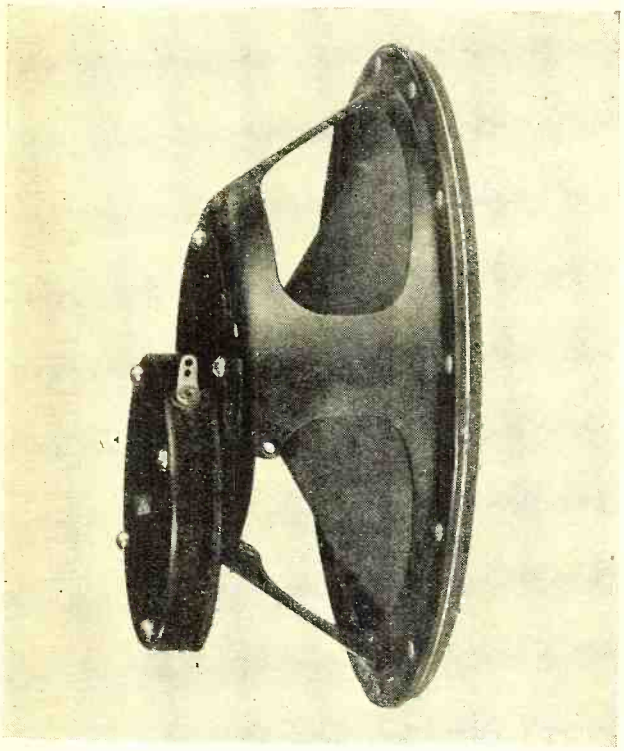
Modern superheterodyne receivers are being designed for operation on very precisely determined r.f. frequencies. In addition, dials carefully calibrated by the manufacturer, together with specially cut oscillator plates, demand that the service man have available dependable and accurately ascertainable frequencies, if the receiver is to be restored to its original factory adjustment. For this reason it was decided to provide a number of frequencies to be selected by means of a switch at will, rather than a continuously adjustable condenser. A little consideration will show that a variable condenser of the 0-100 type can be set by eye with an accuracy of one part in 200. This assumes that the radius of the dial is sufficient so the operator can estimate to one-half of one division. Now, the broadcast band, for example, is nearly 1000 kilocycles wide, which makes it apparent that if the condenser is a perfect straight line frequency type, the signal cannot ordinarily be set to an accuracy of better than 5 kilocycles. Testing frequencies, i.f. frequencies in particular, are being specified to an accuracy greater than this which makes it desirable to have specific frequencies available. In addition, the use of the selector type makes it possible to provide a selectivity test for the i.f. amplifier or for the complete receiver. This is very important in the examination of the receiver for double humps in the tuning curve, as well as to assure that all the tuned circuits in the receiver are in good condition.

The selectivity test is provided in this design by the condenser, C1, the knob and pointer of which swing on the front panel over a calibrated dial graduated in kilocycles from +10 kilocycles to —10 kilocycles. The values of inductance and capacity for the various settings of the tap switch are so proportioned that the variation is constant and as stated on the panel. For example, with the switch in the 1500 kilocycle position, the frequency is variable from 1490 kc. to 1510 kc. in steps of 1 kc. In the same way with the selector switch set at 175 kc. the same control varies the frequency from 165 to 185 kc. This feature permits a very (*Continued on page* 55)

FIGURE 1. THE CIRCUIT DIAGRAM



HOW SCIENTISTS ARE FINDING NEW ELECTRICITY



A CRYSTAL LOUDSPEAKER UNIT

Figure 5. The crystal unit is mounted off center in a metal case to bring the cone of the speaker into direct contact with one corner of the crystal while the other three corners are held tightly

Will the telephone and the loudspeaker, pickup, and a great number of other electro-magnetic means are employed of static devices, such for instance as electric

"crystal" electricity, known long before electro-dynamics were thought of, has found new and useful applications with the aid of the electronic amplifier.

By Irving J.

WHAT will microphones and loudspeakers and a great number of other apparatus and instruments look like in the future? How will they work? What new possibilities will be opened by them?

Until about 1931 we have been living under the influence of the period following physical discoveries of the genial English physicist, James Clerk Maxwell. This period was filled with the industrial and technical application of the fundamental laws of electro-dynamics which Maxwell first had brought into a clear mathematical form. There are definite reasons to believe that the new era we are now entering has every indication that *ELECTRO-STATIC ENGINEERING* is coming forward more and more.

Electro-static phenomena, neglected heretofore (although known long before current electricity) are today again of primary interest. Their inherent excellent physical characteristics have been opened now for industrialization by the highly-developed radio and electronic industries. Electro-acoustics, electronic optics, highest voltages—all attained an extensive fertilization from electro-statics.

One of these phenomena — piezo electricity — of static devices, such for instance as electric "crystal" electricity, known long before electro-dynamics were thought of, has found new and useful applications with the aid of the electronic amplifier.

Piezo-Electric Crystals

Certain substances have inherent electrical properties, i.e., the body of a crystal, for instance, when subjected to physical influences achieves an electrical charge. Such influences can be heat, pressure, torque, etc.

The reverse of this phenomenon is also possible. Therefore a crystal under the influence of electrical charges can change its size, temperature, etc., and if those charges are quickly alternating, an almost proportionate displacement of the crystal body will follow, bringing about mechanical movements analogous to the change of the electrical charges.

While the first data about piezo electricity go back as far as 1780, when Coulomb made his first measurements, these data were not taken up again until 1833, when Becquerel, the famous French physicist and chemist reported, for the first time, exact measurements of the piezo-electric effect in a number of substances.

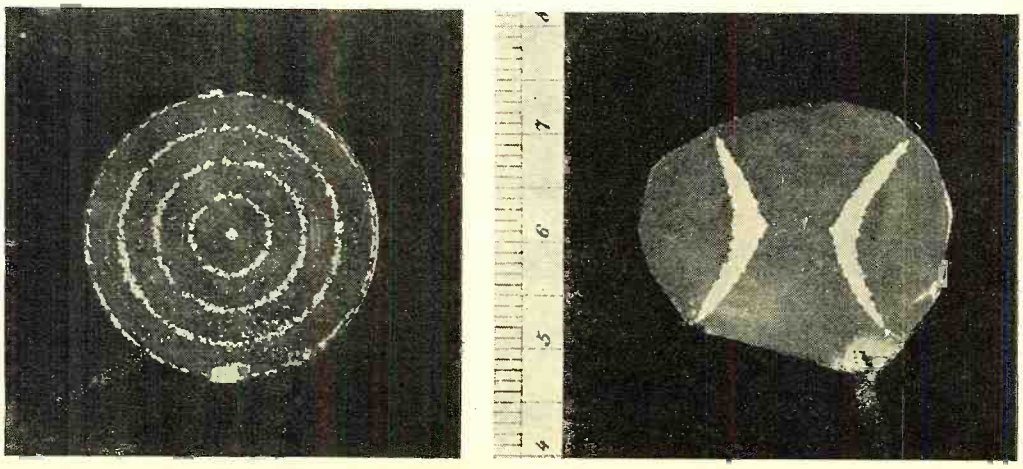
With regard to the *pyro*-electric properties, their discovery goes back several centuries. It is reported that travelers observed that crystals of tourmaline were attracted by hot ashes, and vice versa, a charge being built up upon this crystal similar to the one developed upon amber if it is rubbed. (It is possible to use a pyro crystal as a means for temperature control!)

The first use of the piezo-electric properties of quartz was made in 1880. Pierre Curie used the piezo quartz for compensating electrical charges against the ionization currents of his radio-active preparations, which brought about a new determination of the piezo-electrical constants.

These forces of piezo and pyro electricity (the latter one appearing if the crystal is heated) produce electrical charges which remain in such a constant proportion to the original stimulation that fine calibration, for precision measurements,

OSCILLATING FIGURES ON TOURMALINE CRYSTALS

Figure 2, left. The pattern form on a Tourmaline crystal oscillating at 132 kilocycles. Figure 3, right. Another crystal oscillating at 139 kilocycles. The patterns are formed by vibration of the Lycopodium powder which is sprinkled on the surface



APPLICATIONS OF THE RELATION BETWEEN AND CRYSTALS

the microphone and the phonograph devices for which electro-dynamic and at the present, be replaced by the use those used in the application of piezo- phenomena

Saxl, Ph.D.

is possible with them. Small as they are, they can be reproduced with an almost unbelievable exactness.

For this purpose the quartz crystal is cut into plates so that their longer axis is parallel with the optical axis and their smaller one parallel to an electrical axis. The bordering planes are silvered.

If the crystal is hung up, and the scale of a balance is attached to its other end, small electrical charges are developed upon the opposing planes, if weights are placed upon the scale. These changes are proportionate to the pulling power.*

Exactly as a dynamo can be used as a generator, so the same reversal is possible with the piezo-electric phenomena. As theoretically predicted in 1881 by Lippman, quartz, (and with this any other piezo-electric substances) can generate electricity under the strain of mechanical forces. Also, by putting electrical charges upon them, mechanical forces can be produced.

Due to their crystallographic construction, piezo-electric crystals have specific frequencies at which they oscillate in accordance with their dimensions. Therefore piezo-electric oscillators are today known the world over as a standard frequency control for high precision measurements and radio transmitters.

Physically speaking, such oscillators consist of the crystal silvered on the ends which have a maximum electrical charge, used as controlling elements in oscillating circuits of the type shown in Figure 1. The contact plates P-1 and P-2 press elastically upon the constricting ends of the crystal C, which is placed in the grid circuit of the oscillator. In the oscillating circuit shown in Figure 1, the oscillating *frequency is primarily dependent upon the physical dimension of the quartz plate.* The electrical constants of the rest of the circuit as for instance in the condenser C and the coupling coil L, are not quite as important once the system has started to oscillate. As the quartz plate can be ground with a high degree of accuracy, precision oscillators based upon this principle can be easily constructed.†

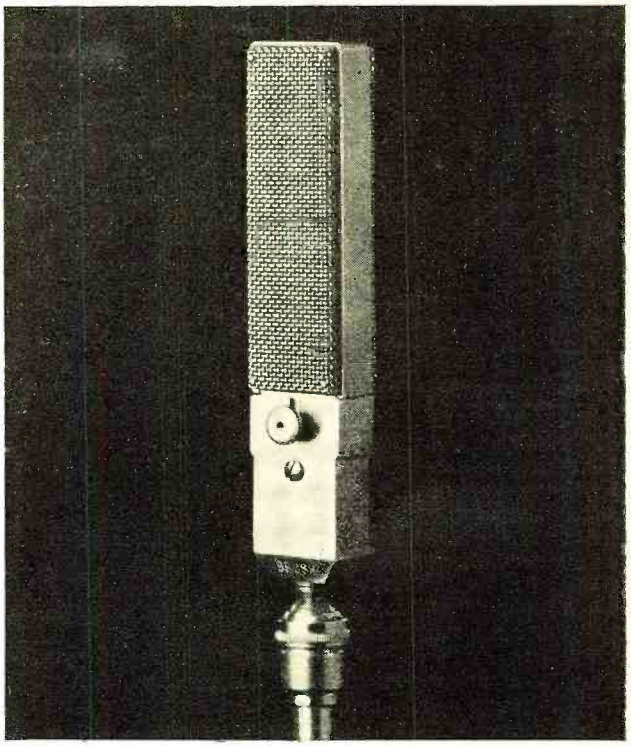
For placing this circuit in operation, it has to be tuned by turning condenser C until the meter A shows a maximum deflection (or a Neon tubes gives maximum light) indicating that the system is oscillating. After this a slight change in the condenser position does not markedly influence the frequency.

It is possible to use not only the fundamental frequencies but also harmonics. For keeping the frequency constant the crystal has to be placed under thermostatic control in a constant-temperature bath.

However, there are limits given to the construction of such master oscillators which are mostly due to the fact that the physical dimension of the quartz plate must not be brought below a certain minimum. If ground too thin, the crystal may break, particularly if power oscillators are used.

For quartz, the frequency range extends over a range of from 100 to about 6000 kilocycles, the lower frequency being determined by the maximum available sizes of naturally-formed crystals, the maximum frequency (shortest wavelength) being limited by the thickness of the quartz. Below .4 millimeters the quartz crystal is impractical.

While the square and round quartz discs usually employed, heretofore, will control wavelengths between 100 and 1000 meters

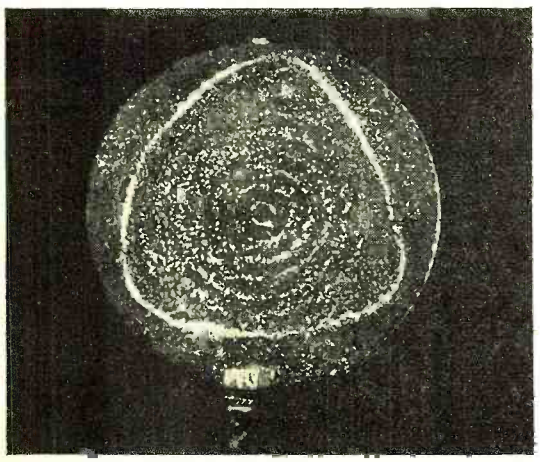


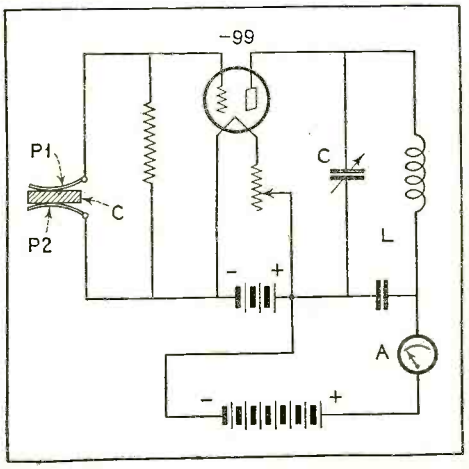
A PIEZO-ELECTRIC MICROPHONE

Figure 6. In this microphone the Rochelle salt crystal directly changes sound vibrations into variations of electric potential generated within the crystal which is protected by a wire mesh screen

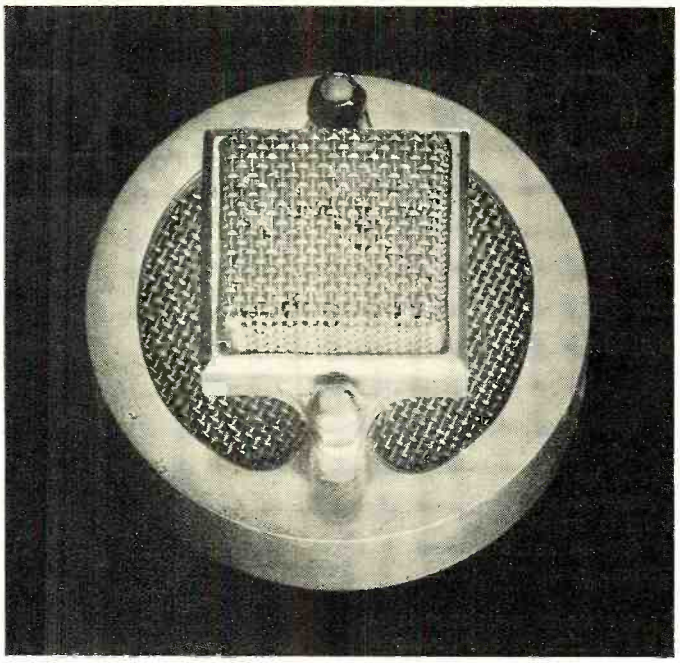
A FREQUENCY CONTROL CRYSTAL AND HOW IT IS USED

Figure 4. A photograph of a Tourmaline crystal oscillating at 159 kc. Figure 1, at right, shows the circuit for a crystal-controlled oscillator operating on a -99 tube





with a fair amount of accuracy, they are practical for shorter wavelengths only in connection with a system of successive multiplying and amplifying stages. The apparatus thus not only becomes expensive but in addition cumbersome, a special disadvantage in portable transmitters as they are necessary for the Army, the Navy, the police department, etc. It, has, therefore, been a considerable improvement to introduce for piezo-electric oscillators, particularly those of the short-wave and ultra-short-wave range, tournamaline crystals. They have been made available, now, in standard sizes by Carl Zeiss.



EXCHANGEABLE CRYSTAL "MIKE" HEAD

Figure 8. A crystal microphone mounted in the head of a standard condenser microphone for easy replacement

Tourmaline Crystals

Tourmaline is a mineral which crystallizes rhomboedrically in a hexagonal crystalline system. It was used formerly for making polarized light, and to test the polarizing properties of certain materials (tourmaline pliers) in scientific work.

Now the laws of optics are connected with Radio in electronic optics. In controlling the shorter waves tourmaline crystals are superior to quartz oscillators. In addition they are quite insensitive to exterior influences, especially variation in voltage or current supply or changes in the inductance and capacity. Also, the temperature coefficient is smaller than that for quartz. They are more stable than quartz oscillators at the same temperature and for ultra-short wavelengths they control a greater power output than is feasible in connection with quartz oscillators of the same diameter. Accuracies of 1/10 of 1%, or even higher, can be obtained.

The diameter of such crystals differs as the wavelength. While for a 2 meter wavelength a diameter of 8 millimeters is used, for a wavelength of 8 meters, a diameter of 20 millimeters is used.

Tourmaline, in addition, has a very important advantage over quartz in that the transversal oscillations are uniformly distributed over the crystals in such a way as to enhance the longitudinal oscillations of the tourmaline crystals.

Harmonics and secondary oscillations have a considerably smaller influence upon the frequency of the tourmaline crystals than of the quartz.

How uniformly the crystal swings can be seen in Figure 2. The front side of such crystals have been covered with lycopodium power and figures appear similar to sound figures upon a disc oscillating in sound frequencies, this lycopodium powder settles down at these parts of the crystal, which remain practically unmoved, while those parts which undergo considerable displacement remain uncovered. The frequencies in this particular case are 132 kilocycles. The unique photographs of this and also the following tourmaline crystals were made by Dr. Harald Straubel.‡ The crystals are stable at their basic frequency.

It is difficult to reach secondary oscillation by this method, however. Figure 3 shows these at 139 kilocycles. The scale on the margin is centimeters, so that the actual size of the crystal can be readily recognized. There are also slightly different looking formations, as for instance, the one shown in Figure 4 for 158 kilocycles, which shows the great regularity of the oscillating planes.

While the use of tourmaline crystals has brought about an unusual possibility for controlling short waves in a simple and highly efficient way, the use of such crystals as generators of electricity is somewhat limited by their piezo electrical constant. This constant is

$$K = 5.7 \times 10^{-3} \frac{\text{el. st. un.}}{\text{Kg.}}$$

for tourmaline crystals and 10% higher for quartz crystals.

For quartz this amounts to only about .06 micro electro static units per dyne applied force.

Rochelle Salts Used

However, there is a crystal, sodium potassium tartrate, or as it is commercially known, Rochelle Salts, that has the highest piezo-electric effect of any substance known thus far and which amounts to 14.3 micro-electro-static units per dyne.

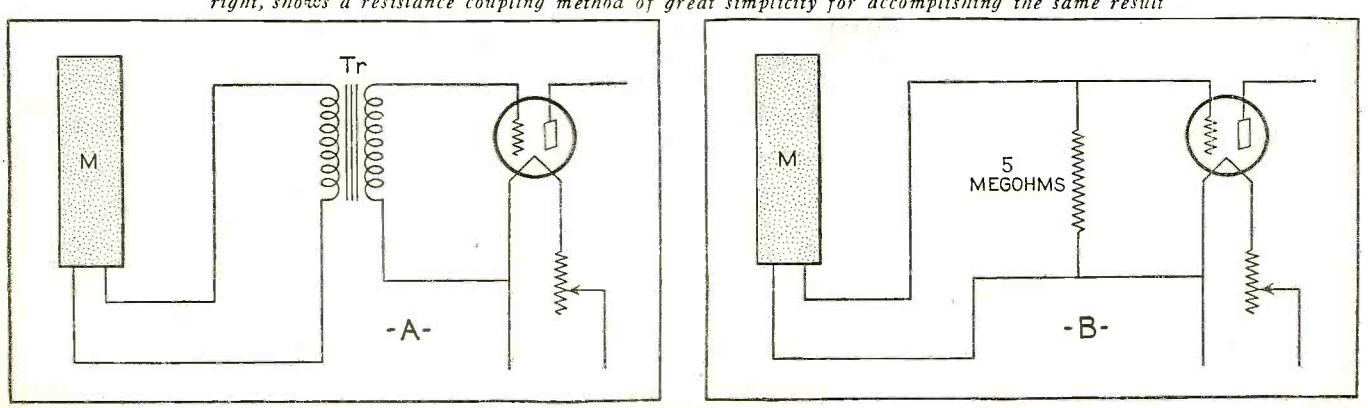
Dr. C. B. Sawyer and Mr. C. B. Scott, together with Mr. C. F. Brush, Jr., have succeeded in growing these Rochelle Salt crystals to considerable size; clear crystal without aqueous mother liquor. In addition, they were able to minimize the effect of saturation and of the influence of temperature.

The crystal is grown, first, to the approximate size of the plate desired and milled to the accurate size, a process much more precise than the old time wet-string process.§

A great mechanical displacement of the plates under the influence of the electrical charge applied thereto is reached by *cementing two crystals upon each other in opposite polarities.* Such bimorph elements therefore will operate by bending or twisting, and they wil, like bi-metals (*continued on page* 61)

CONNECTIONS BETWEEN THE MICROPHONE AND THE AMPLIFIER

At left, Figure 7A shows how a transformer of special design connects to the grid of the pre-amplifier tube. Figure 7B, right, shows a resistance coupling method of great simplicity for accomplishing the same result

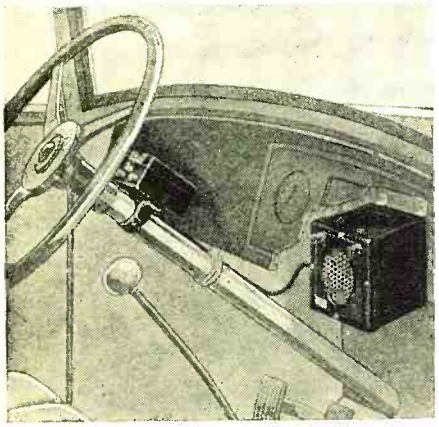


What's New IN AUTOMOBILE RADIO

With summer and the vacation touring season rapidly approaching, a multitude of car owners are contemplating radio installations. Brief descriptive data is given here on a number of the newest models, showing important new developments

Mechanical Remote Control Eliminated

Description—This manufacturer introduces the new Zenith model 460 seven tube superheterodyne automobile radio receiver which is equipped with direct tuning. This new departure in motor car design eliminates the necessity of remote control drive cables and means accurate station finding without backlash or other mechanical difficulties. Convenience of installation is indicated by the fact that there are but two units to install. The control unit includes the tuning condensers, and the chassis includes the amplifier, the power unit and the loudspeaker. In a great many types of cars it is possible to mount both units on the steering column. In cars with limited space the chassis unit can be mounted on the dashboard as illustrated. The receiver employs the following type tubes: one –85, two –89, two –6D6, one –6C6, and one –6Z4. The set is equipped with a six-inch dynamic type speak-



er, automatic volume control, sensivitity control, tone control and an interference eliminator system. The chassis can be removed from the container for servicing, by simply unscrewing three hexagon nuts. The battery leads are fused, protecting the system from short circuit. The dial is calibrated in kilocycles permitting easy locations of stations. This new auto radio receiver is also adaptable for installation in motor boats and airplanes.

Maker—The Zenith Radio Corp., 3620 Iron Street, Chicago, Ill.

Compact Design For Easy Installation

Description—The new General Electric Model B 40 motor car receiver is combined with the loudspeaker and the B eliminator in one compact metal case measuring only 8⅝ inches by 8⅝ inches by 7 inches. This metal case is mounted on a single stud which means boring only one ½-inch hole in the bulkhead of the car. The remote control unit clamps in any position on the steering post and by means of an accessory clamp it can be attached direct to the instrument panel board. It is therefore, apparent to the radio dealer, automobile serviceman or the motor car enthusiast that this receiver lends itself to easy and quick installation. When servicing is required, the set is easily removed from the mounting

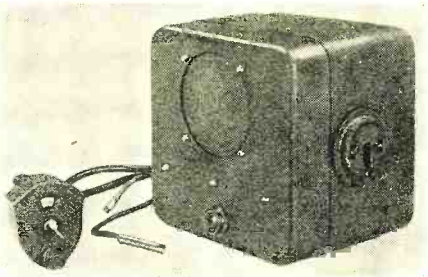
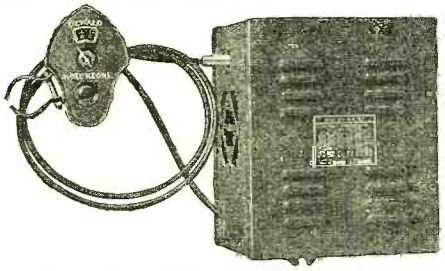


plate by loosening six accessible nuts. The receiver features a new vibrator type B battery eliminator, automatic volume control, two-point tone control and an electro-dynamic type speaker. The control box fitted with a lock switch, employs the key for operating the manual volume control. The set takes advantage of the new type automobile tubes which include: one –78, one –6A7, one –6B7 and one –89 output power tube. The problem of eliminating ignition interference has been overcome by employing double shielding of the power supply, complete shielding of the equipment and by the use of the tone control which makes it possible to reduce much of the noise met with in noisy locations.

Maker—General Electric Co., Bridgeport, Conn.

New Single-Unit Receiver

Description—The New DeWald Motortone six-tube superheterodyne motor-car receiver measures only 9½ inches high by 7½ inches wide by 6½ inches deep. The receiver has been designed for compactness and simplicity of installation. The single metal case houses the power supply, speaker and receiver chassis. There are only three holes to drill and two wires to connect. For

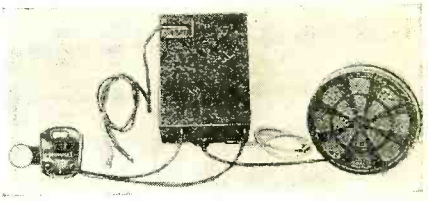


quick servicing, it is only necessary to loosen the wing nut on the separate detachable bracket on which the complete assembly is held in place against the dashboard. The receiver employs the following type tubes: one –6A7, one –78, one –85, one –37, one –41 and one –84 type tube. The attractive remote control is equipped with a lock switch and an illuminated tuning dial. This control head may be mounted on the right or left hand side of the steering post. This set is equipped with a console tone dynamic type speaker and automatic volume control.

Maker—Pierce-Airo, Inc., 520 Sixth Ave., New York City.

Eight Tube Superheterodyne

Description—The new Fada "Motoset" automobile superheterodyne receiver, model 101, is combined with the electric power supply in a single case and is easily and rigidly installed in any convenient position in the car by drilling three holes to accommodate the stud bolts which project from the exterior of the case. The speaker is also mounted by means of stud bolts. The remote control, designed for convenient installation, can be attached to either the right or left-hand side of the steering column or directly on the instrument panel. The mounting strap for fastening the control head is adjustable to fit various sizes of steering posts. The remote control uses a special worm drive operating a gear on the variable condensers in the receiver chassis which prevents backlash on the tuning con-



trol and holds the condensers tuned to the desired station. The following type 6.3 volt automobile tubes are utilized: three –39 type, one –37 type, one –85 type, two –89 type and one –98 full-wave mercury vapor rectifier tube. The total current consumed by the tubes, power supply and speaker is 6.25 amperes. Additional features of this set include automatic volume control, a non-glare illuminated tuning dial and a dynamic type loudspeaker with a nine inch cone. The shielded case housing the radio chassis and power supply measures 10⅛ inches long, by 7¾ inches deep by 7⅛ inches high. The speaker dimensions are 9½ inches overall diameter by 4½ inches deep.

Maker—Fada Radio and Electric Corp., Long Island City, N. Y.

Sturdy Constructed Receivers

Description—These illustrations cover the new Atwater Kent models 636 and 756, six-tube superheterodyne automobile receiver, equipped with the dynamotor type B supply which eliminates the necessity of B and C batteries. The receivers are practically the same with the exception of the control mountings. Model 636, a direct tuning receiver is designed for mounting on the instrument panel board. The B supply for this set is a separate unit and it can be

(*Continued on page* 57)

How to Make A Ribbon Microphone

By Earl R. Meissner

THE ribbon-microphone—or velocity microphone as it is now called—is enjoying increasing popularity because it demonstrates a number of decidedly advantageous features, aside from its excellent frequency characteristics. It has none of the hiss of the carbon microphone, for instance; is not at all critical in adjustment or as much subject to variations with humidity and temperature as are most condenser microphones; is substantially free from resonance peaks; is a low impedance device which permits its use at a considerable distance from its pre-amplifier; and it has marked directional characteristics enjoyed by no other type of microphone now in common use.

In addition to all these features, this type of microphone has one other which is of particular interest to amateur builders. *It is the most simple type of microphone to construct at home.* There is nothing critical about it. The one requirement is that the parts employed and their assembly be such as to provide a high magnetic flux across the gap in which the ribbon is suspended, and that the ribbon be of sufficiently light material to respond freely to sound vibrations impinging upon it.

The directions given in this article will enable anyone to construct a duplicate of the model shown here and obtain the same excellent results demonstrated by it in several months of use. (*When tested in the laboratory this unit showed up to excellent advantage. It demonstrated its freedom from resonance peaks and both the low and high frequencies held well up, giving it a frequency range so far greater than that offered by the average microphone employed by the amateur that there is no comparison.—The Editors.*)

First for a word of detailed explanation. When a conductor is moved across a magnetic field a voltage is induced in it. This is an old, old principle but a mighty interesting one to the radio experimenter, especially when the conductor is a light foil which can be actuated directly by sound waves. Such an arrangement constitutes a microphone which possesses many exceptional and long sought for characteristics.

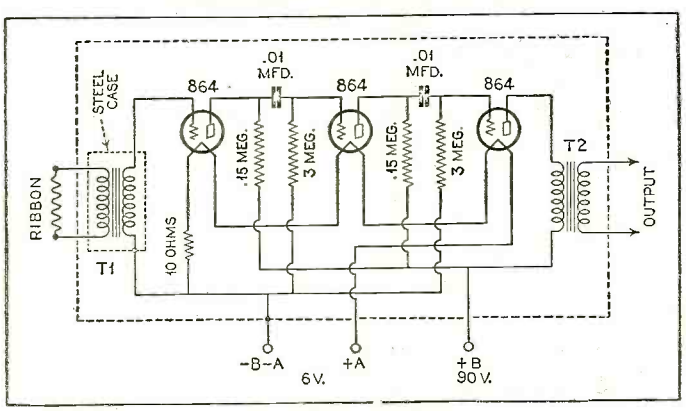
It is found to possess marked directional properties. Sound waves traveling in the plane of the ribbon have no effect on it while waves traveling in the direction perpendicular to the ribbon produce a maximum effect. This is very desirable, as reflected sounds are picked up from certain directions only. Thus the apparent period of reverberation of a room is reduced, allowing the microphone to be used successfully in places where the ordinary "mike" would sound "boomy".

Next the velocity microphone is found to have a very wide frequency range. It will cover from 30 to 14,000 cycles. It has been shown that the induced voltage is proportional to the velocity of the sound wave which is a constant. Thus it is independent of frequency. Why this is so can roughly be seen as follows. Consider a sound wave which has just reached the front of the ribbon. It will be a fraction of a second later that this same wave is diffracted around the pole pieces (which constitute a small baffle board) and impinges on the back of the ribbon. Thus there exists a difference in phase between the force acting on the front of the ribbon and the force acting on the back of the ribbon. If these two forces are exactly in phase there is no resulting force on the ribbon while if they are 180 degrees out of phase a maximum force is exerted.

This difference in phase varies for each frequency because they all have different wave lengths. Thus for low notes which have wave lengths of several feet the difference in phase is very small while for high frequencies where a wave length may be an inch or so, the difference in phase becomes large. In other words the higher the frequency the greater the difference in phase and hence the greater force tending to move the ribbon. It might now seem that the high frequencies would be overemphasized but because of the mass of the ribbon more and more force is required to move it

THE AUTHOR'S PRE-AMPLIFIER

Figure 2. The transformer T1 must have extremely low primary impedance. There are several makes now available for this purpose, but one can be made by revamping a standard transformer, as described in the text



at the higher frequencies. These two effects tend to compensate each other giving the microphone a very good over-all characteristic.

Another desirable feature of the "Ribbon" is that its output impedance is extremely low. This makes it easy to insulate and keep free from noise as compared to the condenser microphone. It also makes it possible to locate the "mike" several feet away from the amplifier.

However the thing which recommends it most to the experimenter is its simplicity to build. All that is needed is a ribbon suspended in a magnetic field. Figure one shows such a microphone which the author made in a few hours and he didn't have the use of machine tools either; no, just a good old fashioned hack saw, a couple of files, three taps, a few drills and plenty of elbow grease.

Constructing the Microphone

The first thing to do is to secure a couple of permanent magnets. They need not be the exact dimensions shown but it is necessary that they be alike and have a hole through each pole. The ones the author used were chrome steel magnets found on a Main Street bargain counter. They were originally made for a one time popular magnetic speaker.

The pole pieces are next designed so that the air gap will be 5/16 inch. This leaves 1/32 inch clearance on each side of the quarter-inch ribbon. They are made from cold rolled steel. Tap the ends as shown and tap the backs to suit the holes in the magnets.

The ribbon clamps are made from 3/16 inch by ¼ inch brass bar. While they may look intricate they are in reality easily filed out. In order to line up the holes accurately clamp the top and the bottom pieces together with a small "C" clamp. Then with a No. 50 drill bore the holes for the 2-56 screws. Remove the top part of the clamp and run a body drill (No. 42) through the hole just bored while a 2-56 tap is run through the bottom part of the clamp. In drilling the No. 19 holes for the mounting screws with the spaghetti bushings it is wise to use a small drill first and then run the proper size through afterwards.

It is only necessary to insulate one ribbon clamp from the pole pieces. This is done by means of two fiber washers and a short piece of spaghetti slipped over the mounting screw where it passes through the clamp. A soldering lug placed under the fiber washer so as to make contact with the clamp serves as one terminal while a lug placed under the screw head at the other end of the same clamp serves as the other terminal. This lug is of course in electrical contact with the pole piece which is in turn in contact with the ribbon clamp at the other end. Twisted pair (preferably shielded though not absolutely necessary) connect these output terminals to the amplifier. Construction can be somewhat simplified by using bakelite for the large recessed portions of the clamps. This eliminates the need for insulating washers and bushings. The smaller pieces of the clamp assembly should be brass, with soldering lugs slipped under the head of a clamping screw at each end of the ribbon.

A word of explanation should be given here concerning the magnetic principles involved. By making the air gap small the flux density is greatly increased and it is upon this flux density that the effectiveness of the microphone is completely dependent. The idea is to concentrate the flux as highly as possible in the space in which the ribbon is located and moves. To do this the pole pieces are employed, which decreases the width of the gap to 5/16 inch. In addition to this the pole pieces are tapered so that their faces are only ⅛ inch wide. Thus practically the entire magnetic field is limited to the small air gap between the ⅛ inch faces of the pole pieces and the maximum practical flux obtainable from the two magnets is therefore taken fullest advantage of.

In assembling the magnets be sure that they are placed with like poles together. After the magnets and pole pieces have been assembled the entire assembly should be remagnetized because if the magnetism of either magnet has been partly lost the effectiveness of the microphone will be very much lower than it would be with fully saturated magnets. Unless one has the necessary electro-magnets for this work, it will be advisable to take the assembly out to a magneto service station where it can be magnetized at a very nominal cost.

The ribbon is the very heart of the instrument. It is advisable to purchase a specially made duralumin ribbon properly corrugated for this purpose. The most common practice is to use ribbon material approximately .00035 inch thick. Thinner ribbons increase the sensitivity somewhat while thicker ribbons reduce sensitivity and seem to reduce the high-frequency response.

In stringing the microphone one end of the ribbon is

(*Continued on page 62*)

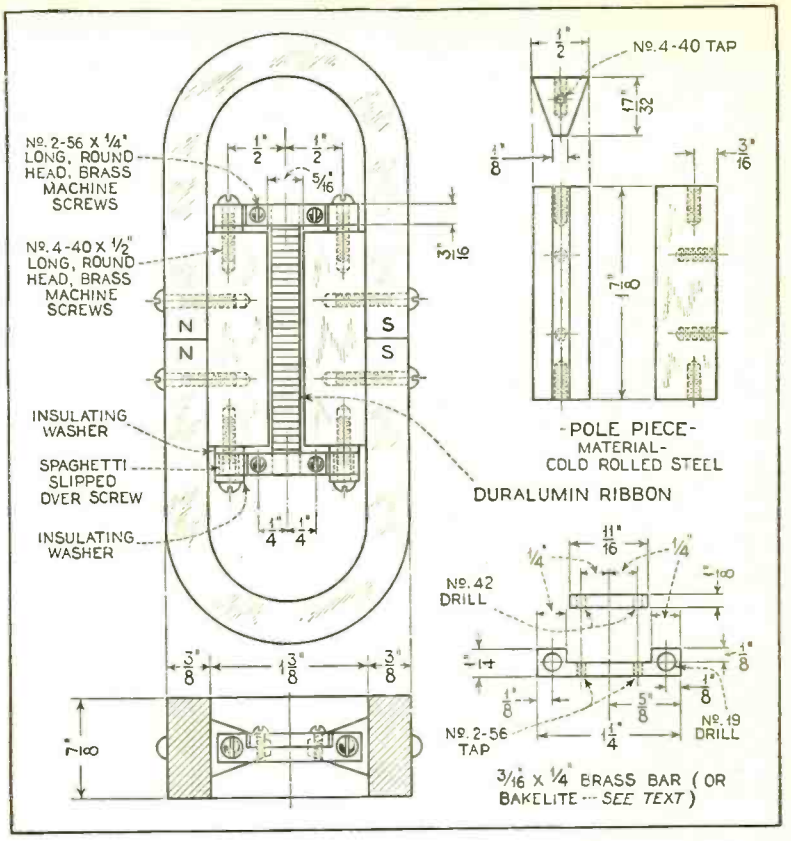
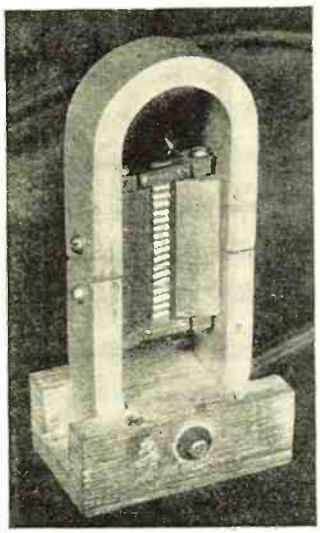
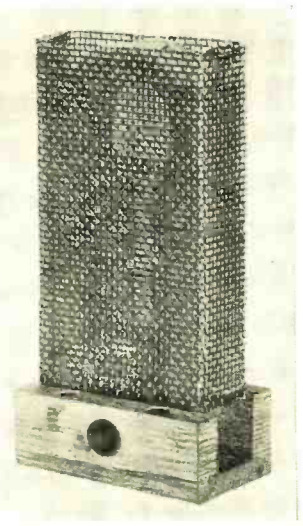


FIGURE 1. THE COMPLETE SPECIFICATIONS

THE COMPLETED MICROPHONE

(Left) The simplicity of the assembly is quite apparent. The simple base shown here is effective, but if desired may be made of brass or other non-magnetic material—or the unit may be suspended by means of cords. (Right) A screen inclosure lined with voile or light silk protects the ribbon from drafts and mechanical damage





Design Principles of

Long-Distance Receivers

FOR THE BROADCAST BAND

This article concludes the construction data on the DX receiver with which Mr. Long has logged close to 50 trans-Pacific stations on the 200-550 meter broadcast band

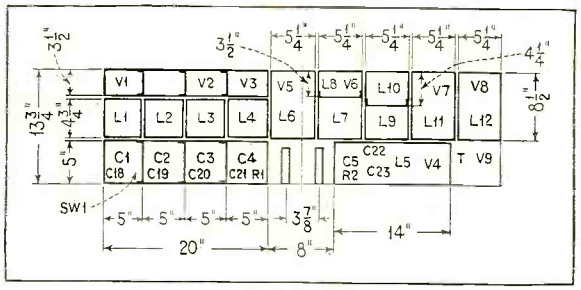
By C. H. Long

Part Five

OWING to the size of the receiver, it was considered best in order to avoid undue weight to construct the chassis frame of wood, though if the builder prefers he may of course use steel or other metal. The construction is very strong, and at the same time the weight is quite moderate. The construction details are given in Figure five. Select white pine or cypress, ¾ x 2¾ inches, is used for the frame, and 5/16 inch 3-ply wood is used for the top. The pieces are bolted and screwed together in a substantial manner, angle irons (which can be prepared by the local machine shop) being employed to brace the inside corners. A ¾ by 2¾ inch piece, to which the tuning condensers are bolted, is bolted down to the top. The whole may be shifted as a unit and bolted down to the chassis in perfect alignment, which is preferable to attaching the condensers individually to the chassis. Holes bored through the ply wood top in the proper place permit adjustment of the condensers from beneath, if necessary in future servicing. Previous to insertion, the partitions are suitably bored to pass the wiring.

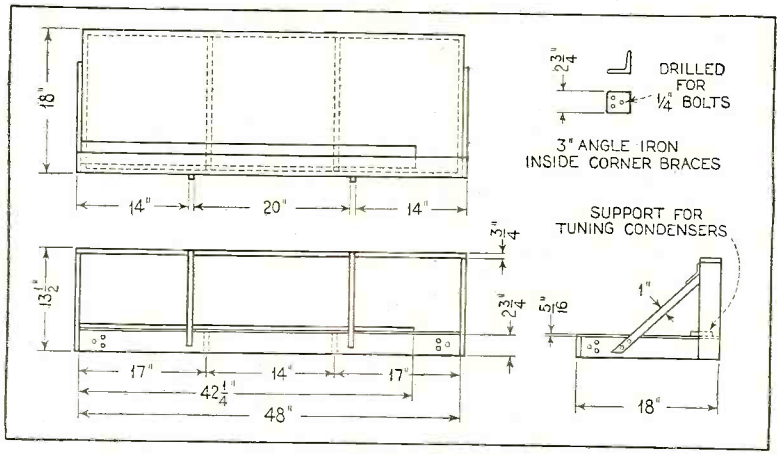
Construction of the Shields

All shields are made of heavy gauge pure copper sheet. Constructional details are given in Figure six. The layout of the shielding is shown in Figure seven. After construction the shield cans are polished with steel wool, cleaned with alcohol, and treated with very thin shellac (or equivalent) to prevent corrosion. A sheet of copper 8½ by 48 inches forms the bottom of all the cans except the oscillator and condenser cans. The bending and forming of the cans had best be left in the hands of a good local tinsmith, who has the necessary tools to do a first class job. Previous to bending, the strips are drilled, notched, and marked with a scriber where they are to be bent. The tops of the cans are fitted by friction; the cans themselves are bolted down by brass machine screws. The cans are held together by brass machine screws at the overlap (or may be soldered). The partitions shown in the shielding layout are soldered at the overlaps to their respective cans. The condensers C30 and C31 are provided with shields screwed onto the condenser frames.



CHASSIS LAYOUT

Figure 7 (above) shows the placement and major contents of each shield. Figure 5 (below) shows the constructional details of the base and frame



Mounting of Parts

The tuning condensers are attached to their support and aligned with a shaft running full length. The drum dials are attached to the center panel, and the condenser support loosened and shifted slightly to secure perfect alignment. The tuning condensers are provided with insulated couplings between each section and between C4 and the tuning dial. This makes for noiseless and the smoothest possible operation. Wooden strips ¾ inch thick are placed on either side of the tuning condenser support to serve as a base for the oscillator and condenser cans. The condensers controlling regeneration are mounted by bolting them to the underside of the board to which the upperside of the panels is attached. Both are so mounted that clock-wise rotation increases regeneration. Before the switches are mounted leads of sufficient length to reach the desired points should be soldered to them. All switches, etc., are so mounted that they are insulated from the shield cans. The photographs of the receiver may be referred to for the remaining details of mounting and placement of parts.

Wiring

In wiring the receiver special care should be observed that all joints are securely soldered. Shielded wire, with the shield grounded, should be used for plate leads and others through which feed-back or external pick-up may be possible. Such leads should also, of course, be kept short and the length of wire outside the cans a minimum. Leads entering the shield cans are brought in from the bottom, except that the grid side of the signal frequency coils is taken out through the cans in order to shorten the leads. Leads not shielded are provided with a short length of spaghetti tubing where they pass through the shielding, as an insurance against shorts. Filament and B plus leads are cabled together according to the usual practice. The base shield serves to carry the negative filament supply, but in no case, contrary to common practice, is the shielding made a part of a tuned or other circuit carrying radio-frequency current. For instance, it will be noted by reference to the circuit diagram that the by-pass condensers are connected directly to negative filament rather than to the shielding as is customary. After the wiring is completed, the shield cans are slipped into place, and the leads of the signal-frequency

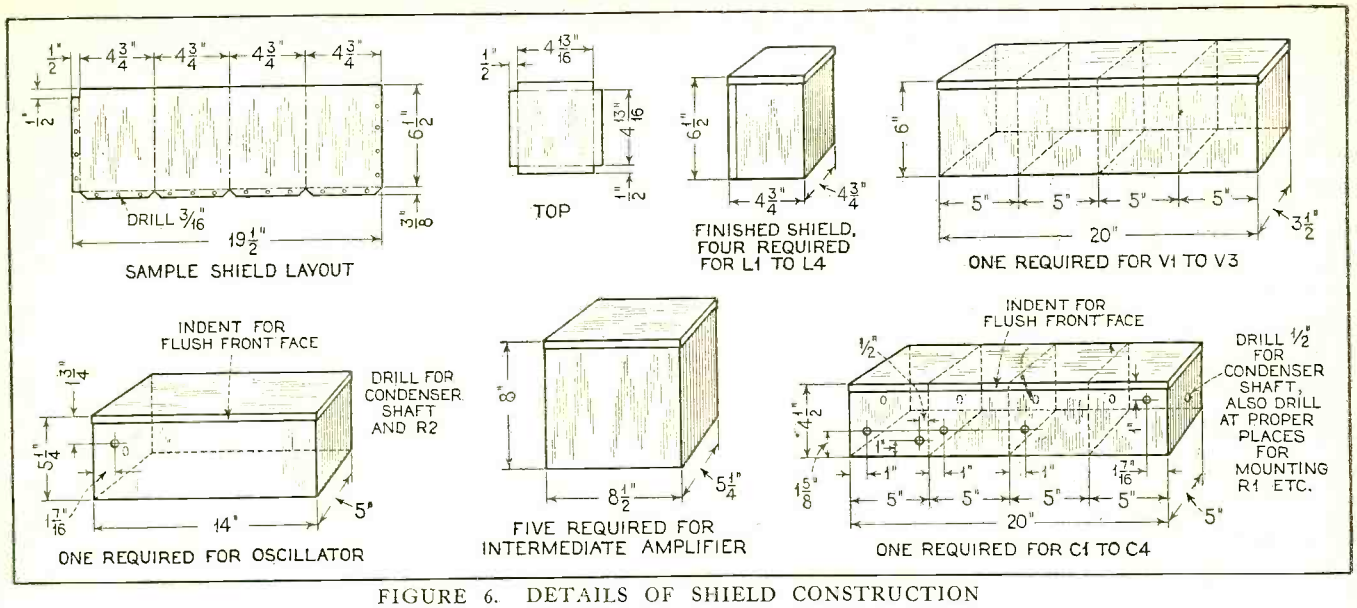


FIGURE 6. DETAILS OF SHIELD CONSTRUCTION

coils brought out through the holes in the cans and soldered to their respective positions.

Adjustment

A wise preliminary after completing the wiring is a thorough testing and rechecking to make sure that there are no shorts or wrong connections. With the output taken from V3 the signal-frequency section is best adjusted first. The amplifying stages should be neutralized one at a time in the customary way. The stages are now lined up by means of the compensating condensers and the coil inductance compensators (a small piece of sheet copper held by nuts on the threaded brass rod passing up through the center of the coil) so that they are in step over the entire scale. During this process the detector should be adjusted for a moderate amount of regeneration. Final neutralizing and compensating adjustments will probably be necessary.

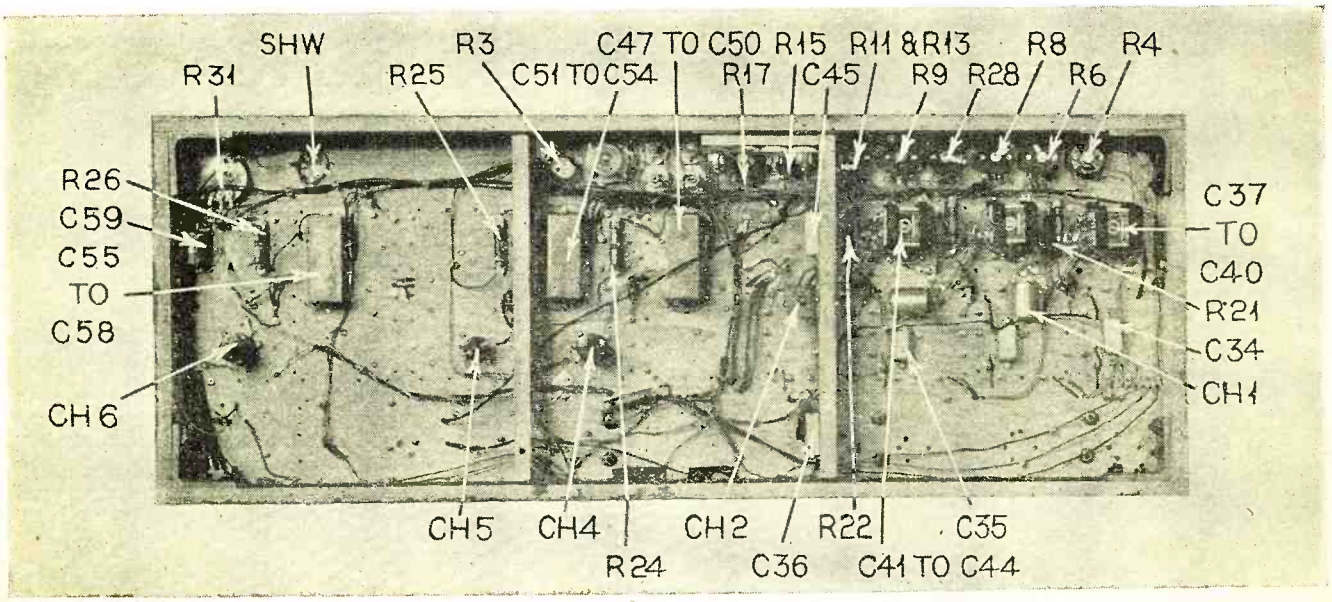
We are now ready to take the output from V8, after first tuning in a signal of moderate strength around 900 kilocycles on V3. With the intermediate condensers about 1/3 of the way in (C6 and C16 about ½ in) and all filter transformer coils well separated, the signal should be found on the oscillator dial reasonably close to the first dial's reading (re-adjustment of the intermediate condensers may be necessary before anything is heard). When the signal is picked up the intermediate amplifier may be tuned to resonance by ear or output meter.

The next step is the tuning of the intermediate amplifier to 175 kilocycles. This is conveniently accomplished as follows: A station is tuned in on, say, 650 kilocycles. Now without touching the oscillator dial, the detector dial is rotated until the signal of higher frequency picked up on the first part of the receiver is again being heterodyned through the intermediate amplifier. Suppose this occurs with a station operating on 1030 kilocycles. The difference between 650 and 1030 is 380, half of which, 190, is the intermediate frequency being employed. Since this frequency is too high, steps must be taken to lower it, until with repeated trials the correct value is reached. Or, without altering the oscillator dial, the intermediate amplifier may be tuned to resonance with a 1000 kilocycle signal tuned in on the signal frequency section. The use of low amplifying gain in both sections together with nearly critical regeneration in both first and second detectors will give exact points of reference and speed up work. The intermediate transformers may now be adjusted for the degree of band-pass desired. It may be found advisable to insert small resistances in the tuned grid and plate circuits of V5, V6, and V7 in order that their effective resistance may be made high enough to match that of the filter stages.

The oscillator should now be lined up so that it tunes with the signal frequency section by suc- (*Continued on page 56*)

UNDER THE CHASSIS

A few extra parts are shown here. These were installed for an extra r.f. stage which was later abandoned, and was not included in the circuit diagram. Also there are one or two parts which were replaced by other makes after this photo was made. The values and symbols remain as shown in the list of parts last month



What Our American

CLEAR CHANNEL SUPER-POWER

By The Broadcast Committee of the I.R.E.*

In line with RADIO NEWS' *policy of reviewing broadcasting, the two views are printed on these broadcasting are always matters of controversy, think of these conceptions. If after reading the their letters will be sent to the*

THE combination of clear channels and shared channels which forms the basis for the plan of broadcast allocation now in effect in the United States was adopted by the Federal Radio Commission in 1928. The clear channel assignment was evolved at that time as the result of overwhelming expert testimony, based not only on the lessons of some seven years of broadcasting in its present form, but also on the more mature experience of the other older branches of the radio industry. During the past four years, ample opportunity has been afforded for both the expert and the layman to obtain first-hand information on the relative advantages of the clear channel under a great variety of operating conditions. Yet current discussion of broadcast problems frequently discloses much inaccurate information and loose thinking on this important question. Under the circumstances, it is felt that a careful recapitulation of the engineering viewpoint on the place of the clear channel in the existing scheme would prove interesting and, perhaps, valuable.

It is characteristic of radio signals, in common with other types of wave motion, that once they are launched "on the air" they continue to travel away from their source while their intensity diminishes at a rate determined only by the conditions which they encounter in transit until they are too feeble to be detected or until they are lost in the prevailing noise level due to random electrical disturbances. There is no means known to the art whereby the projected waves can be abruptly brought to a stop at some remote point or whereby their intensity can be suddenly reduced to a negligible value at a predetermined distance. It is obvious, therefore, that from the radio transmission standpoint, purely artificial boundaries such as those of the zone or the state or the nation are of no significance.

Suitable Signal Ratios

This same fundamental consideration governs the operation of two or more broadcast stations on a single, assigned carrier frequency. The signals from any one station cannot be prevented from invading the areas local to the others. Successful shared channel broadcasting, therefore, hinges on the possibility of receiving a signal from the wanted station which is predominately stronger than those from all other stations holding the same frequency assignment. Experience indicates that if the reproduced program is to have entertainment (as distinguished from novelty) value, the intensity of the wanted signal at any particular receiving point must be from 20 to 100 times the combined intensity of the interfering signals established at the point by all other stations operating on the same channel. Even these large ratios do not always represent a high standard of performance. The background of interference must be extremely feeble if it is not to detract from the artistic excellence of the reproduction, and for high-grade urban coverage an effort is usually made to obtain considerably greater ratios.

*Institute of Radio Engineers.

The result of the restrictive effects of interference described above is to limit the acceptable service from a shared channel station to areas where the received signal intensities are high, hence to areas within a few miles of the transmitter. The limitations of shared channel operation are, therefore, apparent. It is clear that while such an arrangement will accommodate a considerable number of stations and will afford service to a relatively large number of detached areas closely surrounding such stations, there will in general be much larger intervening areas in which no station produces a predominately strong signal and in which, therefore, no service worthy of the name can be given. This analysis, then, indicates that the field of the shared channel is to serve important detached centers of population, such as our cities and larger towns.

In the United States, however, on account of its size and its important agricultural interests, a considerable part of the population is sparsely distributed in small towns and villages and on farms. It is essential that these people be given broadcast service as an ordinary matter of equity. In addition, they constitute a noteworthy fraction of the buying public, which is supporting American broadcasting as it is constituted today. The establishment of the present system of clear channels followed early appreciation of the fact that service to this group could not be provided on a shared channel basis but that national channels on which only one station operated at a time would have to be employed for the purpose. The experience of subsequent years has served only to emphasize the fundamental soundness of this conclusion.

On account of the absence of interference from other stations assigned to the same carrier frequency, the signals from a clear channel station (except where subject to excessive fading) will afford service until they have reached the point where they are too feeble to be heard above the prevailing electrical noise level with any degree of satisfaction. Fortunately, the electrical noise level in most rural districts is quite low, with the result that reasonably long distances can be covered with transmitting stations of moderate power. If higher power is employed, however, the range of the station and the area which it serves will be considerably extended. In addition, at the more remote receiving points the grade of service will be improved because the stronger signal is further above the prevailing electrical noise level and the reproduced program, therefore, suffers relatively less from an objectionable noise background. Since higher power on clear channels will thus extend and improve the broadcast service in outlying rural communities, since the avowed purpose of the clear channel is to serve such communities, and since clear channels by their very nature are reserved for the use of a single station so that interference with other stations assigned to the same carrier frequency is not a possibility, it is thought to be logical and consistent not only to permit but to require the use of adequate power by all stations holding clear channel assignments. This, briefly, is the basis for the practically unanimous engineering position regarding the use of high power on clear channels. Under existing conditions, there is no technical reason for not requiring all clear channel stations to employ transmitters of at least 50 k.w. Conversely, the denial to the rural listeners on many of the clear channels of the improved and extended service which could be made available to them by requiring the use of 50 k.w. transmitters on those channels is not based on technical reasons.

Failure, in the past, to use sufficiently high power to enable distant listeners to obtain the full advantage of the inherent characteristics of clear-channel operation has led to suggestions for the virtual abandonment of these channels. Where the distances and time differences involved are no greater than those in the United States the assignment of additional stations to the existing clear channels must inevitably result in a real limitation of the areas served and the assignments will thus lose their clear-channel nature. The engineering conception of the clear channel has always embodied high power as one of its essential accompaniments.

High Power Coverage

In addition to its value as a means of affording service to distant towns and extensive rural areas, the clear-channel station is also well adapted to cover a single relatively large center of population, such as one of our major cities. This is due to the fact that high power can be employed and that the station will, therefore, be surrounded by a relatively large area in which strong signals prevail, permitting excellent reproduction to be obtained. There are easily recognized economic and operating advantages to be gained by a broadcast station in associating itself with a large city which will enable it to extend a service of the highest order to the mutual advantage of everyone concerned. Under the circumstances, it is not surprising that practically everyone of the existing clear-channel stations is identified with one of our larger cities. This fact, however, should not be allowed to direct attention from the principal purpose of the clear channel, that is, service to scattered outlying units of population, for which it would not be economically possible to obtain broadcasting on any other basis.

To recapitulate:

1. The field of the shared channel is to afford broadcasting service to important detached centers of population, such as our cities and larger towns.
2. The field of the clear channel is to afford service to those vast intervening areas in which the density of population is so low that a broadcast service could not otherwise be supported and in addition to a single large center.

These principles, if kept firmly in mind, will afford insight into one phase of the

(*Continued on page* 59)

Broadcasting Needs

possible improvements in the theory of radio pages. As any proposed changes in American the Editors would be glad to hear what readers articles our readers feel like expressing themselves, organizations making the proposals

RADIO BROADCAST TRAFFIC CONTROL

By H. K. Randall*

IN these days when selling is hard, dealer and serviceman may well reflect that every visit paid to the radio salesroom, and every service call that comes in, proceed from just one cause: the desire of Mr. and Mrs. John Public to hear what is on the air, or to hear it better.

Just how anxious *are* Mr. and Mrs. Public, and the little Publics, to hear what is on the air? Many, for example, are sure they would like to hear more musical programs, less broken up by talking of any kind, and particularly by selling talk. Yet if there is one pronounced trend in recent broadcasting, it has been the *increase* of talking, and the preference of sponsors for talking programs instead of straight music!

The superior technique of modern comedy and dramatic broadcasts has liberated many listeners from their former horror of "talk" programs. But, as broadcasting men well know, the shift to more talk and less music has not been due to demand from listeners, so much as to the insistance of advertisers on programs that will pay them a return. Give Mrs. Public an hour of music, and she may tune it in, pick up a novel, and not hear a word of the announcements. But give her a fifteen-minute mystery-thriller, and if she likes it she will put down the book and listen to everything that's said. No wonder, then, that a radio set is fast becoming, not so much a "musical instrument," but a "talking machine." Speech reproduction is less exacting on equipment than music: Ed Wynn is nearly as funny on a $7.98 midget as on a $200 superheterodyne with a flat fidelity curve. The big difference comes when one tries to receive Stokowski's ethereal overtones. But we cannot safely assume that the broadcasting which sells the most toothpaste and cigarettes for the sponsor will necessarily roll up the best volume of business for the radio dealer.

"The Best" Can Still Be Improved

Put the station man on the defensive, and he will soon prove to you that "American broadcasting is the best in the world." But is that the end of the argument? The reputation American receiving sets have had for many years, of being the "best in the world," has not deterred American manufacturers from laboring to make them still better—so far as they have been able to do so in the face of the ever-shrinking *price* that Mr. Public is willing to pay for his new radio.

Years ago, when there were only three or four million sets in our country, broadcasters managed to give us plenty of programs, including many regular hours of pretty good music with only very brief sales talk—and it paid the advertisers well enough so that they kept coming back for more. Now, with four or five times larger circulations to sell, why cannot commercial broadcasting do at least as well for us, and earn something besides to pay good salaries to a few Wynns and Cantors? Or to put it another way: the revenue of commercial broadcasting is found sufficient to keep far more stations in operation than the listening public has any need of, especially around the big cities: licensees clamor incessantly for construction permits to build ever larger and costlier transmitters. Why cannot some of this overflow earning power be turned to producing more good programs, of the types which advertisers do not find profitable, on a moderate number of stations? Suppose our broadcasting *is* better than Europe's. Our people are more responsive to advertisements of all kinds; and besides, with one nation-wide language, they could be reached with far less waste in multiplicity of stations. The important question to the radio trade is, whether the listeners within range of any of our broadcasting centers are now getting the least-interrupted service in the best possible variety and arrangement (not the greatest number of stations) that can be financed from the earning power of the total means of access to their sets, represented in the channel facilities alloted for their service by the Federal Radio Commission.

Here indeed is where the "public interest" enters heavily into the picture—not to mention the nearly forgotten "public convenience," to which the Radio Act's wording nevertheless accords first place!

Broadcast traffic direction is in fact something almost non-existent as yet, except in towns where only one station is licensed, with few others near enough to be satisfactorily heard. In such cases it is clear that the licensee has been in effect appointed as a traffic director for the territory he covers. He is free to determine and schedule all the broadcasting which can legally be done there, for his own profit. The "rub" is that if his market is really rich enough to pay him much of a profit, he may soon have competition from other station licensees, and from then on there is no unified program traffic direction. For lack of it, the scheduling of programs on the various channels available for broadcasting in the larger cities is a chaos of duplication and conflicts at some hours, and lack of needed programs at other hours: listeners must search the entire dial for whatever kind of service they desire, with no assurance that they will find it at all. Even if they do, after a few minutes they must start the search all over again. There is but little system or cordination to beguile the tired listener by making it easy for him to find the kind of diversion he wants, when he wants it, and keep it with him. Surely there is a veritable travesty here on the "public convenience"!

This tremendous and unnecessary wastage of listener-good-will involves also the destruction of very real financial resources, whose saving would represent a vast source of ways and means for good broadcasting, scarcely tapped as yet. For lack of program traffic direction, we see such absurdities as the carrying on of broadcasting in a city at fifteen points of the dial, yet frequently offering so little variety among all fifteen that listeners wanting something else turn their sets off entirely, and *thus become for the moment a clear loss to the whole radio industry!*

If the homeward-bound crowds in a city were to find fifteen city busses all bound in the same direction, and none in other directions, it would be quickly realized that something was wrong with the traffic management. Even if the one favored bust route were in fact the "most popular" one, that would not justify discontinuing service on the others. And even though dance music may be the most popular type of radio program after 10 P.M., that does not justify the use of nearly all the available broadcast channels for programs of that type. The absurdity of this radio traffic mismanagement is really much worse than suggested by the city-bus comparison, for if there are fifteen thousand people homeward bound, and if it happens that fourteen thousand of them want to go in one "favorite" direction, then it is necessary to run most of the busses in that direction; each bus will only carry about so-many passengers. But if there are fifteen radio channels available in that city, and if fourteen thousand out of a total of fifteen thousand listeners all prefer one kind of program, then that kind need only be furnished on two or three of the channels, and the whole fourteen thousand listeners can happily tune them in. The other twelve or thirteen stations can then be used (at an increase in aggregate cost) for broadcasting a dozen kinds of less-popular service. Or, better yet, two or three of them can be so used, and the other nine or ten can be shut down: the money it would have cost to run them can then be used to improve the quality of entertainment on all the stations running, and to cut down the amount of advertising they will have to carry in order to pay a profit.

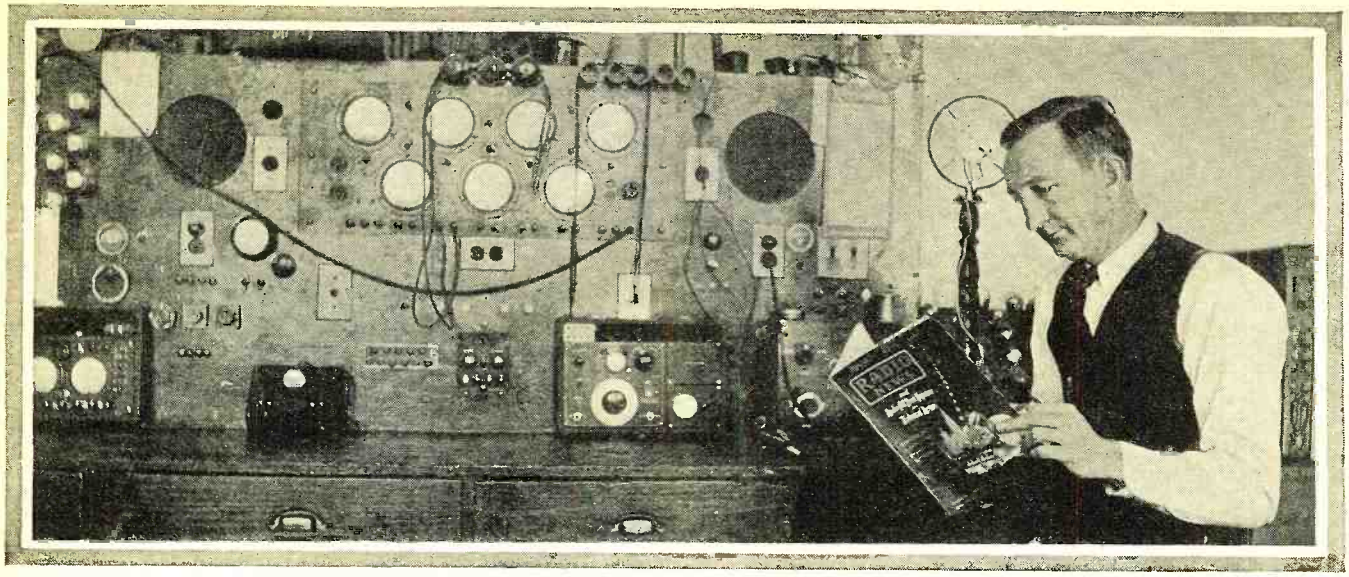
Betterments of this kind are now almost entirely prevented by the prevailing practice of leaving the control of traffic on each individual channel to the station-owner who happens to have transmission service for sale on that channel: that is, we do without any traffic management at all for the dial as a whole. The result is about as practical as if fifteen different bus companies all competed wildly for the heavy traffic on the city's populous routes, and all neglected the other routes: or as if each page of a newspaper were under a different (and competing) advertising management. But because radio is new, and because we in America have so little comprehension of any type of program traffic other than the planless disorder resulting from competition of individual station-owning licensees, it goes merrily on its helter-skelter way, almost unquestioned!

Station Operators as Traffic Managers

The privilege of directing program traffic is of course the main thing of commercial value involved in what we call a "broadcast station license." No advertising concern would be interested for a moment in a "license to operate a radio station," unless the license carried with it the right to determine program traffic on the channel—to accept for one period, at a price agreed upon, a program supplied by a network company, and to reject for the next period one offered

(*Continued on page* 59)

*Executive Director, American Radio Audience League.



The Service Bench

Duplicate and Mobile Test Equipment, Trade Marks; Service Notes—Filing System, Insured Meters, Concealing P. A. Speakers, Noise-Reducing Antennas, Radio Service Clubs, Sound-on-Film Projector, P. A. Systems Provide Summer Business

Conducted by
Zeh Bouck

THE proverbial one-armed paperhanger has nothing on the serviceman who attacks an unanticipated rush of business without duplicate test equipment. The average service bench boasts of a single test panel—the mountain to which Mohamet brings every receiver. If, during the period of test, a rush job comes in, the original set-up must be disconnected and the first receiver temporarily removed to make way for the new arrival. John M. Fowler, Radio Instructor with the Birmingham Public Schools, Birmingham, Alabama, has devised a bench whereby the old order is reversed, and, for the first time, the mountain comes to Mohamet! Detailed sketches appear in Figures 1 and 2. The idea, primarily, is that of a long service bench, with the test equipment mounted on a sliding shelf which can be pushed to any position along the length of the bench. While the arrangement admits of many modifications suiting individual requirements and existing service benches, the serviceman cannot do much better than follow Mr. Fowler's detailed plans.

The test panel itself, which is three feet long, is preferably of 5/16-inch aluminum. Bakelite may be used, but should be braced with wood along the lower, back surface to prevent warping. From left to right, the test panel carries a dynamic loudspeaker, set analyzer, ohmmeter and dynatron oscillator. Power supply for the speaker field, the condenser tester and the oscillator is mounted directly behind the latter. A flexible cord of convenient length plugs into any one of the three double outlets in the wall, just above the bench.

The equipment on the panel may be varied to suit the technique of the individual serviceman. For instance, a devotee of the point-to-point procedure, might substitute additional voltmeters and a capacity meter for the set analyzer.

Two working lamps, with flexible goosenecks, are mounted permanently on the shelf above the slide track. A mobile lamp, for the test equipment itself, is mounted on the moving panel. If the track is kept well soaped, no difficulty should be experienced in sliding the panel to the desired position in front of the receiver. However, a possible improvement occurs to *The Service Bench*. By drilling four or five small holes in the bottom edge of the sliding panel, to a depth of three-quarters the diameter of ball bearings, and inserting bearings, the panel will ride much more easily. The track should be kept well oiled, for steel against bakelite or aluminum develops a coefficient of friction which in time may wear down the ball sockets. As we suggest, the idea (which as Hamlet might say, is the thing) admits of modification, and the more ambitious serviceman will mount the lower edge of the panel on small rollers or wheels, or suspend from a track in barn-door fashion.

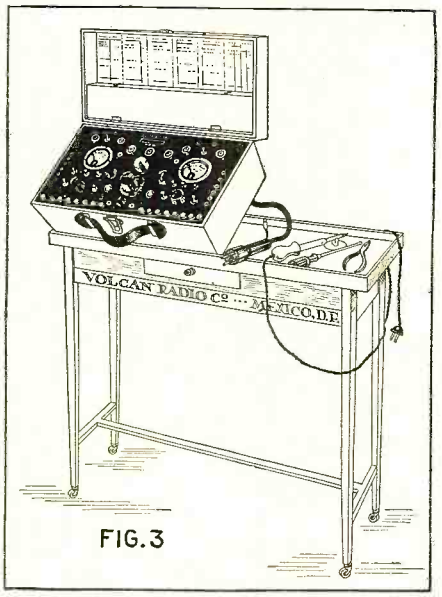


FIG. 3

Mobile Test Sets

In cases where present installations are such as to make the sliding test panel impracticable, the mobile test suggests a way out of the difficulty.

The Volcan Radio Company, of Mexico City, was recently faced with the pleasant problems of rapidly expanding business. Originally equipped with the conventional type of service benches, they found these inadequate to meet the demands of increased servicing. Repairing from forty to fifty sets a day (did someone say depression?) their principal problem was the moving about of diagnometers, oscillators, electric phonographs, etc., from one bench to another, or moving the incoming sets themselves to and from different test positions. The matter was sufficiently solved by means of a table on casters such as sketched in Figure 3. This table is 35 inches high, 35 inches long and 15 inches wide. Note the tray type top which prevents small screws and round tools from rolling off with the usual profane if not catastrophic results.

TRADE MARKS AND DECORATIONS

We considered last month the added attractiveness of stationery, business cards, circulars and literature embellished with small cuts pertaining to the business of radio servicing. Further samples are shown in Figure 4.

Drawing A is the inevitable microphone, and is particularly applicable to the letterhead or card of the serviceman specializing in public-address work. Figure B emphasizes the test end of the game, and should tie up well with the shop featuring free tube tests and inspection. Drawing C puts over

the general idea of *SERVICE*, and ties it up with radio with the familiar zig-zag. The same idea is back of sketch D, and is recommended where sales and service are combined. Figure 4E becomes a little more technical and brackets the word *RADIO* with antenna and ground symbols.

As we suggested last month, your local printer can have line-cuts made directly from the reproductions on these pages, in any size desired, and incorporate them in your stationery and literature.

If you have ideas of your own in this direction, sketch them out roughly and send them in. Or better yet, if they are already a part of your business printing, let us see them. We'll gladly pay for them, and—with your permission—reproduce them for the benefit of other servicemen.

SERVICE NOTES

Konrad F. du Moulin, radiotrician of Atascardera, California, and member of the Official Radio Service Men's Association, has devised a filing system that is both simple and adequate for all magazine articles which may be of future use to him in his work. He uses the ordinary business ledger, the first part of which is tabbed with the alphabet—generally two pages to a letter. The entry is made alphabetically with reference to a page in the latter part of the ledger where the article is described in more detail, giving the magazine, number and page, and occasionally a brief synopsis. For instance, the article on public-address systems, appearing on page 536 of RADIO NEWS for March, 1933, would be entered under "P" as "Public-Address System—24." The number 24 is the page reference in the main portion of the ledger, where the following entry would be made: "Public-Address System—How to Build a Rack and Panel—Radio News, March, 1933, page 536 (Constructional details)." This might also be cross-indexed under "A" as—"Amplifier—Public Address—24."

The Littlefuse Laboratories, Chicago, Ill., show their faith in human nature and the integrity of the service profession, by issuing a $100 indemnity protection guarantee with every Littlefuse, protecting the owner against overload destruction of any meter properly operated with the fuse.

G. H. Wright, president of Wright-DeCoster, suggests that the serviceman making permanent or semi-permanent out-of-door P.A. installations avail himself of the natural possibilities for an artistic job. He points out that speakers can be effectively screened by trees, shrubbery and cornices. As he notes, the ability to do this is another sales argument in favor of your installation which may bear weight with the town councillors and committeemen.

Noise Reduction Antennas

The Lynch Manufacturing Company is introducing a series of specialized parts designed to reduce certain types of radiated interference by cutting down the noise-to-signal ratio in the antenna circuit through the use of scientifically designed couplers and transposed lead-ins. While primarily engineered for short-wave work, this system should be effective in quite a number of broadcast installations, and the potentialities of the idea as a service-sales proposition are considerable. Needless to say, the possibilities should be investigated by all servicemen having short-wave clients.

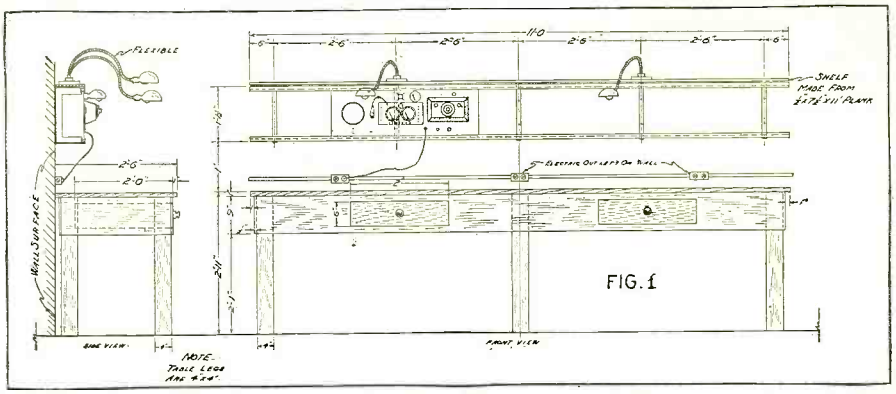


FIG. 1

FIG. 4

A Radio Service Club

Raymond Schaaf, of Petoskey, Michigan, revives the Service Club idea with a few new thoughts on the subject. He writes:

"As a subscriber to RADIO NEWS and as an active radio serviceman, I am writing to you for information, names, addresses, suggestions, etc., on the plan that I shall outline below. So far in my reading I have never run across an organization just like the one I have in mind; and my thought was that the Service Bench ought to have some good 'dope' on an idea of this sort.

"It is my intention to start a Radio Service Club, membership privileges being free radio service for one year, the only cost to the members being that of the parts used in repairing the set. The membership fee is $2 per year, and there are no dues. I hope to work several towns on this plan and thereby provide capital to equip a service shop devoted solely to the members of the club. This club, being a city-wide organization, would be a wonderful help in running down interference, etc. It is my hope to get the Tobe Deutschmann service franchise for the club. I also expect to be able to handle all P.A. systems, centralized radio installations, etc. Each radio serviceman will be required to be a member of the Institute of Radio Servicemen.

"Whether or not such an organization is in actual operation, I do not know. If you know of any such, I should be pleased to receive their names and addresses so that I may get from them their plans and forms, articles and by-laws. I do not care to start on such a venture too much in the dark."

The Institute of Radio Servicemen may have some definite information relevant to this idea. We also refer Mr. Schaaf to the suggestions contained in the contributions of The Radio Shop of Liberty, Ind., in *The Service Bench* for August and September. We further suggest that readers of this department having definite knowledge of such enterprises communicate directly with Mr. Schaaf, sending us copies of their letters. We'll print them—and pay for them!

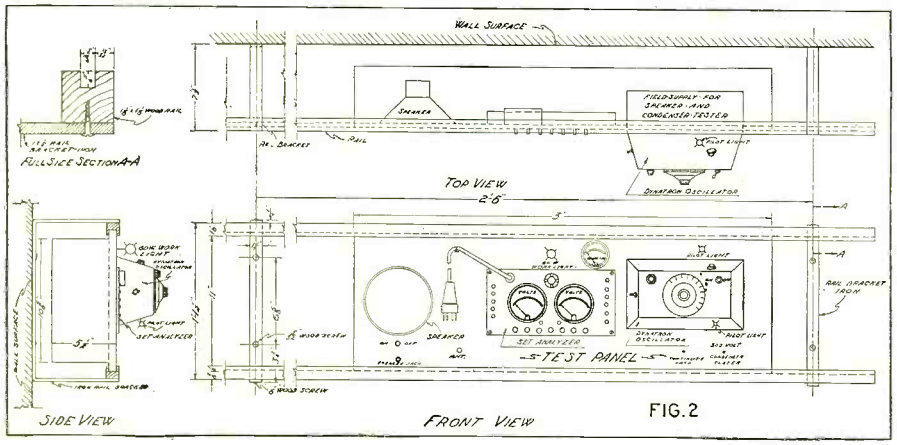


FIG. 2

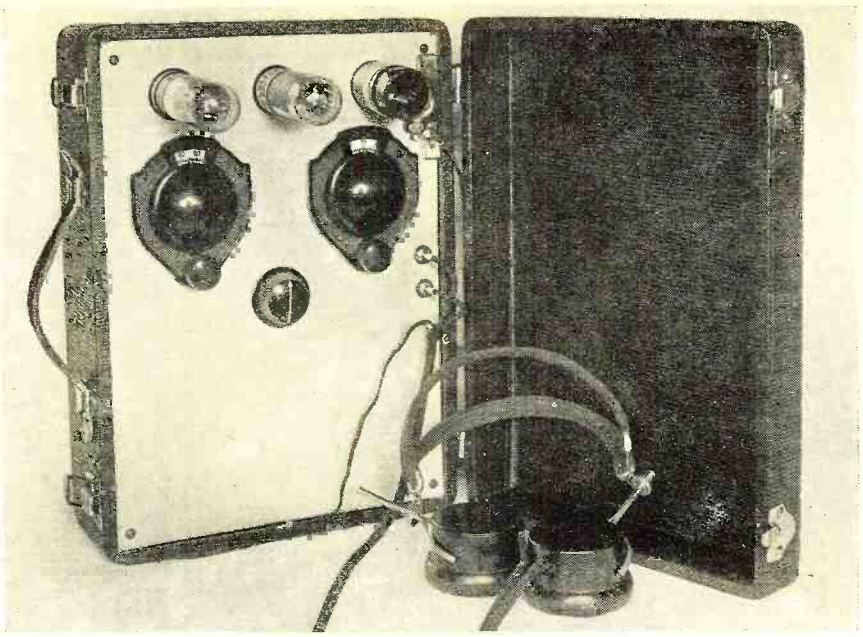
Sound on Film Projector

Herman A. DeVry, Inc., Chicago, have developed a portable sound-on-film projector which will recommend itself to the well-established serviceman appreciating the possibilities of sidelines. The apparatus projects


FIGURE 5

from professional 35 mm. film and comes complete with projector, amplifier, power supply and speaker. The combined weight is 74 pounds and an idea of the portability

(*Continued on page 63*)



A Handy Two Tube

Portable S-W Receiver

By **Bernard J. Montyn**

DURING the summer the short-wave fan may wish to carry a short-wave receiver with him on automobile or camping trips and a portable receiver will come in handy. Also, a light, portable set is useful when comparing locations for short-wave reception.

For simplicity, quietness in operation and portability, the two-volt series of tubes are the most logical to employ. A regenerative detector and single audio stage take up little room while requiring only small batteries. The entire outfit shown here can be put in a carrying case of approximately 12¼ inches by 8¾ inches by 6 inches, inside dimensions. With a little ingenuity, the reader will find room to place the plug-in coils, the tubes and the 'phones in the cover of the case.

The regenerative detector has always been the standby of the radio operator—both commercial and amateur. When properly operated it will give excellent results. By adding a single stage of audio-frequency amplification, weak stations can be brought in more readily. Therefore, the receiver illustrated here consists of a regenerative detector and one audio stage.

A capacitively-coupled antenna has been chosen. Although a seperate antenna winding has its advantages, the condenser-coupling will do away with one coil and, once adjusted, it works satisfactorily. The coils then need only a four-prong base.

A series of five coils will cover the entire range from 15 to 550 meters. The individual ranges of the coils used with this set are as follows: 1. *15-30 meters,* 2. *29-58 meters,* 3. *54-100 meters,* 4. *100-225 meters,* 5. *220-550 meters.*

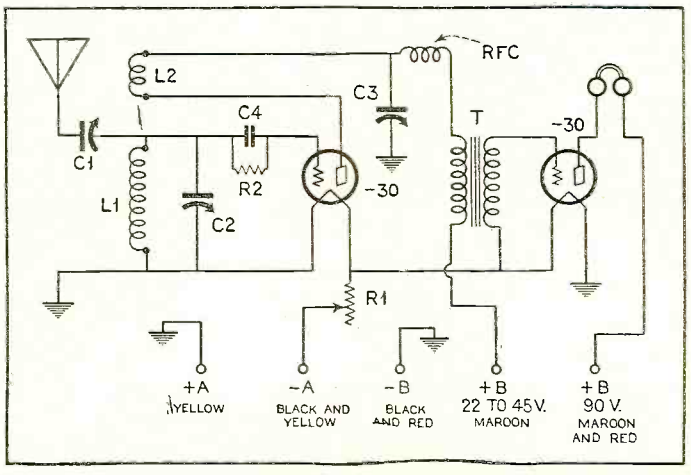
The use of vernier dials will be found imperative; for sometimes as many as four or five stations may be found within one division.

A metal panel should be used to provide electrostatic shielding. When this panel is grounded and the condenser rotors are grounded, "hand-capacity" will be minimized.

The drain on the batteries is rather small, it is possible to employ the smallest types available, keeping weight and size of the outfit low. A very compact 45-volt battery is now available. Two of these and a small 3-volt A battery are al that is needed.

The construction should not offer any great difficulties. The metal panel should first be prepared and drilled. A panel is available which will fit a suitable carrying case. The two variable condensers, three sockets, the antenna and insulated phone jacks are then mounted on the panel. The r.f. choke and the audio transformer can be fastened to some of the bolts which are used to support the other parts. The grid leak and condenser are supported by the wiring.

The special small B batteries fit in the remaining space below the panel. Batteries should be securely fastened by metal clamps. The reader can add certain conveniences to suit himself, for instance, extra sockets, screwed to the side of the cover, are handy ways of carrying the tubes while transporting the set.



Operation

It is now generally known that tuning on short waves seems much sharper than on the broadcast band. Therefore, if it is not done patiently and carefully, the layman might tune all through the dial and conclude that the set is not working. Yet the same receiver, handled by an experienced short-wave fan might yield a whole string of foreign stations. In operation the regeneration control should be advanced until the tube oscillates. Then by tuning the other dial, a whistle will be heard for every station. If the whistle remains steady (not morse code) the station is probably transmit-

(*Continued on page* 57)

Broadcasting Stations in North America

(Exclusive of the United States)

Alphabetically by Call Letters, Location, Frequency and Power, Including Frequencies from 550 to 1500 Kilocycles

Canada

Call	Location	Kilocycles	Watts
CFAC	Calgary, Alta.	690	500
CFBO	St. John, N. B.	1030	500
		(Using 50 w.)	
CFCA	Toronto, Ont.	1120	500
CFCF	Montreal, Que.	600	500
CFCH	North Bay, Ont.	930	100
CFCN	Calgary, Alta.	1030	10,000
CFCO	Chatham, Ont.	1210	250
CFCT	Victoria, B. C.	1430	50
CFCY	Charlottetown, P. E. I.	630	500
CFJC	Kamloops, B. C.	1120	100
CFLC	Prescott, Ont.	930	100
CFNB	Fredericton, N. B.	1210	50
CFQC	Saskatoon, Sask.	890	500
CFRB	Toronto, Ont.	690	10,000
CFRC	Kingston, Ont.	915	250
CHCH	Montreal, Que.	1200	100
CHCK	Charlottetown	1310	100
CHCS	Hamilton, Ont.	630	1,000
		(Uses CKOC transmitter)	
CHGS	Summerside, P. E. I.	1120	500
		(Uses 100 watts)	
CHLP	Montreal, Que.	1120	100
CHLS	Vancouver, B. C.	730	100
		(Uses CKCD transmitter)	
CHMA	Edmonton, Alta.	580	250
CHML	Mount Hamilton, Ont	890	50
CHNC	Bowmanville, Ont.	840	5,000
		(Uses CKGW transmitter)	
CHNS	Halifax, N. S.	1050	500
CHRC	Quebec, Que.	645	100
CHWC	Butte, Sask.	1010	500
CHWK	Chilliwack, B. C.	700	100
CHYC	Montreal, Que.	730	5,000
		(Uses CKAC transmitter)	
CJBC	Bowmanville, Ont.	840	5,000
		(Uses CKGW transmitter)	
CJCA	Edmonton, Alta.	730	500
CJCB	Sydney, N. S.	880	50
CJCJ	Calgary, Alta.	690	500
CJGC	London, Ont.	910	5,000
		(Operates on 595 kc. temporarily)	
CJGX	Winnipeg, Man.	630	500
CJOC	Lethbridge, Alta.	580	100
CJOR	Vancouver, B. C.	1210	500
CJRM	Moose Jaw, Sask.	880	500
CJRW	Winnipeg, Man.	880	500
CKAC	Montreal, Que.	730	5,000
CKCD	Vancouver, B. C.	1010	100
CKCI	Quebec, Que.	645	100
		(Uses CHRC transmitter)	
CKCK	Regina, Sask.	1010	500
CKCL	Toronto, Ont.	580	500
		(Uses CFCL call on Sunday)	
CKCO	Ottawa, Ont.	1010	100
CKCR	Waterloo, Ont.	645	100
CKCV	Quebec, Que.	1310	50
CKFC	Vancouver, B. C.	1410	50
CKGW	Toronto, Ont.	840	5,000
CKIC	Wolfville, N. S.	1010	50
CKLC	Calgary, Alta.	840	1,000
CKMC	Cobalt, Ont.	1210	100
		(Using 50 watts)	
CKMO	Vancouver, B. C.	1410	100
CKNC	Toronto, Ont.	1030	500
CKOC	Hamilton, Ont.	1010	1,000
CKOK	Windsor, Ont.	540	1,000
CKOV	Kelowna, B. C.	1200	100
		(Using 50 watts)	
CKPC	Preston, Ont.	880	100
		(On 930 kc. temporarily)	
CKPR	Fort William, Ont.	780	100
CKTB	St. Catharines, Ont.	630	1,000
CKUA	Edmonton, Alta.	580	500
CKWX	Vancouver, B. C.	730	100
CKY	Winnipeg, Man.	780	5,000
CKX	Brandon, Man.	930	500
CNRA	Moncton, N. B.	630	500
CNRH	Halifax, N. S.	815	500
		(Uses CHNS transmitter)	
CNRO	Ottawa, Ont.	600	500
CNRV	Vancouver, B. C.	1030	500
CPRY	Toronto, Ont.	840	5,000
		(Uses CKGW transmitter)	
VAS	Glace Bay, N. S.	685	4,000
10AB	Moose Jaw, Sak.	1200	25
10AK	Stratford, Ont.	1200	10
10AT	Trail, B. C.	1155	25
10BU	Canora, Sask.	1200	15
10BP	Wingham, Ont.	1200	15
10BI	Price Albert, Sask.	1200	25
10BQ	Brantford, Ont.	1200	5

Cuba

Call	Location	Kilocycles	Watts
CMAB	Pinar del Rio	1249	20
CMAF	Havana	660	500
CMBC	Havana	1270	150
CMBD	Havana	965	150
CMBG	Havana	1070	225
CMBJ	Havana	1140	150
CMBK	Havana	1485	15
CMBL	Havana	1445	20
CMBN	Havana	1185	150
CMBR	Havana	1485	40
CMBS	Havana	780	150
CMBW	Havana	925	150
CMBY	Havana	1230	250
CMBZ	Havana	1010	150
CMC	Havana	840	500
CMCA	Havana	1230	150
CMCB	Havana	1070	150
CMCD	Havana	1140	250
CMCF	Havana	890	250
CMCH	Havana	1405	50
CMCJ	Havana	1185	250
CMCM	Havana	1405	15
CMCN	Marianao	925	250
CMCQ	Havana	780	1,000
CMCR	Havana	1365	150
CMCU	Havana	630	150
CMCW	Havana	965	150
CMCY	Havana	1325	1,000
CMGA	Colon	834	100
CMGB	Matanzas	205	30
CMGC	Matanzas	820	30
CMGE	Cardenas	1375	30
CMGF	Matanzas	987	100
CMGH	Matanzas	1040	15
CMHD	Caibarien	950	250
CMHI	Sta. Clara	1030	30
CMHK	Cruces	1225	15
CMHL	Cienfuegos	1290	20
CMJC	Camaguey	1382	150
CMJE	Camaguey	1175	50
CMJF	Camaguey	930	200
CMJG	Camaguey	1050	50
CMJH	C. de Avila	1150	30
CMJI	C. de Avila	1335	45
CMHJ	Cienfuegos	1125	40
CMJL	Camaguey	960	50
CMJN	Camaguey	1240	50
CMJO	C. de Avila	1110	50
CMJP	Moron	1360	7.5
CMK	Havana	730	3,150
CMKC	Santiago de Cuba	1034	150
CMKJ	Guantanamo	1300	20
CMQ	Havana	630	250
CMW	Havana	590	1,400
CMX	Havana	890	500

Mexico

Call	Location	Kilocycles	Watts
XEA	Guadalajara, Jal.	1155	100
XEAW	Reynosa, Tamps.	965	10,000
XEB	Mexico City	1030	1,000
XEC	Toluca, Mex.	1000	50
XED	Guadalajara, Jal.	1155	500
XEF-XER	Villa Acuna	735–665	500KW.
XEFA	Mexico City	1250	500
XEFB	Monterrey, N. L.	1315	100
XEFC	Merida, Yuc.	1050	10
XEFD	Tijuana, B. C.	1020	300
XEFE	N. Laredo, Tamps.	1000	100
XEFI	Chihuahua, Chih.	1000	100
XEFJ	Monterrey, N. L.	1000	100
XEFO	Mexico City	940	5,000
XEFW	Tampico, Tamps.	1240	70
XEFZ	Mexico City	1500	100
XEG	Mexico City	1075	100
XEH	Monterrey, N. L.	1132	265
XEI	Morelia, Mich.	1310	125
XEJ	C. Juarez, Chih.	1000	100
XEK	Mexico City	990	100
XEL	Saltillo, Coah.	1000	10
XEM	Mexico City	1300	250
XEN	Mexico City	711	1,000
XEO	Mexico City	940	5,000
XEQ	C. Juarez, Chih.	750	5,000
XES	Tampico, Tamps.	1055	500
XER	See XEF-XER		
XET	Monterrey, N. L.	690	500
XETA	Mexico City	1140	500
XETB	Torreon, Coah.	1380	125
XETC	Jalapa, Ver.	1000	100
XETF	Veracruz, Ver.	630	500
XETH	Puebla, Pue.	840	100
XETR	Mexico City	600	1,000
XETU	Pachuca, Hgo.	890	100
XETW	Mexico City	830	500
XEU	Vera Cruz, Ver.	1010	100
XEV	Puebla, Pue.	1000	100
XEW	Mexico City	910	5,000
XEX	Mexico City	1210	500
XEY	Merida, Yuc.	1000	105
XEZ	Mexico City	780	500

RADIO PROGRAM FEATURES

AN OFFICIAL PROGRAM SERVICE

THE radio receiver is worth only what it receives. One of the main difficulties in broadcast listening is to determine just when the more popular programs are on the air. Most listeners miss as much as 50 per cent of the worth-while programs for this reason. RADIO NEWS is therefore presenting this second instalment of a monthly broadcast schedule, listing day by day what is felt to be the most noteworthy programs on the air in the evenings, on Saturday afternoons and all day Sunday. The programs have been chosen by a committee of art, music and educational critics, as well as representative listeners. The programs listed are for the period of June 10th-July 10th inclusive. The listings include the name of the program, the time the program is on the air, the type of program, the name of the sponsor, the chain and the national stations through which it is transmitted. To use the lists one should refer to the day of the week and then run down the hours, marking off those programs you wish to listen to. If you want to find the time for a given program, the name of the program is shown bold face and is easily picked out. The list is correct up to the day of going to press. All time is Eastern Daylight Saving Time. Deduct one hour for Eastern Standard Time, two hours for Central Standard Time, three hours for Mountain Standard Time and four hours for Pacific Standard Time. All programs are sustaining, unless otherwise noted. All time is p. m. unless otherwise noted.

Compiled by

Samuel Kaufman

MONDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WHAM, WGAR, CKGW, WIS, WWNC, WRVA, WJAX, WJR, WLW. Also **6:45**—WOAI, WKY, KSTP, KPRC, KOIL, WREN, WEBC, WDAY, KFYR, KWK, WBAP, WENR, KWCR, KTBS.

6:00—MEYER DAVIS' WALDORF-ASTORIA ORCHESTRA. NBC. WEAF, WCAE, WTIC, KSD, (WBEN, KPRC, WFBR, WJAR, WCKY, WOC, WHO on 6:15) WIOD, WIS, WTAG, KGO, KHQ, WIBA, WSB, WMC, WSMB, WKY, WOAI, KTBS, KOA, (WFI, CKGW, WDAY, WDAF, KTHS, WAPI, WSAI off 6:15) KDYL, KGW, WWNC, KOMO, KFYR, KFSD, WWJ, WMAQ.

6:45—COUNTESS OLGA ALBANI. Songs. NBC. WEAF, WTAG, WCAE, WJAR, WFBR, WBEN, WMAQ, WOC, WHO, WIS, WSM, WSB, WMC, KGO, WRC, KFSD, WSAI, KGW, KOMO, WWNC, WOW, WJAX.

6:45—LOWELL THOMAS, News. Sponsor: Sun Oil Co. NBC. WJZ, WGAR, WLW, CKGW, WBAL, WBZ, KDKA, WHAM, WJR, WSYR, WBZA.

7:00—AMOS 'N' ANDY. Drama. Sponsor: Pepsodent Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WLW, WCKY, WRVA, WPTF, WJAX, WJR, WMAL, WHAM, WGAR, WWNC, WIOD, WFLA, CKGW. Also **11:00**—WMAQ, WENR, KWK, WREN, KOIL, WTMJ, WSM, KDYL, KSTP, WMC, WSB, WBAP, KPRC, KOA, WSMB, KTHS, WOAI, KHQ, WKY, KGO, KFI, KGW, KOMO, KFSD, WJDX, WDAF.

7:15—EVERETT MARSHALL. Songs and Orchestra. Sponsor: Westinghouse Electric & Manufacturing Co. NBC. WJZ, WBAL, WMAL, WBZ, WBZA, WSYR, KDKA, WCKY, WJR. Also, **11:15**—KYW, KWK, KWCR, KSO, KOIL, WREN, WTMJ, WIBA, KSTP, WEBC, WDAY, KFYR, WMC, WDJX, WSB, WSMB, WKY, WBAP, KPRC, KTHS, WOAI, KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ.

7:15—BUCK ROGERS IN THE YEAR 2433. Drama. Sponsor: Kellogg Co. CBS. WABC, WNAC, WGR, WFBM, WHK, WHAS, WCAU, KMOX, CKOK, WCCO.

7:30—FIVE STAR THEATRE—GROUCHO AND CHICO MARX. Drama. Sponsor: Standard Oil Co. of N. J., Pa., La., and Colonial Beacon Oil Co. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, KDKA, WPTF, WWNC, WIS, WMC, WSMB, KTBS, WRVA, WMAL, WSAZ, WSM.

7:30—JUST PLAIN BILL. Sponsor: Kolynos Sales Co. CBS. WABC, WCAO, WAAB, WKBW, WHK, WCAU, WJSV, CKOK.

7:45—THE GOLDBERGS. Drama. Sponsor: Pepsodent Co. NBC. WEAF, WEEI, WSAI, WENR, WOW, WTAG, WJAR, WCSH, WLIT, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WDAF.

7:45—BOAKE CARTER. News. Sponsor: Philco Radio & Television. CBS. WABC, WCAO, WNAC, WGR, WBBM, WHK, KMBC, WHAS, WCAU, WJAS, KMOX, WJSV, CKOK, WBT, WCCO.

8:00—SOCONYLAND SKETCHES. Drama. Sponsor: Standard Oil Co. of N. Y. NBC. WEAF, WTIC, WTAG, WEEI, WJAR WCSH, WGY, WBEN.

8:00—CLIQUOT CLUB ESKIMOS. Harry Reser's Orchestra. Sponsor: Cliquot Club Co. NBC. WJZ, WBZ, WBZA, WBAL, WHAM, KDKA, WGAR, WLS, KWK, KWCR, KOIL, WREN, KSO, WCKY, WMAL.

8:00—SINGIN' SAM. Sponsor: The Barbasol Company. CBS. WADC, WOKO, WCAO WNAC, WGR, WGN, WKRC, WHK, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, CKOK, WCCO.

8:45—THE BAND OF FAMOUS BRANDS. Sponsor: Philip Morris & Co. NBC. WEAF, WEEI, WTIC, WJAR, WCSH, WLIT, WRC, WGY, WBEN, WCAE, WWJ, WMAQ, WDAF.

8:45—PHIL COOK AND INGRAM SHAVERS. Sponsor: Bristol-Myers Co., NBC. WJZ, WBZ, WBZA, WJR. WBAL, KDKA, WGAR, WCKY, WMAL, WLS, WSYR, KWK, KWCR, WREN, KSO. KOIL.

9:00—A. & P. GYPSIES. Sponsor: Great Atlantic & Pacific Tea Co. NBC. WEAF, WIIC, WTAG, WEEI, WJAR, WCSH, WLIT, WRC, WGY, WBEN, WCAE, WTAM, WWJ. WSAI, WMAQ, KSD, WOC, WHO, WOW. WDAF.

9:00—SINCLAIR GREATER MINSTRELS. Sponsor: Sinclair Refining Co. NBC. WJZ. WBZ. WBZA. WHAM, KDKA, WGAR, WSB, WLS. KWK. WREN, WTMJ, WBAL, KSTP. WEBC, WDAY, KFYR, WRVA, WWNC, WIS, WJAX, WIOD, WMC, WJR. WFLA, WSM, WSMB, WJDX, KVOO, KPRC, WOAI, KTBS, WKY, KOIL, KWCR, WFAA, WLW, KSO, WIBA.

9:30—AN EVENING IN PARIS. Sponsor: Bourjois, Inc. CBS. WABC, WCAO, WNAC, WGN, WHK, CKOK, KMBC, WCAU, WJAS, WEAN, KMOX, WJSV, KERN, KMJ, KHJ, KOIN, KFBK, KGB. KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, KLZ, WCCO, WDSU, KOMA, KSL.

9:30—JACK FROST MELODY MOMENTS, Sponsor: National Sugar Refining Co. NBC. WJZ. WBAL, WHAM, KDKA, WGAR, WLW, WJR. WENR.

10:00—CONTENTED PROGRAM. Sponsor: Carnation Milk Co. NBC. WEAF, WGY, WBEN, WCAE, WTAM, WWJ, KSD, WENR, CKGW, CFCF, WOAI, WOC, WHO, WDAF, KSTP, KPRC, WTMJ, WEBC, KFYR, WSM, WMC, WSB, WKY, WFAA, WLW.

10:00—RICHFIELD COUNTRY CLUB. Alex. Morrison. Golf Lessons. Sponsor: Richfield Oil Co. of N. Y. CBS. WABC, WOKO, WCAO. WAAB, WKBW, WDRC, WCAU, WJAS, WFBL, WJSV, WPI, WICC, WLBW, WHP, WHEC.

10:30—EDWIN C. HILL—"Human Side of the News." CBS. WABC, WOKO, WCAO, WAAB, WKBW, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WFBL, WSPD, WQAM, WDBO. WGST, WPG, WLBZ. WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, WKBH, WFEA, WREC, WCCO. WODX, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC. WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WNOX.

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC, WOKO, WCAO, WAAB, WGR, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, KFH, WSJS. WORC, WNAX, WKBN, WIP, WNOX.

TUESDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WJR, WHAM, WGAR, WLW, WIS, WWNC, WRVA, WJAX, CKGW. Also, **6:45**—WENR, KSTP, KOIL, WREN, WEBC, WDAY, KFYR, WOAI, WKY, KTBS, WBAP, KWCR, KWK, KPRC, KSO.

6:00—MME. FRANCES ALDA. Songs. NBC. WEAF, WDAF, WSM, WCKY, WFBR, KSD, (WSB, CKGW, WDAY, WSAI off 6:15), (WBEN, WJAR, WJAX, WOC, WHO, WFAA on 6:15), WIOD, WWNC, WIS, KGW, WCAE, WIBA. KFYR, KOA, WSMB, KGO, WOAI. KTBS, KFSD, WTAG, WAPI, KDYL, KOMO, KHQ, WIOD, WMAQ, WFLA.

6:30—MID-WEEK HYMN SING. NBC. WEAF, KGO, WMAQ, WDAF, KFYR, KGW. KFSD, WSB, KTAR, WIBA, KTBS, WSAI, WWJ, KTHS, KVOO, KHQ. WGY, WOAI, KSD, KGIR, WIS, WJDX, WTAG, WWNC.

6:45—JACK DEMPSEY'S GYMNASIUM. Drama. Sponsor: Wyeth Chemical Co. CBS. WABC, WKRC, WCAU, WCAO, WHK, WKBW, CFRB.

6:45—LOWELL THOMAS. News. Sponsor: Sun Oil Co. NBC. WJZ, WBZ, WBZA, CKGW, WJR, WBAL, KDKA, WGAR, WHAM, WLW, WSYR.

7:00—AMOS 'N' ANDY. Drama. Sponsor: Pepsodent Co., NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WLW, WCKY, WMAL, CKGW. WIOD, WFLA, WRVA, WPTF, WGAR, WJR. Also **11:00** — WMAQ, KDYL, WDAF, KOIL, WTMJ, KSTP, WSM, WMC, WSB, WSMB, KTHS, WFAA, KPRC, WOAI, WKY, KOA, WHAM, KGO, KFI, KGW, KOMO, KHQ, WENR. KWK, WREN.

7:15—BUCK ROGERS IN THE YEAR 2433. Drama. Sponsor: Kellogg Co. NBC. WABC, WNAC, WGR, WBBM, WHK, WHAS, WCAU. KMOX, CKOK. WCCO.

7:30—JUST PLAIN BILL. Sponsor: Kolynos Sales Co. CBS. WABC, WJSV, WCAU, WHK, WCAO, CKOK, WAAB, WKBW.

7:45—THE GOLDBERGS. Drama. Sponsor: Pepsodent Co. NBC. WEAF, WTAG, WFAA, KPRC. WKY, WEEI, WJAR, WCSH, WFBR, WFI, KFYR, WRC, WGY, WREN, WCAE, WTAM, WWJ, WSAI, WENR, WOW, WDAF, WTMJ, WOAI.

7:45—BOAKE CARTER. News. Sponsors: Philco Radio & Television. CBS. WABC, WBBM, WHAS, WJSV, WHK. WCAU, WCAO, CKOK, WNAC, WJAS, WBT, KMOX. WGR, WCCO, KMBC.

8:00—BLACKSTONE PLANTATION. JULIA SANDERSON AND FRANK CRUMMIT.

Sponsor: Waitt & Bond Co., NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WFI, WRC, WGY, WBEN, WCAE, WTAM, WWJ.

8:00—ENO CRIME CLUES. Drama. Sponsor: Harold F. Ritchie & Co. NBC. WJZ, WBZ, WBZA, KDKA, WHAM, WGAR, WBAL, WMAQ, KWK, WREN, WLW, WMAL, WJR.

8:15—THE MAGIC VOICE. Drama. Sponsor: Ex-Lax Co. CBS. WABC, WHAS, WJSV, WADC, WKRC, WCAU, WOKO, WHK, WCAO, CKOK, WNAC, WJAS, WBT, WEAN, WDRC, KMOX, WGR, WFBM, WFBL, WGN, KMBC, WSPD, KRLD.

8:30—WAYNE KING'S ORCHESTRA. Sponsor: Lady Esther. NBC. WEAF, WTAG, WCAE, WTMJ, WEEI, WBEN, WJAR, WFI, WRC, WGY, WTAM, WCSH, WWJ, WSAI, KSD, WOC, WHO, WOW, KSTP, WMAQ, WDAF.

8:30—KATE SMITH LA PALINA PROGRAM. Sponsor: Congress Cigar Co. CBS. WABC, WHAS, WJSV, WADC, WKRC, WCAU, WHEC, WMT, WOKO, WHK, WCAO, CKOK, WOWO, WJAS, WISN, KMOX, WGR, WFBM, WFBL, WCCO, WKBN, WGN, KMBC, WSPD.

8:45—ABE LYMAN'S ORCHESTRA AND IRVING KAUFMAN. Sponsor: Sterling Products, Inc. CBS. WABC, WHAS, WJSV, WADC, WKRC, WCAU, WOKO, WHK, WCAO, CKOK, WJAS, WEAN, WDRC, KMOX, WGR, WFBM, WFBL, WCCO, WGN, KMBC, WSPD, WNAC.

9:00—BEN BERNIE'S BLUE RIBBON ORCHESTRA. Sponsor: Premier Pabst Sales Co., NBC. WEAF, WBAP, WTAG, WEEI, WJAR, WCSH, WSB, WRC, WFI, WFBR, WGY, WBEN, WTAM, WCAE, WLS, WSAI, WWJ, WOC, WHO, WOW, WDAF, KSTP, WDAY, KFYR, WSM, WMC, WSMB, WKY, WOAI, KPRC, KSD, WCKY, WTMJ, WRVA, KOA.

9:00—HOUSEHOLD MUSICAL MEMORIES. Sponsor: Household Finance Corp. NBC. WJZ, WBAL, WBZ, WJR, WBZA, WHAM, KWK, KDKA, WREN, WMAQ, KSO, WSYR.

9:00—EASY ACES. Drama. Sponsor: Lavoris Chemical Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, CKOK, WCCO.

9:15—THREADS OF HAPPINESS ORCHESTRA. Sponsor: Spool Cotton Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGN, WKRC, WHK, CKOK, WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, WGST, WBRC, WBT, KRLD, KTRH, KLRA, WREC, WCCO, WLAC, WDSU, WTAR, KOMA, WHEC, KTSA, WTOC, KFH, WNOX. Also **11:15**—KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, KLZ, KSL.

9:30—ED WYNN AND THE FIRE CHIEF BAND. Sponsor: Texas Co. NBC. WEAF, WCSH, WFI, KDYL, WSM, WFBR, WRC, WGY, WBEN, WEEI, WJAR, WCAE, WTAM, WWJ, WTAG, CFCF, WMAQ, KSD, WOW, WHO, WOC, WLW, WDAF, WIBA, KSTP, WEBC, WDAY, KFYR, WTMJ, WRVA, WWNC, KFSD, WIS, WJAX, WIOD, KVOO, WMC, WSB, WJDX, WSMB, WFLA, WBAP, KPRC, WKY, WOAI, KOA, KGIR, KGHL, KTAR, KTBS, KGO, KFI, KGW, KOMO, KHQ, KTHS.

10:00—NBC SYMPHONY ORCHESTRA—WALTER DAMROSCH. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WRC, WFBR, WFI, WGY, WBEN, WTAM, WCAE, WENR, WWJ, WLW, KSD, WOC, WHO, CKGW, CFCF, WRVA, WWNC, WIS, WJAX, WIOD, WFLA, (WDAF, WTMJ, WIBA, KSTP, WEBC, WDAY, KFYR, WSB, WAPI, WMC, WJDX, WSMB, WKY, WBAP, KPRC, WOAI, KTBS, KTHS, KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ, KFSD, KTAR, off 11:00).

10:00—SIGMUND SPAETH-TUNE DETECTIVE. NBC. WJZ, WBAL, WCKY, KWCR, CFCF, WREN, WJR, KDKA, KWK, KOIL, WMAQ, WSYR.

10:00—FIVE STAR THEATRE. Sponsored by Standard Oil Co., of N. J., Pa., La., and Colonial Beacon Oil Co. CBS. WABC, WJSV, WDBJ, WCAU, WOKO, KLRA, WLAC, WCAO, WICC, WFEA, WDSU, WNAC, WJAS, WBT, WREC, WTAR, WSJS, WEAN, WDOD, WBIG, WORC, WKBW, WDRC, WHP, WFBL, WNOX, WMBG, WOBU.

10:30—EDWIN C. HILL—"Human Side of the News." CBS. WABC, WOKO, WCAO, WAAB, WKBW, WBBM, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WKBN, WNOX.

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC, WOKO, WCAO, WAAB, WGR, WBBM, WHK, CKOK, WDRC, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WNOX.

WEDNESDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, WJR, KDKA, WHAM, WGAR, WIS, WWNC, WRVA, WJAX, CKGW, WLW. Also, **6:45**—WENR, KWK, KWCR, WREN, KOIL, KSO, KSTP, WEBC, WDAY, KFYR, WKY, WBAP, KPRC, WOAI, KTBS.

6:00—MEYER DAVIS' WALDORF-ASTORIA ORCHESTRA. NBC. WEAF, WCKY, KSD, WWNC, WIBA, WIS, WSMB, WKY, KPRC, KPO, KVOO, WOAI, KTBS, KOA, KDYL, (WSM, WFBR, WMC, WOC, WHO on 6:15) (WSAI, WSB, WDAY, WDAF, CKGW, WKY off 6:15) WAPI, WIOD, KFYR, WWJ.

6:30—BACK OF THE NEWS IN WASHINGTON. William Hard. NBC. WEAF, WFBR, WBEN, WCKY, WEBC, WMAQ, KSD, WDAF, WJAR, KTHS, WOAI, KTBS, WTIC, WOW, WMC, KOA, KFYR, WAPI, WJDX, WWNC, WIS, WIBA, WSMB, KVOO, KGO, KFI, KGW, KOMO, KHQ, KFSD, KTAR.

6:45—LOWELL THOMAS. News. Sponsor: Sun Oil Co. NBC. WJZ, WBZ, WBZA, KDKA, WGAR, WHAM, WLW, CKGW, WBAL, WJR, WSYR.

7:00—AMOS 'N' ANDY. Drama. Sponsor: Pepsodent Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WLW, CKGW, WMAL, WRVA, WPTF, WCKY, WIOD, WGAR, WJR, WFLA. Also, **11:00**—WMAQ, WENR, KWK, WREN, WDAF, KOIL, WTMJ, KSTP, WSM, WMC, WSB, WSMB, KTHS, WBAP, KPRC, WOAI, WKY, KOA, KGO, KGW, KFI, KDYL, KOMO, KHQ, WHAM.

7:15—EVERETT MARSHALL. Songs and orchestra. Sponsor: Westinghouse Electric & Manufacturing Co. WJZ, WBAL, WMAL, WBZ, WBZA, WSYR, WCKY, KDKA, WJR. Also **11:15**—KYW, KWK, KWCR, KSO, KOIL, WREN, WTMJ, WIBA, KSTP, WEBC, WDAY, KFYR, WSB, WMC, WJDX, WSMB, WKY, WFAA, KPRC, KTHS, WOAI, KOA, KDYL, WBAP, KGO, KFI, KGW, KOMO, KHQ.

7:15—BUCK ROGERS IN THE YEAR 2433. Drama. Sponsor: Kellogg Co. CBS. WABC, WNAC, WGR, WBBM, WHK, CKOK, WHAS, WCAU, KMOX, WCCO.

7:30—JUST PLAIN BILL. Sponsor Kolynos Sales Co. CBS. WABC, WCAO, WAAB, WKBW, WHK, CKOK, WCAU, WJSV.

7:45—THE GOLDBERGS. Drama. Sponsor: Pepsodent Co. NBC. WEAF, WTAG, KFYR, WEEI, WJAR, WCSH, WFBR, WLIT, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WENR, WOW, WDAF, WTMJ, WFAA, KPRC, WOAI, WKY.

7:45—BOAKE CARTER. News. Sponsor: Philco Radio & Television. CBS. WABC, WCAO, WNAC, WGR, WBBM, WHK, CKOK, KMBC, WHAS, WCAU, WJAS, KMOX, WJSV, WBT, WCCO.

8:00—FANNY BRICE AND GEORGE OLSEN'S ORCHESTRA. Sponsor: Standard Brands. NBC. WEAF, WTIC, WTAG, WEEI, WJAR, WCSH, WLIT, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WLS, KSD, WOW, WDAF, WOC, WHO, WCKY.

8:00—ENO CRIME CLUES. Drama. Sponsor: Harold F. Ritchie & Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WHAM, WGAR, KOIL, WMAQ, WLW, KWK, WREN, WMAL, WJR.

8:30—TASTYEAST JESTERS. Trio. Sponsor: Tastyeast, Inc. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, KDKA.

8:30—KATE SMITH LA PALINA PROGRAM. Sponsor: Congress Cigar Co. CBS. WABC, WADC, WOKO, WCAO, WGR, WGN, WKRC, WHK, CKOK, WOWO, WFBM, KMBC, WHAS, WCAU, WJAS, KMOX, WFBL, WSPD, WJSV, WISN, WCCO, WHEC, WMT.

8:45—PHIL COOK AND HIS INGRAM SHAVERS. Sponsor: Bristol-Myers Co. NBC. WJZ, WBZ, WBZA, WJR, WBAL, WHAM, WMAL, WLS, WSYR, KWK, KWCR, KOIL, WREN, KSO, KDKA, WGAR, WCKY.

8:45—ABE LYMAN'S ORCHESTRA AND IRVING KAUFMAN. Sponsor: Sterling Products Co., Inc. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, CKOK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WCCO.

9:00—ADVENTURES OF SHERLOCK HOLMES. Drama. Sponsor: G. Washington Coffee Refining Co. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, KDKA, WGAR, WJR, WLW, KWK, WREN, KWCR, CKGW, CFCF, KOIL, WLS, WMAL, WSYR. **Also, 12:15 A. M. Thursday**—KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ, KTAR, KFSD, KGIR, KGHL.

9:30—DONALD NOVIS AND BELASCO ORCHESTRA. Sponsor: John H. Woodbury Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WHAM, WGAR, KSO, WLW, WENR, KWCR, KWK, WREN, KOIL, WSM, WMC, WSB, WJDX, WSMB, KTBS, KVOO, WFAA, KPRC, WOAI, WKY, KTHS, KSTP.

9:30—ROBERT BURNS PANATELA PROGRAM. Burns and Allen; Guy Lombardo's Orchestra. Sponsor: General Cigar Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGN, WKRC, WHK, CKOK, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, WBRC, WBT, WDOD, WCAH, WRR, KLZ, KTAT, KTRH, KLRA, WREC, WCCO, WODX, WDSU, KOMA, WHEC, KSL, KTSA, WIBW.

10:00—CORN COB PIPE CLUB. Sponsor: Larus & Bro. Co. NBC. WEAF, WTIC, WTAG, WCSH, WRC, WFBR, WLIT, WGY, WBEN, WTAM, WCAE, WENR, WWJ, WLW, KSD, WOC, WHO, WOW, WDAF, KOA, KGIR, KGHL, KGO, KFI, KGW, KOMO, WEEI, WJAR, KHQ, KDYL, WTMJ, WIBA, WEBC, WDAY, KFYR, KSTP, WRVA.

10:00—OLD GOLD PROGRAM. Sponsor: P. Lorillard Co. CBS. WABC, WADC, WOKO, WCAO, WAAB, WKBW, WGN, WKRC, WHK, CKOK, WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, WBRC, WBT, WDOD, WCAH, WRR, KLZ, KTAT, KTRH, KLRA, WREC, WCCO, WODX, WDSU, KOMA, WHEC, KSL, KTSA, WIBW.

10:30—EDWIN C. HILL—"Human Side of the News." CBS. WABC, WOKO, WCAO, WAAB, WKBW, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WNOX.

10:45—LIGHT OPERA GEMS. Channon Collinge, conductor. CBS. WABC, WOKO, WCAO, WAAB, WGR, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WSBT, WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WNOX.

11:15—LITTLE JACK LITTLE. Vocalist and pianist. CBS. WABC, WOKO, WCAO, WAAB, WKBW, WHK, CKOK, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR, WMBD, WDBJ, WHEC, KSL, KTSA, WTOC, WSBT, WIBW, CFRB, WMT, WSJS, WORC, WNAX, WNOX.

THURSDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, WJR, KDKA, WGAR, WHAM, WIS, WWNC, WRVA, WJAX, CKGW, WLW. **Also, 6:45**—WENR, KSTP, KOIL, WREN, WEBC, WDAY, KFYR, WOAI, WKY, KPRC, KWK, KTBS, WBAP, KWCR.

6:45—LOWELL THOMAS. News. Sponsor: Sun Oil Co. NBC. WJZ, WBAL, WBZ, WBZA, WJR, KDKA, WGAR, WLW, CKGW, WSYR.

7:00—AMOS 'N' ANDY. Drama. Sponsor: Pepsodent Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WLW, WCKY, WMAL, CKGW, WRVA, WPTF, WIOD, WFLA, WGAR, WJR. Also **11:00**—WMAQ, WENR, KWK, WREN, WDAF, KOIL, WTMJ, KTHS, WFAA, KPRC, WOAI, WKY, KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ, WSMB, KSTP, WSM, WMC, WSB, WHAM.

7:00—THE STREET SINGER. CBS. WABC, WOKO, WCAO, WNAC, WGR, WHK, CKOK, WDRC, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WBIG, WHP, WKBH, KFAB, WFEA, WREC, WISN, WCCO, WODX, WSFA, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC,

KSL, WTOC, CFRB, WACO, WMT, KFH, WSJS, WORC, WKBN, WNOX.

7:15—BUCK ROGERS IN THE YEAR 2433. Drama. Sponsor: Kellogg Co. CBS. WABC, WNAC, WGR, WBBM, WHK, WHAS, KMOX, CKOK, WCCO, WCAU,

7:15—BOOTH TARKINGTON'S MAUD AND COUSIN BILL. Drama. Sponsor: Great Atlantic & Pacific Tea Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WMAQ.

7:30—JUST PLAIN BILL. Sponsor: Kolynos Sales Co. CBS. WABC, WCAO, WAAB, WKBW, WHK, WCAU, WJSV, CKOK.

7:45—THE GOLDBERGS. Drama, Sponsor: Pepsodent Co. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WENR, WOW, WDAF, WTMJ, KFYR, WFAA, KPRC, WOAI, WKY.

7:45—BOAKE CARTER. News. Sponsor: Philco Radio & Television. CBS. WABC, WCAO, WGR, WBBM, WHK, KMBC, WHAS, WCAU, WJAS, KMOX, WJSV, CKOK, WBT, WCCO, WNAC.

8:00—FLEISCHMANN HOUR—RUDY VALLEE AND GUEST STARS. Sponsor: Standard Brands, Inc. NBC. WEAF, WTAG, WEEI, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WMAQ, KDYL, KSD, WOC, WHO, WOW, CKGW, WSB, CFCF, KSTP, WEBC, WTMJ, WDAF, WIOD, WJAX, WFLA, WMC, WAPI, WJDX, WJAR, WRVA, WSMB, WOAI, WKY, KOA, KFI, KGO, KGW, KOMO, KTAR, KFYR, WDAY, KHQ, KPRC, (WSM, WBAP, WSAI, WCKY on 8:30) (WLW off 8:30) WPTF.

8:30—KATE SMITH LA PALINA PROGRAM. Sponsor: Congress Cigar Co. CBS. WABC, WADC, WOKO, WCAO, WGR, WGN, WKRC, WHK, WOWO, WFBM, KMBC, WHAS, WCAU, WJAS, KMOX, WFBL, WSPD, WJSV, CKOK WISN, WCCO, WHEC, WMT, WKBN.

8:45—HOWARD THURSTON, MAGICIAN. Sponsor: Swift & Co. NBC. WJZ, WREN, KOIL, WBZ, WBZA, WHAM, KDKA, WGAR, KWK, WJR, WLS, WLW.

8:45—ABE LYMAN'S ORCHESTRA AND IRVING KAUFMAN. Sponsor: Sterling Products, Inc. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, CKOK, WCCO.

9:00—CAPTAIN HENRY'S MAXWELL HOUSE SHOW BOAT. Charles Winniger, Lanny Ross, Annette Hanshaw, others. Sponsor: General Foods Corp. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WMAQ, KSD, WOC, WHO, WOW, WDAF, WTMJ, WRVA, WWNC, WIS, WJAX, WIOD, WFLA, WJDX, WMC, WSB, WAPI, WSMB, KTBS, WKY, KPRC, WOAI, WSM, WBAP, WCKY, KTSP.

9:00—EASY ACES. Drama. Sponsor: Lavoris Chemical Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, CKOK, WCCO.

9:30—WAYNE KING'S ORCHESTRA. Sponsor: Lady Esther. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, KSO, KWK, KWCR, KOIL, WENR, WREN, WGAR, WJR, WHAM.

9:30—COLONEL STOOPNAGLE AND BUDD. Sponsor: General Motors Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGR, WKRC, WHK, CKOK, WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB. KOL, WFPY, KWG, KVI. WGST, WBT, WCAH, KRLD, KLZ. KTRH, WREC, WCCO, WDSU, KOMA, WHEC, KSL, KTSA, KFH.

10:00—LUCKY STRIKE HOUR — JACK PEARL. Sponsor: American Tobacco Company. NBC. WEAF, WTAG, WEEI, WJAR. WCSH. WFI, WFBR, WRC, WGY, WENR. KSD. WOC. WHO. WOW, WDAF, WBEN, WCAE, WTAM, WWJ, WLW, WTMJ, KSTP, WEBC, WDAY, KFYR, WIBA, WRVA, WIS, WWNC, KVOO, WJAX, WIOD, WFLA, WSM, WMC, WSB, WSMB, WJDX, KTHS, KTAR, KFSD, WKY. WBAP. KPRC, WOAI, KTBS, KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC. WOKO, WCAO, WAAB, WGR. WHK, CKOK, WDRC, WFBM, KMBC, WJAS. WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ, WLBW, WBIG, WHP, KTRH, WKBH, WFEA, WREC, WCCO, WODX, WSFA, WLAC, WDSU, WTAR, WMBD, WMBG, WDBJ. WHEC, KSL, KTSA, WTOC, WSBT, WIBW, CFRB, WMT, KFH, WSJS, WORC, WNAX, WKBN, WIP, WNOX.

11:00—JAMES MELTON. Songs. NBC. WEAF, WFBR, WRC, WWJ, WSAI, WCKY, WCAE, CKGW, WTAM, WOC, WHO, WFI, KSD.

FRIDAYS

5:00—ROLLICKERS QUARTET. NBC. WEAF, WTIC, WTAG. WEEI, WJAR, WCSH. WRC. WTAM. WWJ, CFCF, WRVA. WWNC, WIOD, WIBA, KSTP, WEBC, WDAY, KFYR, WSM, WSB, WMC, WSMB, WKY, KPRC, KTBS, WAOI. KOA, KDYL, KGO, KFI, KGW, KOMO. KHQ, KFSD.

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA. KDKA, WJR, WGAR, WIS, WLW, WWNC, WRVA, WJAX, WHAM, CKGW. **Also, 6:45—** WENR, KSTP, KOIL, WREN, WEBC. WDAY, KFYR. WOAI, WKY, KPRC, KTBS. WBAP, KWCR, KWK.

6:45—LOWELL THOMAS. News. Sponsor: Sun Oil Co. NBC. WJZ, WLW, WHAM, CKGW, WGAR, WBZ, KDKA, WBAL, WBZA, WJR, WSYR.

7:00—AMOS 'N' ANDY. Drama. Sponsor: Pepsodent Co. NBC. WJZ. WBZ, WBZA, WBAL, KDKA, WLW, WJR, WCKY, CKGW, WRVA, WPTF, WMAL, WFLA, WIOD, WGAR. **Also 11:00—**WMAQ, WENR, KWK. WREN, WDAF, KOIL, WTMJ, KSTP, WSM, WMC, WSB, WSMB, WHAM, KTHS, WBAP, KPRC, WOAI, KHQ, WKY, KOA, KGO, KFI, KGW, KOMO, KDYL.

7:15—BOOTH TARKINGTON'S MAUD AND COUSIN BILL. Drama. Sponsor: Great Atlantic & Pacific Tea Co. NBC. WJZ, WBZ, WBZA, WBAL, KDKA, WMAQ.

7:15—BUCK ROGERS IN THE YEAR 2433. Drama. Sponsor: Kellogg Co. CBS. WABC, WNAC, WGR, WBBM, WHK, CKOK, WHAS, WCAU, KMOX, WCCO.

7:30—FIVE STAR THEATRE. Drama. Sponsor: Standard Oil Companies of N. J., Pa., La., and Colonial Beacon Oil Co. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, KDKA, WPTF, WWNC, WIS, WMC, WSMB, KTBS, WRVA, WSM, WSAZ, WMAL.

7:30—JUST PLAIN BILL. Sponsor: Kolynos Sales Co. CBS. WABC, WCAO, WAAB, WKWB, WHK, CKOK, WCAU, WJSV.

7:45—THE GOLDBERGS. Drama. Sponsor: Pepsodent Co. NBC. WEAF, WTAG, WKY. WFAA, WOAI, WEEI, WJAR, WCSH, WLIT, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WENR, WOW, WDAF, WTMJ, KFYR, KPRC, WFBR.

7:45—BOAKE CARTER. News. Sponsor: Philco Radio & Television. CBS. WABC, WCAO, WNAC, WGR, WBBM, WHK, CKOK, KMBC, WHAS, WCAU, WJAS, KMOX, WJSV, WBT, WCCO.

8:00—JESSICA DRAGONETTE AND THE CAVALIERS. Sponsor: Cities Service Co. NBC. WEAF, WTIC, WCSH. WCAE, WLIT, WFBR, WRC, (WGY off 8:30) WDAF, WBEN, WOAI. WTAM. WWJ, WSAI, KYW, KSD, WOC, WHO, WOW, CKGW, KSTP, KOA, KPRC. KTBS, WTMJ, WEBC, WKY, WTAG, WFAA, WEEI, KDYL, WJAR.

8:00—NINO MARTINI. Songs. Accompanied by Howard Barlow's Symphony Orchestra. CBS. WABC, WOKO, WCAO, WNAC, WGR, WHK, CKOK, WBRC. KMBC, WJAS. WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WDOD, KVOR, WTAQ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WISN, WCCO, WSFA, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, CFRB, WSJS, WNAX, WNOX.

9:00—BEST FOODS MUSICAL GROCERY STORE. Tom Howard, Jeannie Lang, others. Sponsor: Best Foods, Inc. NBC. WEAF, WTIC, WTAG. WEEI, WJAR, WCSH. WMAQ, WFBR. WRC, WGY, WBEN, WTAM. KSD, WDAF, WWJ. **Also, 12:30 A. M., Saturday—**KOA, KGO, KGW. KHQ, KOMO, KDYL. KFI, KFSD, KTAR.

9:00—FIRST NIGHTER. Drama. Sponsor: Campana Corp. NBC. WJZ, WBZA, WBAL, WBZ, WHAM, KDKA, WGAR, WCKY, KWK, WREN, KTAR, KOIL, KSTP, WEBC, KOA. KDYL, WSB, KGO, KFI, KGW, KOMO, KHQ, KFSD, WOAI, KPRC. WKY, KTBS. WLS, WAPI, WTMJ, WSMB, WJR, WSM.

9:00—IRVIN S. COBB. Humorist. Sponsor: Gulf Refining Co. CBS. WABC, WOKO, WCAO, WNAC, WKBW, WKRC, WHK, CKOK, WDRC, WCAU, WEAN, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, WGST, WBRC, WBT, WCAH, KRLD, WBIG. KTRH, KLRA. WREC, WODX, WLAC, WDSU, WMBG, WDBJ, KTSA, WORC, WNOX.

9:30—POND'S PROGRAM. Leo Reisman's Orchestra. Sponsor: Lamont, Corliss & Co. NBC. WEAF. WDAF, WWJ, WTAG, WJAR, WCSH, WLIT, WFBR, WRC, WGY. WBEN, WCAE, WTAM, WSAI, WENR, KSD, WOC, WHO, WOW.

9:30—PHIL BAKER. Variety. Sponsor: Armour & Co. NBC. WJZ. WBAL, WBZ, WBZA, KGW, KOMO, KHQ, WHAM, KDKA, WGAR, WJR, WMAQ, KWK, WREN, KOIL, WTMJ, KSTP, WEBC, WRVA, WWNC, WJAX, WIOD, WSM, WMC, WSB, WAPI, WSMB, WFAA, KPRC, WOAI, WKY, KOA, KGO, KFI, KDYL, KSO.

9:30—THE INSIDE STORY. Interviews by Edwin C. Hill. Sponsor: Socony-Vacuum Corp. CBS. WABC, WADC, WOKO, WCAO. WNAC, WKBW, WGN. WKRC, WHK, CKOK. WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX. WFBL. WSPD, WJSV. KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY. KWG, KVI, WLBZ, WCAH, KRLD, KLZ. WLBW, WHP, KTRH, WKBH, KLRA. WFEA, WHAD, WCCO, KOMA, WMBD, WHEC, KSL, KTSA, WIBW, WACO, KFH, WORC, WMAS.

10:00—JACK BENNY AND FRANK BLACK'S ORCHESTRA. Sponsor: Chevrolet Motor Car Co. NBC. WEAF, WTIC, WTAG, WLIT, WFBR, WRC, WGY, WBEN, WWJ, WCAE, WTAM, WENR, KSD, WOC, WHO, WOW, WDAF, WTMJ, WIS, WIBA, KSTP, WRVA. WWNC, WIOD, WFLA, WSM, WMC, WSB, WJDX, WSMB, KTBS, KVOO, WKY, KTHS, WFAA, KPRC, WOAI, KOA, KDYL, KGIR, KGHL, KGO, KFI, KGW, KOMO, KHQ, KFSD. KTAR, WCSH, WEEI, WJAR, WEBC, WDAY, KFYR, WJAX, WLW.

10:00—COLUMBIA REVUE WITH JOHN P. MEDBURY. CBS. WABC, WOKO, WCAO, WAAB. WKBW, CKOK, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WHP, KTRH, WKBH, WFEA. WREC, WISN, WCCO. WODX, WLAC, WDSU, WTAR. WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WSBT. WIBW, CFRB, WMT, KFH, WORC, WNAX, WNOX.

10:30—RICHFIELD COUNTRY CLUB. Golf lessons by Alex Morrison; Music. Sponsor: Richfield Oil Corp. of N. Y. NBC. WEAF, WEEI, WTIC, WJAR, WLIT, WFBR, WRC, WGY, WBEN, WCAE.

10:30—STREET SINGER. CBS. WABC, WOKO, WCAO, WAAB, WKBW, WHK. CKOK, WDRC, WFBM, KMBC, WCAU, WJAS. WEAN, WFBL, WSPD, WQAM. WDBO, WGST, WPG, WLBZ, WBRC, WICC, WDOD, KVOR, KLZ. WLBW, WHP, KTRH. WKBH. WFEA, WREC, WCCO, WODX, WLAC. WDSU, WTAR. WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WSBT. WIBW. CFRB, WMT, KFH, WORC, WNAX, WNOX.

10:45—FREDDIE RICH'S ORCHESTRA. CBS. WABC, WOKO, WCAO, WAAB, WGR, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC. WICC, WDOD, KVOR, KLZ, WLBW, WHP, KTRH. WKBH, WFEA, WREC, WCCO, WODX, WLAC, WDSU, WTAR. WMBD, WMBG. WDBJ, KSL, KTSA, WTOC, WSBT, WIBW. CFRB, WMT, KFH, WORC, WNAX, WIP, WNOX.

SATURDAYS

4:00—WEEK-END REVUE. Variety. NBC. WEAF. WTAG, WEEI, WJAR, WFBR. WGY. WWJ, WOC. WHO, (WBEN on 4:30) WTAM. WCAE, WSAI, WMAQ, WOW, WDAF, WCKY, WRC, (WFI off 4:30), (WCSH off 4:45).

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WJR, WHAM, WGAR, WLW, WIS, WWNC, WRVA, WJAX, CKGW. **Also, 6:45—** WENR, KSTP. KOIL. WREN, KPRC, WEBC, WDAY, KFYR. WOAI, WKY, KWK. KTBS, WBAP, KWCR.

7:00—POLITICAL SITUATION IN WASHINGTON TONIGHT. Frederic William Wile. CBS. WABC, WOKO, WCAO, WNAC, WGR, WBBM, WHK, WDRC, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WICC, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WHP, KTRH. WKBH, KFAB, WFEA, WREC, WISN, WCCO, WODX, WSFA, WLAC, WDSU, WTAR, WMBG, WDBJ, WHEC, KSL, WTOC, WACO, WMT, KFH, WSJS, WORC, WNAX, WNOX.

7:15—EVERETT MARSHALL. Songs and orchestra. Sponsor: Westinghouse Electric & Manufacturing Co. NBC. WJZ. WBZ, WBZA, WBAL. WCKY, WSYR, WMAL, KDKA, WJR. Also, **11:15—**WTMJ. KSTP, WIBA. WEBC, WDAY. KFYR, WSB, WSMB, WKY, WFAA, KPRC, WOAI, KOA, KDYL, KTHS, WMC, WJDX, KGO, KFI, KGW, KOMO, KHQ. KYW, KWK, KWCR, KSO, KOIL, WREN.

8:15—THE MAGIC VOICE. Drama. Sponsor: Ex-Lax Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK. CKOK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN,

KMOX, WFBL, WSPD, WJSV, WBT, KRLD.

9:00—THE BAND OF FAMOUS BRANDS. Sponsor: Philip Morris & Co. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WRC, WFI, WTAM, WWJ, WMAQ, WCAE, KSD, WDAF, WGY, WBEN, WLW.

9:00—EASY ACES. Drama. Sponsor: Lavoris Chemical Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, CKOK, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WCCO.

10:00—SATURDAY NIGHT DANCING PARTY. B. A. Rolfe's Orchestra. Sponsor: Hudson Motor Car Co. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WRC, WFBR, WFI, WGY, WBEN, WTAM, WCAE, WLW, WMAQ, WWJ, KSD, WOC, WHO, WOW, WDAF, CKGW, KSTP, WSB, WSMB, WBAP, KOA, KDYL, KGO, KFI, CFCF.

10:30—CUCKOO PROGRAM. Comedy and Music. NBC. WJZ, WBAL, WHAM, KOIL, KDKA, WGAR, KWK, KSO, KWCR, WREN, WCKY, KYW, WIS, WJAX, WIOD, WWNC, WRVA, WFLA, WSYR.

SUNDAYS

11:15 A. M.—MAJOR BOWES' CAPITOL FAMILY. Variety. NBC. WEAF, WJAR, WFBR, WRC, WTAM, WDAF, WFLA, KFYR, WAPI, WSMB, KPRC, KOA, KDYL, WEBC, KFSD, (WTAG, WWJ, WLIT, WGY on 12:00), WSAI, WHO, (WIBA, KSTP off 11:45) (WMC, WIOD, WKY, WBAP, KTBS, WAOI off 12:00), WOC, WMAQ, WWNC, KGO, KTAR, KFI, KGW, KOMO, KHQ.

11:45 A. M.—SALT LAKE TABERNACLE CHOIR AND ORGAN. CBS. WABC, WOKO, WCAO, WNAC, WGR, WHK, CKOK, WDRC, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WDOD, KVOR, KLZ, WTAQ, WLBW, WHP, KTRH, WKBH, KFAB, WFEA, WREC, WISN, WCCO, WODX, WDSU, WMBD, KSL, WTOC, WSBT, WIBW, CFRB, WACO, WMT, WORC, WNAX, WKBN, WNOX.

12:15—RADIO CITY CONCERT. Variety. NBC. WJZ, WBAL, WHAM, WGAR, WWNC, WLW, KDKA, KWK, WREN, KOIL, WJAX, WIOD, KFSD, WBZ, WBZA, CFCF, WFLA, WDAY, KFYR, WSMB, KVOO, KPRC, KOA, KDYL, KGO, KFI, (WRVA, WSM, WIBA, KTSP, WFAA, WOAI, WKY on 1:00), WJR, WMAQ, KGW, WAPI, WSYR, KECA, KTAR, (CKGW, WIS on 12:30), WMAL, WEBC, KOMO, KHQ.

1:15—COOK TRAVELOGUES. NBC. WJZ, WBZ, WGAR, WJR, WBZA, WBAL, WMAL, WSYR, WHAM, KDKA, WCKY, WMAQ.

3:30—THE RADIO PULPIT. NBC. WEAF, WEEI, KTHS, WTAG, WCSH, WFBR, WRC, WBEN, WJAR, WCAE, WTAM, WSAI, WOW, WDAF, WLIT, WEBC, KFYR, KSD, KOA, KVOO, KPRC, WOAI, WKY, KGHL, KGO, KGW, KHQ, WGY, KDYL, WOC, WHO, WIBA, KFSD, WMC, WRVA, WJDX, WIS, WWJ, KOMO, WIOD, WFLA, WSM, WSB, KGIR, WPTF, KFI.

5:00—POET'S GOLD. Poetic readings by WJZ, WBAL, WBZ, WREN, WEBC, KFYR, WBZA, WGAR, KWK, WSM, WPTF, WIS, WWNC, KWCR, WIOD, WFLA, WSB, KOA, KGHL, KGW, WJDX, KPRC, WOAI, KTBS, KGO, KHQ, KFSD, KTAR, KOIL, WJAX, WSMB, WBAP, KOMO, WMC, WRVA, KGIR, KVOO, WHAM, WCKY, WCFL, WTMJ, WBAP, KSTP, WKY, WEBC.

5:00—POET'S GOLD. Poetic readings by David Ross. CBS. WABC, WOKO, WCAO, WNAC, WGR, WHK, CKOK, WDRC, WFBM, KMBC, WJAS, WEAN, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WICC, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WHP, KTRH, WKBH, KFAB, WFEA, WREC, WCCO, WODX, WSFA, WLAC, WDSU, WTAR, WDBJ, WTOC, WSBT, WIBW, CFRB, WMT, KFH, WSJS, WORC, WKBN, WIP, WNOX, WMBD.

6:00—CATHOLIC HOUR. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WLIT, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WIOD, WEBC, KFYR, WRVA, WOAI, WSAI, WOC, WHO, WOW, WDAF, WIBA, WFLA, WSM, WMC, WSMB, KPO, WMAQ, WAPI, WJDX, KVOO, WBAP, KPRC, WWNC, WKY, KOA, KGHL, KGIR, KTAR, KECA, KSD, WIS, WDAY, WSB, KTBS, KDYL, WJAX, KGW, KOMO.

7:30—JOE MOSS' SOCIETY ORCHESTRA. Sponsor: J. B. Williams Co. NBC. WEAF, WTIC, WTAG, WJAR, WCSH.

8:00—CHASE & SANBORN HOUR. Sponsor: Standard Brands, Inc. NBC. WEAF, WTIC, WTAG, WIOD, WFLA, WMC, WJDX, KTAR, WBEN, WCAE, WTAM, WWJ, WLW, KSD, WOC, WHO, WDAF, CFCF, WSB, KFYR, WWNC, WIS, KDYL, KPRC, WKY, CKGW, WTMJ, KSTP, WEBC, WDAY, KVOO, WFAA, WOAI, KOA, KGO, KFI, WFBR, WRC, WGY, KGW, KOMO, KHQ, WPTF, (WSM off 8:30), WOW, WJAR, WCSH, WMAQ, WSMB.

9:00—WILL ROGERS. Humorist. Sponsor: Gulf Refining Co. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, WGAR, WJR, WLW, WSYR, WMAL, WRVA, WPTF, WWNC, WIS, WJAX, WFLA, WSM, WMC, WSB, WAPI, WJDX, WSMB, KTHS, WFAA, KTBS, KPRC, WOAI.

9:30—AMERICAN ALBUM OF FAMILIAR MUSIC. Orchestra and vocalists. Sponsor: Bayer Co. NBC. WEAF, WTAG, WCKY, WJAR, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, KSD, WSAI, WENR, WOC, WHO, WOW, WIOD, WFLA, WSM, WMC, WSB, WOAI, WJDX, KTHS, WFAA, WKY, KOA, KPRC, KGO, KFI, KGW, KOMO, KHQ, WSMB, KDYL, WAPI, WRVA, WJAX, WTMJ, KSTP, WEEI, WDAF.

9:30—PENNZOIL PARADE OF MELODIES. Sponsor: Pennzoil Co. CBS. WABC, WHAS, WJSV, WLBZ, WRR, WADC, WKRC, WCAU, WHEC, WOKO, WBRC, KLRA, WLAC, WCAO, CKOK, WDSU, KTSA, WNAC, WBT, KTAT, WEAN, KOMA, WDRC, KMOX, WGR, WFBM, WFBL, WGST, WCCO, WGN, KMBC, WSPD.

10:15—VINCENT LOPEZ'S ORCHESTRA. Dance Music. Vocal Soloists. Sponsor: Real Silk Hosiery Mills. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, WGAR, WLW, WMAQ, KWK, WREN, WTMJ, WIBA, KSTP, WSM, WSB, WJDX, WSMB, WKY, WBAP, KPRC, WOAI, KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ, WHAM, WMC, KSO, WJR.

10:15—COLUMBIA REVUE WITH JOHN P. MEDBURY. CBS. WABC, WOKO, WCAO, WAAB, WGR, WBBM, WHK, CKOK, WDRC, WFBM, KMBC, WCAU, WJAS, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WDOD, KVOR, KRLD, KLZ, WLBW, WHP, KTRH, WKBH, WFEA, WREC, WISN, WCCO, WODX, WLAC, WDSU, WTAR, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, WSJS, WORC, WNAX, WKBN.

Our "Uncle Sam" Says

THE World's Fair at Chicago will be the originating point of many spectacular network Summer Broadcasts . . . Vincent Lopez tells his friends some amazing things about themselves which he says he deducts from numerology . . . Jack Benny's satirical take-offs on commercial announcements are among the funniest things on the air . . . An operation on Kate Smith's feet was the cause of her being brought to the studio in a wheel-chair for her broadcasts . . . Radio stars are all on the alert for talkie contracts these days . . . Despite England's belief that it has the best radio system in the world, we predict that it will yield, partially at least, to commercial broadcasting within the near future . . . Whenever NBC broadcasts a news flash, the announcer says "For further details see your favorite newspaper." This is done to appease publishers who feel that broadcasters are trespassing in the field of news dissemination . . . Staged laughter on certain comedy broadcasts retards rather than promotes the entertainment value of the programs . . . Radio adaptations of newspaper comic strips are going over in big way with adults as well as children . . . Howard Claney, NBC announcer, is said to be adept at painting in oils and water colors . . . NBC page boys won much favorable comment for their own broadcast recently heard over the network . . . Those talented youngsters on WABCs Sunday children's hour can teach some of the adult entertainers a thing or two about swell performing . . . The most dramatic and powerful use of radio to date was President Roosevelt's address to the nation at the end of the banking holiday . . . Barbara Blair, originally cast as an "extra" in the Thursday Five Star Theatre program, snatched stellar honors through her initial efforts . . . With the switching of the Pontiac program to the CBS Building, the network has given up its auditorium studio at Carnegie Hall.

MR. AND MRS. PHIL BAKER

ANDREA MARSH

Personal interviews with broadcast artists and executives

Backstage in

By Samuel

PHIL BAKER, famed comedian and accordionist of vaudeville and musical comedy, was recently signed as the star of the Friday night Armour program on NBC. A musical comedy tempo introduced in his programs won wide acclaim for the new series. Roy Shields, Chicago musical director of the NBC, conducts the orchestra on the Armour programs. The Ambassadors Quartet, the Nell Sisters trio and a cast of dramatic performers assist Baker in his efforts. For many years, Baker's stage act included a stooge who sat in a box and constantly interrupted his efforts on the stage. The stooge is still present on the Baker radio programs. This time, the stooge is in the character of a ghost voice that haunts the air waves, constantly interrupting Baker and indulging in humorous dialogue. In all, the programs are imbued with the pleasant flavor of originality —a thing that many programs lack.

THE NBC recently launched a unique weekly program consisting of a full hour of continuous music without interruption. Even announcements are eliminated in this 100 per cent musical hour known as "The Hour Glass." A balanced selection of better known operatic, semi-classical and modern musical comedy numbers are presented by a large orchestra directed by Harold Sanford, veteran NBC conductor. Soloists include Lois Bennett, soprano, and Robert Simmons, tenor. A large mixed chorus is also heard. The series is presented on Monday nights.

IT seems that when Jack Pearl launched his Baron Munchausen role on the Lucky Strike Hour, he also started a vogue for dialect programs. Comedians apparently believe that jokes sound funnier when they are presented in dialect rather than in straight voices. Sometimes they do, but as a rule even dialect does not make a poor joke acceptable as radio fare. One of the latest dialecticians to come to the air is Solly Ward who fills the role of Papa Fussenfumer in the Five Star Theatre program of the CBS on Thursday nights. Although he is a new figure on the radio horizon, Ward has appeared on the stage for more than a decade. His German dialect style made his name well known in vaudeville circles.

HAROLD SANFORD

SOLLY WARD

He is surrounded by a capable cast of dramatic and musical performers. Josef Bonime's Orchestra supplies the musical background.

THE Richfield Country Club, starring Alex Morrison, the famous golf pro, is a new weekly feature on both the NBC and CBS chains. Presented by the same cast, the series is broadcast on Monday over CBS and Friday over NBC. The programs feature golf instructions by Morrison, one of the world's leading authorities on the technique of the game. Others on the program include Ernest Glendinning, master-of-ceremonies, Betty Barthell, blues singer; Jack Golden's Orchestra and a male quartet. Glendinning, new to radio, is a familiar figure to New York theatre-goers.

AT RIGHT:
JACK GOLDEN
ALEX MORRISON
ERNEST GLENDINNING AND
BETTY BARTHELL

BETTY BARTHELL

JACK DEMPSEY

Broadcasting

Chatty bits of news on what is happening before the microphone

Kaufman

He has been seen on Broadway in numerous plays including "The Church Mouse," "Candlelight," and "The Greeks Had a Word for It." Betty Barthell first came to radio as a pianist but soon developed into a blues singer. Now she has evolved still further inasmuch as she takes comedy parts on the Richfield programs. Golden's Orchestra was a Washington, D. C., favorite for many seasons. More recently, the orchestra has appeared in vaudeville and musical comedy.

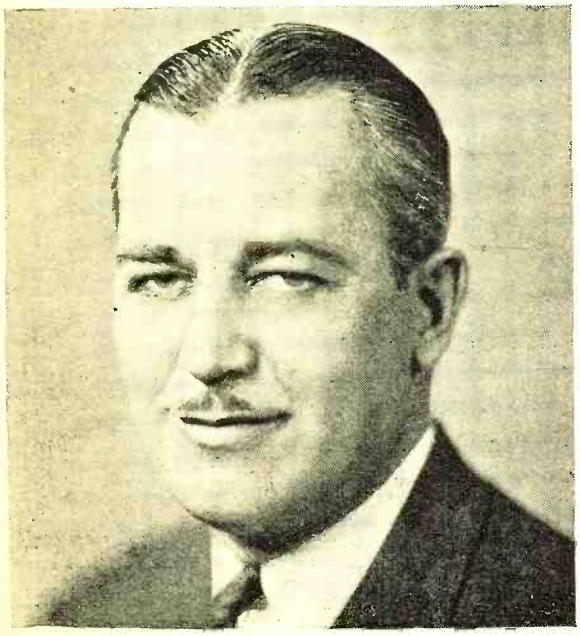
PHIL COOK, the "one-man show" of NBC fame, and Andy Sanella, the versatile musician who is known as the "one-man band" of the same network, have combined their talents in the new Ingram Shavers programs sponsored by the Bristol-Myers Company and heard each Monday and Wednesday over an extensive hook-up. Although there are only two featured men on the series, the programs sound as if ten or more persons are heard on each broadcast. Cook won radio fame for his ability to change his voice and take numerous dramatic parts on a single program. Sanella supplies the incidental music on the guitar, saxophone, banjo, clarinet, violin or whatever instrument he can lay his hands on. Cook is the author of the skits heard on the series.

JACK DEMPSEY, former world's heavyweight boxing champion, is now being starred in a thrice-weekly series on CBS. The programs, entitled "Jack Dempsey's Gymnasium," are heard Mondays, Tuesdays and Wednesdays. Dempsey portrays his own real life role in the dramatic sketches. It is not unusual for radio to borrow talent from the theatrical, talking film and concert fields but it is quite rare to select a radio drama star from the sporting world. Dempsey, one of America's greatest sports idols, won the heavyweight crown from Jess Willard in 1919 and held the title until 1926 when Gene Tunney became champ. Since losing the crown, Dempsey has remained identified with the prize-ring in various capacities. His current CBS series marks his debut as a regular radio artist, although he had made some previous use of the microphone as a guest artist. The series is sponsored by the Wyeth Chemical Company.

ANDREA MARSH, the contralto who leaped to network popularity in very short time, made her first radio appearance over Station KTSP, St. Paul. She is a native of Minneapolis and was educated at a convent in that city. She spent some time in New York studying before she joined Ted Weems' Orchestra with which she scored her greatest radio success. Although a contralto, Miss Marsh keeps away from "blues" numbers. She prefers ballads and rhythm selections. Recently, the NBC decided to allot her a thrice-weekly sustaining period. She is heard Monday, Thursday and Saturday evenings.

WHEN Eddie Cantor was in Florida last winter, the comedian utilized Benny Meroff's orchestra to supply his accompaniment and musical background on the Sunday night Chase & Sanborn Hours. He worked some comedy dialogue lines into the continuity for Meroff, George Givot, a veteran musical comedy performer, was hired to take over the speaking role of Meroff. Givot's Greek comedy dialect immediately won him a spot midst the leading radio comedians of the day. To some extent he "stole the show" from Cantor. Givot's next step up

(*Continued on page 63*)



AT LEFT:
PHIL COOK

GEORGE GIVOT

ROY SHIELD

The DX Corner

IN this fourth 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. 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*
5 A. M. Eastern Standard Time		**Local Time**
19.8	GSF	
30.4	J1AA	
31.2+Sun.	VK2ME	
31.5 Wed., Sat	VK3ME	
31.5	GSB	
70.2	RV15	
6 A. M. Eastern Standard Time		**Local Time**
19.8	GSF	
30.4	J1AA	
31.2+ Sun.	VK2ME	
31.5 Wed., Sat.	VK3ME	
31.5	GSB	
49.4+	W8XAL	
70.2	RV15	
7 A. M. Eastern Standard Time		**Local Time**
23.3+	RABAT	
25.5	GSD	
30.4	J1AA	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5 Wed, Sat.	VK3ME	
49.4+	W8XAL	
70.2	RV15	
8 A. M. Eastern Standard Time		**Local Time**
16.8	W3XAL	
16.8+ Irregular	PHI	
19.6	FYA	
19.7	DJB	
23.3+ Sun.	RABAT	
25.3	GSE	
25.4	I2RO	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5	GSB	
49.4+	W8XAL	
49.9+	VE9DR	
70.2	RV15	
9 A. M. Eastern Standard Time		**Local Time**
19.7	W8XK	
16.8	W3XAL	
16.8+ Irregular	PHI	
19.6	FYA	
19.7	DJB	
25.3	GSE	
25.4	I2RO	
31.3+	W1XAZ	
31.5	GSB	
49.4+	W8XAL	
49.9+	VE9DR	
10 A. M. Eastern Standard Time		**Local Time**
16.8+	W3XAL	
16.8+ Irregular	PHI	
19.6	FYA	
19.7	W8XK	
19.7	DJB	
25.3	GSE	
25.4	I2RO	
25.5 Irregular	DJD	
25.6	VE9JR	
26.8+ Sun	CT3AQ	
31.3+	W1XAZ	
31.4	W2XAF	
31.5	GSB	
49.4+	W8XAL	
49.9+	VE9DR	
11 A. M. Eastern Standard Time		**Local Time**
16.8+	W3XAL	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
25.2	FYA	
25.2	W8XK	
25.3	GSE	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Irregular	VE9JR	
26.8+ Sun.	CT3AQ	
31.3+	W1XAZ	
49.2 Sun.	VE9GW	
49.3 Sun.	W9XAA	
49.9	VE9BJ	
49.9+	VE9DR	
12 NOON Eastern Standard Time		**Local Time**
16.8	W3XAL	
19.6+	W2XE	
19.7	W8XK	
25.2	FYA	
25.4	I2RO	
25.5 Irregular	DJD	
25.6	VE9JR	
31.2+	W3XAU	
31.3+	W1XAZ	
49.2 Sat., Sun.	VE9GW	
49.3 Sun.	W9XAA	
49.9	VE9BJ	
49.9+	VE9DR	
1. P M. Eastern Standard Time		**Local Time**
16.8	W3XAL	
19.5+	W2XAD	
19.7	W8XK	
25.2	FYA	
25.4	I2RO	
25.5	GSD	
25.5 Irregular	DJD	
25.6	VE9JR	
30.4 Sat.	EAQ	
31.2+	W3XAU	
31.3+	W1XAZ	
31.3+	DJA	
31.5	GSB	
31.5	OXY	
49.2 Sat., Sun	VE9GW	
49.3 Sun.	W9XAA	
49.4+	W8XAL	
49.9+	VE9DR	
50.+	HVJ	
2 P. M. Eastern Standard Time		**Local Time**
16.8	W3XAL	
19.5+	W2XAD	
25.2	FYA	
25.4	I2RO	
25.5 Irregular	DJD	
25.5	GSD	
30.4 Sat.	EAQ	
31.2	W3XAU	
31.3	HBL (code)	
31.3+	W1XAZ	
31.3+	DJA	
31.5	GSB	
31.5 Weekdays	OXY	
49.2 Sat., Sun.	VE9GW	
49.3 Sun.	W9XAA	
49.4+	W8XAL	
49.6+ Sun.	W1XAL	
49.9+	VE9DR	
3 P. M. Eastern Standard Time		**Local Time**
16.8	W3XAL	
19.5+ Sat., Sun.	W2XAD	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5 Irregular	DJD	
25.5	GSD	
25.6	FYA	
30.4 Sat.	EAQ	
31.2	W3XAU	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
31.5	OXY	
32.3 Sun.	RABAT	
49.2 Sat., Sun.	VE9GW	
49.3 Sun.	W9XAA	
49.4+	W8XAL	
49.6+ Sun.	W1XAL	
49.9+	VE9DR	
50.00	RV59	
4 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	GSD	
25.5	DJD	
25.6	FYA	
30.4 Sat.	EAQ	
31.2	W3XAU	
31.2+ Tues., Fri.	CT1AA	
31.3	HBL (code)	
31.3+	W1XAZ	
31.3+	DJA	
31.5	GSB	
31.5	OXY	
32.3 Sun.	RABAT	
46.7 Irregular	W3XL	
48.8+	W8XK	
49.1+	YV1BC	
49.1+	W9XF	
49.2 Fri., Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.9+	VE9DR	
50.0	RV59	
5 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	
25.2	W8XK	
25.4	I2RO	
25.5	GSD	
26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.0	TI4NRH	
31.2+	W3XAU	
31.2+ Tues., Fri.,	CTIAA	
31.3 Sun.	HBL	
31.3+	W1XAZ	
31.3+	DJA	
31.4	W2XAF	
31.5	GSB	
31.5	OXY	
32.3	RABAT	
38.4 Sun.	HBP	
46.7 Irregular	W3XL	
48.8+	W8XK	
49.1+	YV1BC	
49.1+	W9XF	
49.2 Fri., Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.8	DJC	
49.9	VE9DR	
50.0	RV59	
50.6 Irregular	HJ4ABE	
6 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	
25.2	W8XK	
25.6	FYA	
30.4 Sat.	EAQ	
31.2	W3XAU	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
31.5	OXY	
32.3 Sun.	RABAT	
49.2 Sat., Sun.	VE9GW	
49.3 Sun.	W9XAA	
49.4+	W8XAL	
49.6+ Sun.	W1XAL	
49.9+	VE9DR	
50.00	RV59	
4 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	GSD	
25.5	DJD	
25.6	FYA	
30.4 Sat.	EAQ	
31.2	W3XAU	
31.2+ Tues., Fri.	CT1AA	
31.3	HBL (code)	
31.3+	W1XAZ	
31.3+	DJA	
31.5	GSB	
31.5	OXY	
32.3 Sun.	RABAT	
46.7 Irregular	W3XL	
48.8+	W8XK	
49.1+	YV1BC	
49.1+	W9XF	
49.2 Fri., Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.8	DJC	
49.9	VE9DR	
50.0	RV59	
50.6 Irregular	HJ4ABE	
6 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	
25.2	W8XK	
25.6	FYA	

25.6 Tues., Fri	VE9JR	.....
26.8+ Tues., Thurs.	CT3AQ	.....
30.4	EAQ	.....
31.0	TI4NRH	.....
31.2+ Tues., Fri	CT1AA	.....
31.3+	W1XAZ	.....
31.3+	DJA	.....
31.4+	W2XAF	.....
31.5	GSB	.....
31.5	OXY	.....
48.8+	W8XK	.....
49.0	W2XE	.....
49.1+	YC1BC	.....
49.1+	W9XF	.....
49.2	VE9GW	.....
49.4+	W8XAL	.....
49.3+ Sun.	W9XAA	.....
49.6	GSA	.....
49.8	DJC	.....
49.9+	VE9DR	.....
50.6	HJ4ABE	.....
7 P. M. Eastern Standard Time		**Local Time**
16.8 Sat.	W3XAL	.....
25.2	W8XK	.....
25.6 Tues., Fri	VE9JR	.....
25.6	FYA	.....
30.4	EAQ	.....
31.2+ Tues., Fri.	CT1AA	.....
31.3+	W1XAZ	.....
31.3+	DJA	.....
31.4+	W2XAF	.....
31.5	GSB	.....
48.8+	W8XK	.....
49.0	W2XE	.....
49.1+	YV1BC	.....
49.1+	W9XF	.....
49.2	VE9GW	.....
49.3+ Sun.	W9XAA	.....
49.4+	W8XAL	.....
49.5	W3XAU	.....
49.6	GSA	.....
49.8	GJC	.....
49.9+	VE9DR	.....
50.6	HJ4ABE	.....
8 P. M. Eastern Standard Time		**Local Time**
25.2	W8XK	.....
25.6	FYA	.....
25.6 Tues., Fri.	VE9JR	.....
31.3+	W1XAZ	.....
31.4+	W2XAF	.....
48.8+	W8XK	.....
49.0	W2XE	.....
49.1+	YV1BC	.....
49.1+	W9XF	.....
49.3+ Sun.	W9XAA	.....
49.2 Fri., Sun.	VE9GW	.....
49.4+	W8XAL	.....
49.5	W3XAU	.....
49.8	DJC	.....
49.9+	VE9DR	.....
50.0	HJ1ABB	.....
50.6	HJ4ABE	.....
51.0	HJ2ABA	.....
9 P. M. Eastern Standard Time		**Local Time**
25.2	W9XK	.....
31.0	TI4NRH	.....
31.3+	W1XAZ	.....
31.4+	W2XAF	.....
45.3 Thurs.	PRADO	.....
48.8+	W8XK	.....
49.0	W2XE	.....
49.1+	YV1BC	.....
49.2 Fri., Sun.	VE9GW	.....
49.3+ Sun.	W9XAA	.....
49.5	W3XAU	.....
49.4+	W8XAL	.....
49.9+	VE9DR	.....
50.0	HJ1ABB	.....
50.6 Irregular	HJ4ABE	.....
51.0	HJ2ABA	.....
10 P. M. Eastern Standard Time		**Local Time**
31.0	TI4NRH	.....
31.3+	W1XAZ	.....
31.4+	W2XAF	.....
45.3 Thurs.	PRADO	.....
45.0 Fri.	TGW	.....
48.8+	W8XK	.....
49.0	W2XE	.....
49.1+	W9XF	.....
49.2 Dri., Sun.	VE9GW	.....
49.4+	W8XAL	.....
49.5	W3XAU	.....
49.9+	VE9DR	.....
11 P. M. Eastern Standard Time		**Local Time**
31. 3+	W1XAZ	.....
45.0 Fri.	TGW	.....
48.8+	W8XK	.....
49.1+	W9XF	.....
49.2 Fri.	VE9GW	.....
49.4+	W8XAL	.....
49.5	W3XAU	.....
49.9+	V9DR	.....

Station Locations

Wavelengths in Meters	*Call Letters*	*City Country*
16.8	W3XAL	Bound Brook, N. J.
16.8+	PHI	Huizen, Holland
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
23.3		Rabat, Morocco
25.2	FYA	Pontoise, France
25.2	W8XK	Pittsburgh, Pa.
25.3	GSE	Daventry, England
25.3+	W2XE	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	J1AA	Japan
30.4	EAQ	Madrid, Spain
31.0	TI4NRH	Heredia, Costa Rica
31.2+	W3XAU	Philadelphia, Pa.
31.2+	VK2ME	Sydney, Australia
31.2+	CT1AA	Lisbon, Portugal
31.3	HBL	Geneva, Switzerland
31.3	GSC	Daventry, England
31.3+	W1XAZ	Springfield, Mass.
31.3+	DJA	Zeesen, Germany
31.4+	W2XAF	Schenectady, N. Y.
31.5	VK3ME	Melbourne, Australia
31.5	GSB	Daventry, England
31.5	OXY	Skamleback, Denmark
32.3		Rabat, Morocco
38.4+	HBP	Geneva, Switzerland
45.0	TGW	Guatemala
45.3	PRADO	Riombamba, Ecuador
48.8	W8XK	Pittsburgh, Pa.
49.0	W2XE	New York, N. Y.
49.1+	YV1BC	Caracas, Venezuela
49.1+	W9XF	Chicago, Ill.
49.2	VE9GW	Bowmanville, Can.
49.3+	W9XAA	Chicago, Ill.
49.4+	W8XAL	Cincinnati, Ohio
49.5	W3XAU	Philadelphia, Pa.
49.6	GSA	Daventry, England
49.6+	W1XAL	Boston, Mass.
49.8	DJC	Berlin, Germany
49.9	VE9BJ	New Brunswick, Can.
49.9+	VE9DR	Montreal, Can.
50.0+	HVJ	Vatican City
50.0	RV59	Moscow USSR
50.5	HJ1ABB	Barranquilla, Colombia
50.6+	HJ4ABE	Medellin, Colombia
51.0	HJ2ABA	Tunja, Colombia
70.2	RV15	Khabarovsk, Siberia

Short-Wave DX Listeners, Attention!

THIS is the fourth installment of this department and we wish our readers to know that it is still in the experimental stage. Do you like it? If so just drop a card or letter to the DX Editor, care of RADIO NEWS, giving your suggestions and comments. If the response from readers is sufficient to warrant its being continued, it will be enlarged and made more complete as time goes on.

You can help to make it more perfect and more useful by mentioning in your letter to the DX Editor the stations you receive most favorably on the short waves, giving, wherever possible, the call letters, location, wavelength or frequency and the periods the stations are on the air. It would be advisable to mention in your letter any peculiarities of transmission that might help to identify the foreign station, such as their method of signing on or off, languages used, any station signals, like the tooting of horns, ringing of bells, or the ticking of a clock, etc. If you keep a log of foreign station reception it would be of invaluable aid to us in presenting this information in the coming DX CORNER. Later on RADIO NEWS is to select a number of proficient RADIO NEWS listening posts from amongst its readers who respond to this request and who show their ability in keeping a several months' accurate log of stations. If our readers will co-operate with the DX Editor in this way, we feel we can have the finest DX department possible and one that should be of great value to DX short-wave fans the world over.

Daylight Saving Time

It will be noted that our time schedules as published on the opposite page are given in E. S. T. rather than in Daylight Saving Time. Anyone living on the Atlantic Seaboard and running on D. S. T. will add one hour for local time. This will make our schedules start with 6:00 o'clock D. S. T. The reader can fill in these changes in the space left for local time.

Official Short-Wave Schedules

We have received an official communication from Le Directeur du Service de la Radiodiffusion regarding their schedule. "The Government station Radiodiffusion Coloniale (Pontoise) will be on the air with a broadcast to Indo China from 8 to 11 E. S. T. daily on 19.68 meters. They will broadcast to Madagascar from 11:15 a. m. to 1:15 p. m. E. S. T. daily on 25.2 meters. It will be on the air to Sénégal, Soudan, French Equatoriale Africa, North America and South America from 3 to 5 p. m. E. S. T. daily on 25.6 meters. They will broadcast a program to Canada and South America from 9 to 11 p. m. E. S. T. daily on 25.6 meters."

An official from the Danish station says that their announcements are as follows: "Kobenhavn, Kalundborg og Danmarks Kortbolgesender" but the announcement at 1:00 p. m. is "God Aften, her er Pressens Radioavis". The station OXY at Skamlebaek will be on the air from 1 p. m. to 6:30 p. m. on weekdays on 31.51 meters in the future. They are now on at this time, temporarlly on 49.5 meters. They go off the air from 2 to 3 p. m. E. S. T. on Sundays as England uses this wavelength during that period.

A communication from Radiodifusion Ibero-Americana states that station EAQ will be on the air during the periods shown in this month's time schedule.

A communication from the officials of the U. S. S. R. at Moscow states that station RV59 will be on the air daily from 3 to 5 p. m. E. S. T. on a wavelength of 50 meters. Station REN will be on the air from 2 to 3 p. m. and 4 to 5 p. m. daily E. S. T. on a wavelength of 45.38 meters.

A communication from L'Office Des Postes, Des Telegraphes et des Telephones states that the station at RABAT, Morocco, is on the air from 7:30 to 9 p. m. E. S. T. on a wavelength of 23.38 meters on Sundays and holidays and from 3 to 5:30 p. m. E. S. T. on a wavelength of 32.26 meters on Sundays and holidays. In the near future the wavelength of the latter program is to be changed to 37.33 meters. An announcement will be made regarding this change, over the air.

An official communication was received from the Compañia Internacional de Radio stating: In regard to stations LSX and LSN these stations are not operating on any basis that would be of interest to ordinary listeners. They say "We are only operating on fixed schedules with commercial telephone channels and 90% of the time we are using secrecy or scrambling devices which completely spoil reception for any amateur."

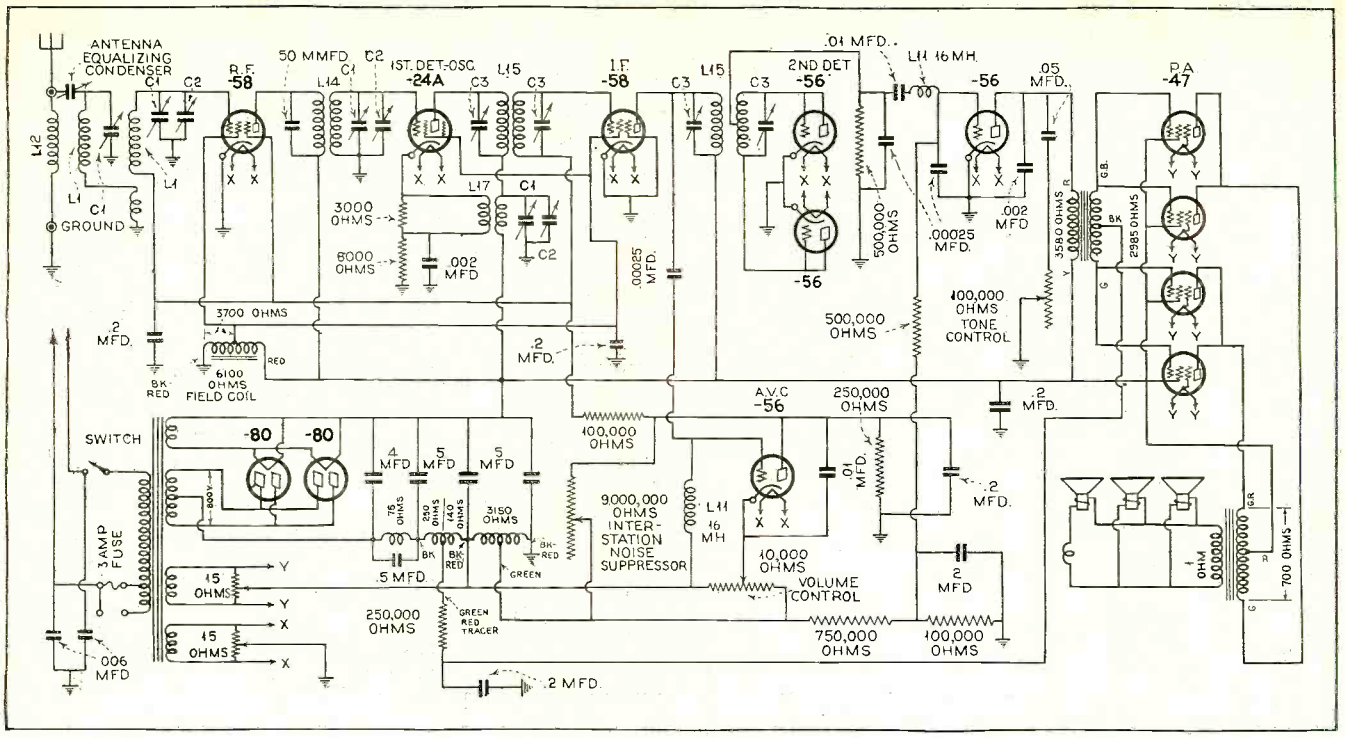
Reception in Maine

My set is built from a plan described in RADIO NEWS by Chesley Johnson. Listed below are the best short-wave stations: W8XK, EAQ, W2XAF, GSC, GSB, W9XF, W9XAA, GSA, W3XAU, W1XAL, VE9GW, VE9DR, VE9DN. The last station is at Montreal, Canada, on 49.96 meters. I also get station XER, Mexico, on 735 kc. I have had one station in Japan on 1111 kilocycles. I understood him to say JFBK. Can anyone confirm this? R. I. Keeler, West Scarboro, Maine.

A Report from Hamilton, N. Y.

Mr. H. S. Bradley reports CTIA coming in good this month. He also reports that DJC

(*Continued on page* 63)



TECHNICAL AND OPERATING DATA ON MODERN

Receiver Performance

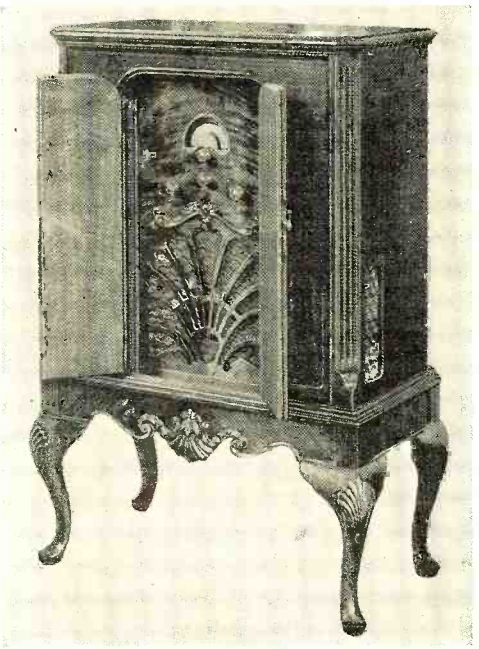
SPARTON "TRIOLIAN" MODEL 28

By the **Technical Staff**

THIS Sparton model is an unusual one in a number of respects, and places special emphasis on the handling of the signal at audio frequencies. The second detector employs two type –56 tubes as push-pull diodes. The output of these being fed through a type –56 amplifier stage into a group of four type –47 pentodes operating in push-pull parallel and constituting the power output stage.

One of the very special features of the receiver is the loudspeaker system which consists of three full dynamic speakers, pitched at different frequencies to give full depth and color in the reproduction of music and speech. These three speakers are mounted on a tri-plane baffle as shown in one of the photographs. This results in even distribution and diffusion of sound which helps the listener to get away from the impression that the music is coming from a loudspeaker.

A superheterodyne circuit is employed and it is rather unusual in that it employs only three tubes which perform the functions of one r.f. stage, first detector, oscillator and intermediate frequency amplifier. Although only three tubes are employed in these circuits, there are seven tuned r.f. and i.f. circuits and, adding the oscillator circuit, eight tuned circuits to provide the necessary selectivity. Two of these tuned circuits are ahead of the r.f. tube.



The Receiver in Brief

Manufacturer's Model: Sparks-Withington; Sparton "Triolian" Model 28.

Tuning Range: 200-550 meter broadcast band.

Tubes: One type –24A, four type –47, four type –56, two type –58 and two type –80.

Power Source: 110 volts, 25–60 cycles.

Speakers: Three dynamic speakers totaling 155 square inches of diaphragm surface, arranged in an arc for equalized distribution of sound.

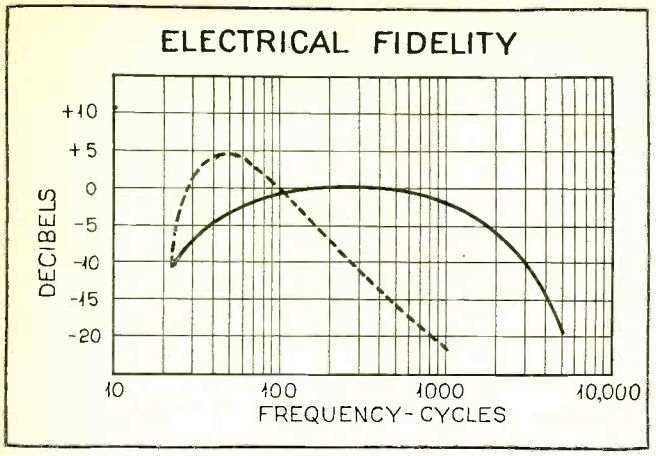
Controls: Combination a.c. switch and volume control (lower left), inter-station noise suppression (lower center), tone and static control (lower right) and main station selector knob.

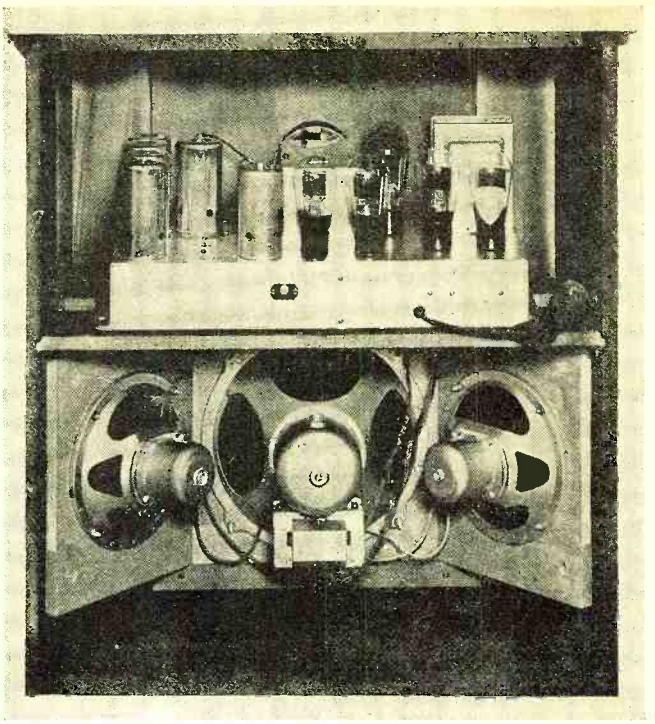
Features: Exceptional volume due to use of four power output pentodes. Triple speakers. Double shields on all radiating parts. Copper coil shields. Built-in power line filter. Automatic volume control. Manual inter-station noise suppression system. Duo-linear second detector. Manual tone and static control.

Operating Characteristics

Sensitivity: The sensitivity characteristic curve shows the signal in microvolts required to provide an output of 50 milliwatts. This is plotted against frequency. The curve shows a degree of sensitivity ranging from .9 microvolt at 540 kc. to a minimum sensitivity of approximately 3 microvolts at 1700 kc. The average sensitivity throughout the band appears to be about 2.2 microvolts.

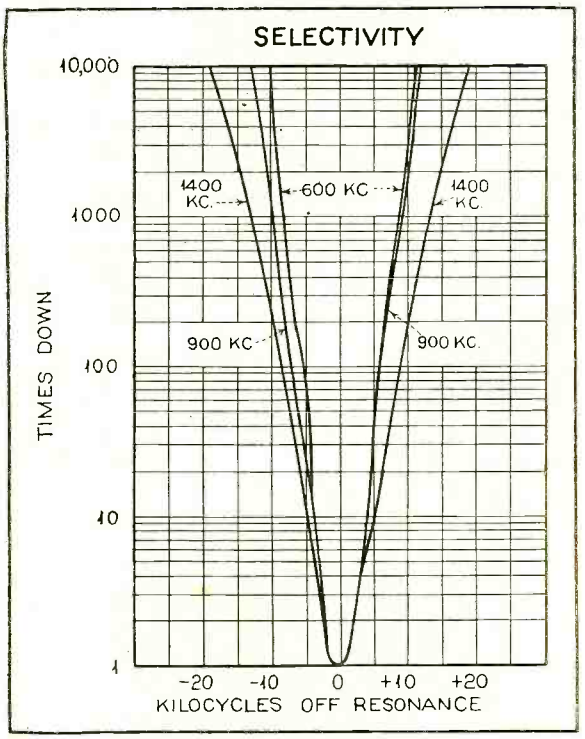
Selectivity: The selectivity characteristic of this Sparton model is





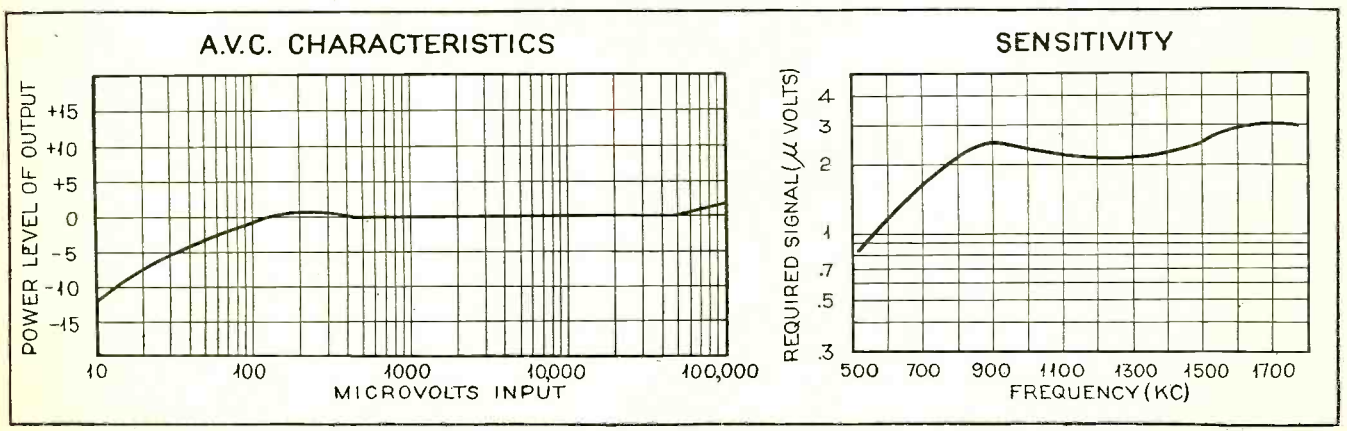
plotted in the usual form. Information is not available as to the modulation percentage employed, but is assumed to be normal standard of 30%. A rather wide variation in selectivity is obtained at different frequencies, varying more or less directly with the sensitivity of the receiver at each frequency. Thus at 600 kc. the sensitivity is nearly maximum. 10 kc. selectivity is provided to approximately 4500 times down. At 1400 kc. this same degree of selectivity obtains to approximately 175 times down. Inasmuch as this receiver is primarily a general purpose broadcast receiver and not one especially designed for DX work, this degree of selectivity is adequate, as is also the sensitivity shown. As a matter of fact, the average sensitivity of 2.2 microvolts is sufficient to permit very satisfactory long distance reception and for ordinary reception purposes has a certain advantage in that the inter-station noise will be less than would be the case with a receiver having a higher degree of sensitivity.

Fidelity: Measurements upon which the fidelity characteristics are based were made with the receiver tuned to 1000 kc. The curve shows the electrical fidelity from antenna to the receiver output but does not take into consideration the triple speaker characteristics. We have no definite information on the characteristics of these speakers, but it is logical to assume that they have been selected to compensate for the drooping electrical fidelity characteristics at the higher frequencies. The electrical fidelity characteristic shows reproduction to be flat within plus or minus two db. from 45 cycles to 1600 cycles with the tone control set at "high." The broken line indicates the electrical fidelity with the tone control set at "low." The great difference between these two curves indicates a wide degree of tone variation at the command of the listener through the medium of the manual tone control on the front panel.

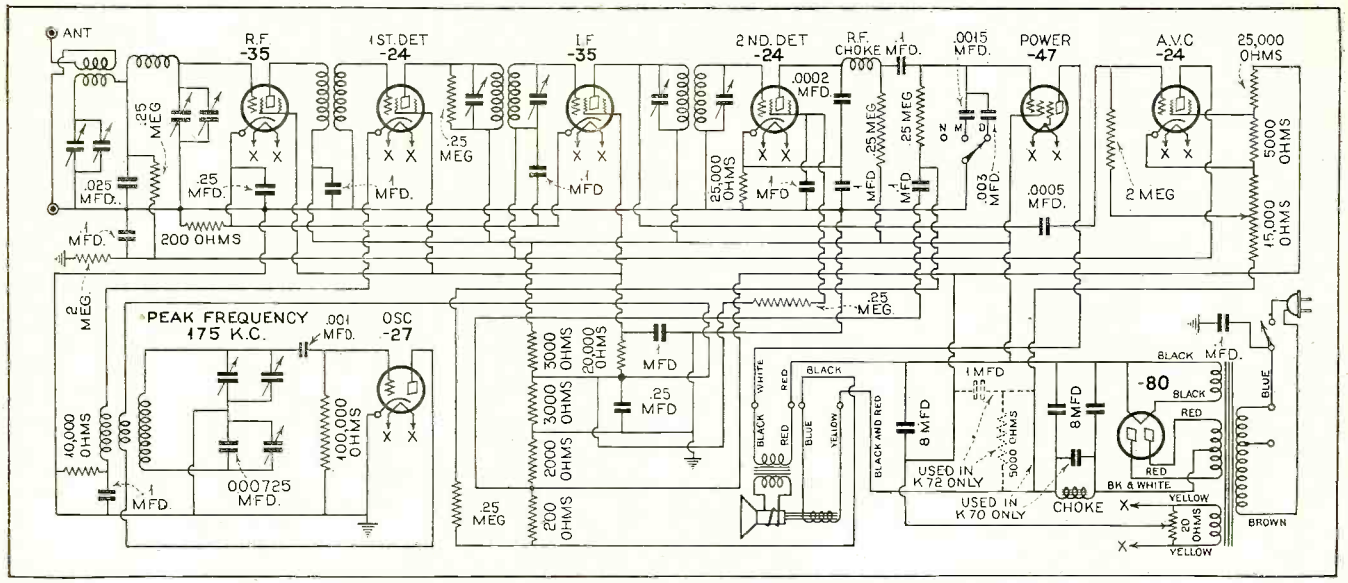


A. V. C. Characteristic: In this chart the zero db. level watts and this level is maintained between plus or minus 2 db. represents an output of 12.8 from all signal inputs between 80 microvolts and 100,000 micro-volts. This range covers substantially all normal reception and the curve indicates that all stations from powerful locals to semi-distant ones will be heard at the same volume level. This range is sufficient to very largely compensate for any fading in the reception of semi-remote stations. The output of 12.8 watts is rather unusual for a broadcast receiver employing a class A power output stage, and is

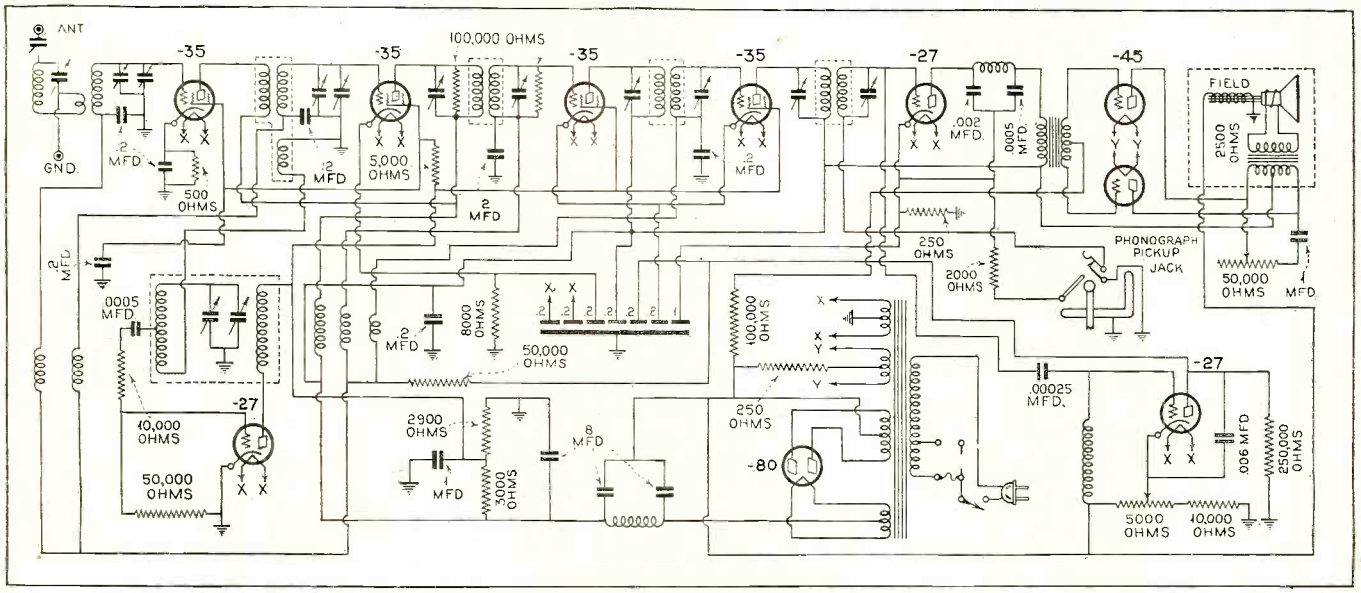
(*Continued on page 62*)



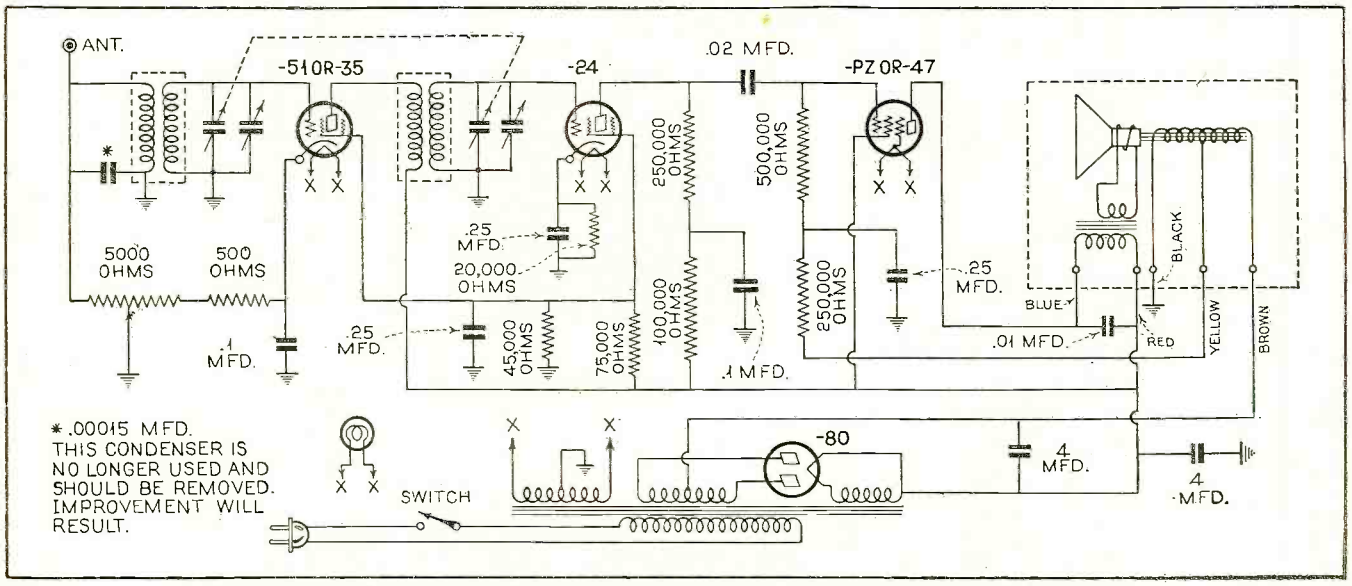
Service Data for Servicemen



KOLSTER-INTERNATIONAL RADIO MODELS K-70—K-72

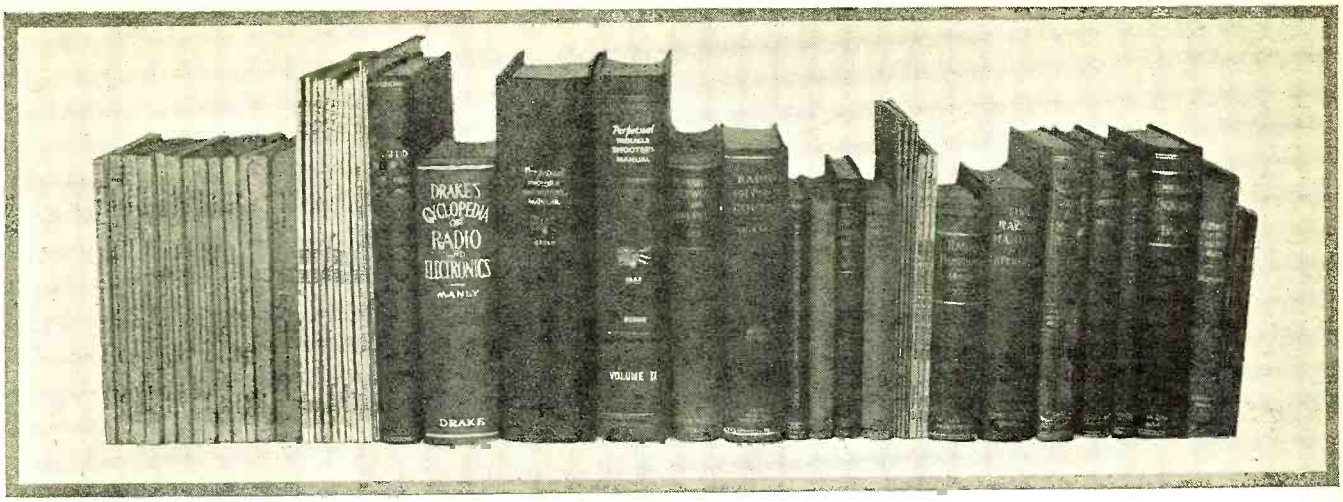


SPARTON MODELS 25 AND 26—SUPERHETERODYNE



STEWART-WARNER MODELS R-101-A and R-101-B ("METROPOLITAN" MIDGET)

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



Technical Review

RADIO SCIENCE ABSTRACTS

Radio engineers, laboratory and research workers will find this department helpful in reviewing important current radio literature, books, Institute and Club proceedings and free technical booklets

Conducted by

Joseph Calcaterra

High-Frequency Measurements, by August Hund. First Edition. McGraw-Hill Book Co. 1933. Engineers, experimenters and students will no doubt welcome this new text on radio-frequency measurements. The book distinguishes itself from others on the same subject by a more thorough and complete treatment. Several little-known measuring devices are described which will be new to the average reader. Also, by omitting many of the mathematical proofs, a greater territory could be covered in a smaller space. The first chapter contains fundamentals of electrical circuits. The usual equations for oscillatory circuits and coupled circuits are shown, but there are a few unusual features. Under the heading: Summation and Multiplication of Sinusoidal Time Variations of Different Frequencies, appear some conclusions which do not agree with other text books. By mathematical analysis, the author shows, that when two voltages of different frequencies are impressed on the same current, the "resultant voltage consists of a part of mean frequency $\frac{f_1 + f_2}{2}$ whose amplitude fluctuates in step with the difference frequency $f_1 - f_2$, etc." This mean frequency reverses its phase at every cycle of $f_1 - f_2$ and therefore cannot be detected with a wavemeter. "Notes on Shielding" is another subject of interest. The change in impedance of coil due to shielding is calculated. The most effective thickness for the shield is also derived. Chapter II deals with high-frequency oscillators and other useful apparatus, including the multivibrator, oscillographs, differential bridges and attenuation boxes. Then follow chapters on the determination of minute currents, voltages frequency, capacitance self-inductance, mutual inductance, effective resistance, power, losses, decrement, phase difference, etc. Final chapters deal with ferromagnetic measurements, tube measurements, modulation measurements, determination on aerials and lines, on wave propagation, on piezo-electric apparatus and miscellaneous measurements. The chapter on voltage measurements contains an unusual amount of useful information on tube voltmeters and harmonic analyzers. Modulation measurements described do not only apply to amplitude modulation but also deal with phase- and frequency-modulation.

Radio operating questions and answers, by A. R. Nilson and J. L. Hornung. Fifth edition. McGraw-Hill Book Co. 1933. The new edition contains much new material on broadcast transmission. Some of the questions are answered in considerable detail. For instance, an explanation of how to change the frequency of a broadcast transmitter, takes five pages. The book is intended for those who are preparing for one of the many radio-operators licenses, including amateur, commercial (telegraph and telephone), aircraft, etc. It consists of a list of hundreds of questions such as may be asked by the radio supervisor and their correct answers, with diagrams. Apart from the questions, the fifth edition now contains so much material that it nearly constitutes a textbook on radio theory, operation, maintenance and radio regulations. Sections are devoted to the various branches. So there is a chapter for amateurs, airplane operators, tube transmitters, arc transmitters, broadcast transmitters, etc.

Here is a question which has stumped many a would-be operator:

Ques. 121. What is meant by impact excitation?

Ans. This phenomenon is also termed *shock excitation,* and designates a method of producing free alternating currents in an excited circuit in which the duration of the exciting current (the impact) is short compared with the duration of the current in the excited circuit. In a circuit of this kind there is very little reaction between the circuits, and, consequently, it produces a lowly damped wave train.

Abstracts of Four Articles in Electrical Engineering for March, 1933

Relay Systems Utilizing Communication Facilities, by J. H. Neher. The article describes several methods of protection for power lines. The systems used are: the d.c. telegraph, the low frequency rectified a.c. pulse telegraph, carrier-current and voice-frequency telegraph.

A New Electronic Recorder, by H. L. Bernarde and L. J. Lunas. A recording pen requires more power than indicating instruments can provide. The electronic recorder contains an amplifier and pilot elements to synchronize the pen and the original measuring instrument.

Vertically cut Sound Records, by H. A. Frederick and H. C. Harrison. A discussion of new researches in the recording of sound by the vertically cut record. The result is such that: noise has been reduced, volume range increased, frequency range increased and playing time increased.

A Method of Control for Gas-filled Tubes, by Carrol Stansbury. Showing several examples of control by the condenser discharge method which has proved very satisfactory.

A Paper from the Proceedings of the Radio Club of America, April, 1933

The Emission Valve Modulator for Superheterodyne Receivers, by Harold A. Wheeler. A discussion of several methods of employing a single tube as detector and modulator. Circuits are shown for the use of a screen-grid tube, a pentode and finally for the new "hexode".

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

Continuous Kennelly-Heaviside Layer Records of a Solar Eclipse, by H. R. Mimno and P. H. Wang. Two models of a new type of apparatus which makes a continuous automatic record of the varying heights of

the Kennelly-Heaviside layers over a long period of time are described in this paper. One model is designed for stationary use while the other is for portable use.

Observations of the Effective Height of the Kennelly-Heaviside Layer and Field Intensity During the Solar Eclipse of August 31, 1932, by G. W. Kenrick and G. W. Pickard. This paper gives the results of observations made on frequencies of 1640, 3492.5 and 4550 kilocycles. The nature of the field intensity variations observed is in good agreement with those anticipated as a result of observations during the eclipse of 1925.

Experiments on Electromagnetic Shielding at Frequencies Between One and Thirty Kilocycles, by Walter Lyons. A method used in measuring the ratio of magnetic field intensities within conducting cylindrical and spherical shells to that outside, values being given for various frequencies between 1,000 and 30,000 cycles per second of the exciting field and various lengths of radii, is described in this paper. The derivation of shielding formulas is explained and the agreement between theory and observation is pointed out.

Graphical Determination of Performance of Push-Pull Audio Amplifiers, by B. J. Thompson. This article describes a relatively simple method of determining graphically the performance of push-pull audio amplifiers which takes into account the coupling between the tubes through the output transformer. The method is equally applicable to class A or class B conditions.

Theory of the Detection of Two Modulated Waves by a Linear Rectifier, by Charles B. Aiken. A mathematical analysis of the detection, by a linear rectifier, of two modulated waves, is developed in this paper. The cases of identical and of different programs are both considered. The effect of noise background on the reception of signals on shared channels is discussed and reduction of "flutter" effect and distortion, made possible by the use of a linear rectifier are considered. Heterodyne detection and "masking" effects are also discussed.

Review of Contemporary Literature

Two New Oscillators for the Radio-Frequency Range, by C. T. Grant. Bell Laboratories Record, April, 1933. This article gives the circuit and constructional features of a new push-pull high frequency oscillator designed to cover the range from 50 to 3,000 kilocycles. It delivers an output of approximately 30 milliamperes into a load resistance of 100 ohms and has a harmonic content of less than three percent and very stable operating characteristics under normal operating conditions.

World Wide Short-Wave Reception with the AC5W-58 and DCSW34, by James Millen. Published by the National Co. A pamphlet containing much useful information on the properties of short waves, aerial systems, transposed lead-ins, etc. There are several graphs and a list of short-wave stations.

The Reproduction of Orchestral Music in Auditory Perspective. Published by Bell Telephone Laboratories. An account of a demonstration of musical reproduction in perspective whereby each instrument is heard distinctly and in its correct location.

Free positive electrons. Science, February 24, 1933. Dr. Carl D. Anderson, of the California Institute of Technology has discovered the existence of positive electrons from cosmic-ray studies. The new particle will be named "positron".

The Neutron. Science, March 3, 1933. Dr. Franz N. D. Kurie, after experiments on atomic collisions in which neutrons take part, concluded that the neutron is not a mere combination of positive and negative charges but is a fundamental particle itself.

Loudspeakers Summon Physicians in the New York Hospital. Bell Laboratories Record, April, 1933. This article gives a description of the general circuits and equipment designed and installed in the New York Hospital for paging physicians.

Mixer Circuits That Work, by H. H. Scott. General Radio Experimenter, March, 1933. This article explains the theory and uses of mixer circuits, the selection of the circuits best suited for various mixer applications, the importance of impedance relations and the electrical and mechanical features which must be considered in selecting suitable controls and accessories. Diagrams of a number of mixer and control circuits are given.

Commercial Noise Measurement, by H. H. Scott. General Radio Experimenter, March, 1933. A description of the new General Radio Noise Meter designed to fill the need for an inexpensive noise meter to fill many commercial requirements of machinery manufacturers, sound-proofing and acoustical engineers.

Iron-Content Cores for High-Frequency Coils, by Alfred Schneider. The Wireless Engineer & Experimental Wireless, April, 1933. This article describes the theory and construction of a new core material, "Ferrocart" designed to eliminate to a very large extent the losses usually resulting from the use of iron-content cores in high frequency coils.

A Magnetron Oscillator for Ultra-Short Wavelengths, by E. C. S. Megaw. The Wireless Engineer & Experimental Wireless, April, 1933. This article describes the characteristics and performance of a magnetron oscillator of improved design, primarily intended for operation on wavelengths of from one to 10 meters, but which can be used on shorter or longer wavelengths if desired. Its output is 40 to 50 watts on wavelengths down to three meters and falls off to about 10 watts at one meter.

The Cause and Elimination of Night Effects in Radio Range-Beacon Reception, by H. Diamond. Bureau of Standards Research Paper No. 513. This booklet describes a new antenna system for use at radio range-beacon stations which eliminates the troublesome night effects hitherto experienced in the use of the range-beacon system.

Regulation of Radio Broadcasting, by Manuel K. Berman. Boston University Law Review, Vol. XIII, No. 1. A discussion and analysis of the historical background and present status of the regulatory powers exercised over radio broadcasting by the government and the necessity for such regulation. The considerations affecting the granting or refusal of new licenses or renewals to applicants are listed and explained.

The Time to Re-Style Radio Sets Is Now. Electronics, April, 1933. This article points out the importance of styling in increasing sales by the tremendous force of "eye-appeal," and cites instances of the increased sales records made in other fields by re-styled products.

Aids In Manufacturing Electronic Apparatus. Electronics, April, 1933. This article discusses in detail the important factors which must be taken into consideration in the design and manufacture of radio apparatus to attain highest manufacturing efficiency and low cost of production.

Considerations on Detector-Output Tube Systems, by J. R. Nelson, Electronics, April, 1933. This article points out the features which it is desirable to incorporate in tubes designed for use in receivers which require a single tube to perform several functions. Such receivers, such as the two-tube superheterodynes designed to use a single tube as a detector-oscillator and another tube as a detector-output are now being seriously considered where compactness and low cost are important.

Back to Quality in Radio Receivers. Electronics, April, 1933. An editorial on the effect which the skimping required to produce cheap sets and parts has had in lowering the quality of performance of radio receivers, with suggestions for improving quality of reception.

How to Get Copies of Articles Abstracted in This Department

The abstracts of articles featured in this department are intended to serve as a guide to the most interesting and instructive material appearing in contemporary magazines and reports. These publications may be consulted at most of the larger public libraries, or copies may be ordered direct from the publishers of the magazines mentioned.

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Review of Technical Booklets Available

1. *Radio Parts and Sets 1933 Spring and Summer Catalog No. 54.* A catalog of 152 pages, issued by the Wholesale Radio Service Co., one of the oldest mail order houses. The catalog contains illustrations, descriptions, specifications, list and net prices of a variety of radio parts, tools, replace-

ment items, receiver chassis, complete sets, public address systems and electrical merchandise required by dealers, servicemen, set builders, amateur and commercial operators, experimenters and engineers.

2. *1933 R. F. Parts Catalog.* An 8-page folder containing specifications on the entire line of Hammarlund variable and adjustable condensers, r.f. transformers, sockets, shields and miscellaneous parts for broadcast and short-wave receivers, complete short-wave receivers and transmitting variable condensers.

4. *A 15 to 200-Meter Comet "Pro" Superheterodyne.* A description of the outstanding features of the Hammarlund-Roberts High-Frequency Superheterodyne designed especially for commercial operators for laboratory, newspaper, police, airport and steamship use.

5. *A 1933 Volume Control, Fixed and Variable Resistor Catalog.* This 12-page catalog, issued by Electrad, Inc., gives data on standard 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). Many revisions and additions to the Electrad 1932 line are included.

7. *Rich Rewards in Radio.* This 64-page book is filled with valuable and interesting information on the growth of radio and the opportunities existing in the fields 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. The book also contains detailed information on the complete home-study courses in radio and allied subjects offered by the National Radio Institute. This book is available only to 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.* This 16-page catalog gives 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.

10. *Information on the Suppression of Motor Radio Noises.* This interesting and useful folder of the International Resistance Co. gives information on how to overcome motor-generator, ignition coil, interrupter and spark plug noises in automobile radio installations.

16. *RMA 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. It also contains a list of the most commonly used values of resistors with their corresponding color designations. A catalog of Lynch products is included.

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. Details are given on how to obtain, without charge, a copy of the 64-page Centralab Volume Control Guide for Servicemen.

25. *Noise-Reducing Antenna Systems.* This folder describes in detail the two types of noise-reducing systems perfected by the Lynch Mfg. Co. for both broadcast and short-wave reception. The transposition type can be used on both long and short waves and is specially adapted for use in connection with all-wave and amateur receivers. The shielded transmission type is especially suited for use on broadcast receivers.

29. *Practical Radio Engineering.* This 32-page catalog gives the details on the courses offered by the Capitol Radio Engineering Institute of Washington, D. C., to fit the requirements of professional radiomen, radio servicemen, operators and technicians, who are ambitious to get into the higher paid positions in radio reserved for those with advanced training. Three types of courses are offered: (1) an intensive 9-months full-time resident course requiring regular attendance at classes; (2) a complete home-study course which can be mastered entirely at home and (3) a combination home-study and post-graduate resident course consisting of the regular home-study course followed by a 10 weeks practical training at the school with regular full-time attendance at classes. (Please do not write for this catalog unless you are interested in taking up a course on radio.)

34. *Service Man's Replacement Volume-Control Chart.* A revised 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. Contains specifications for over 2,000 different receiver models. A handy chart which should be in every serviceman's kit.

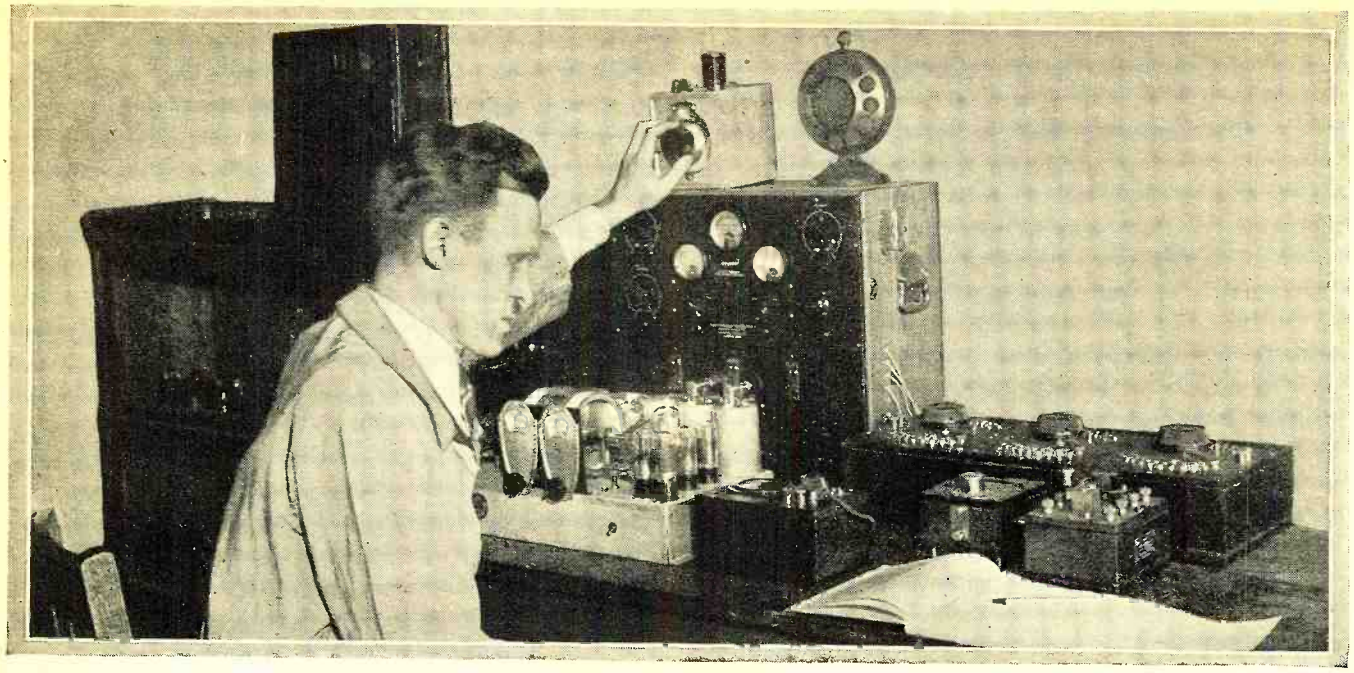
39. *Radio Servicing and Radio Physics.* A 4-page folder which gives descriptions and tables of contents of two of the most complete, easily understood and inexpensive books on every phase of radio. The books are written by A. A. Ghirardi and Bertram M. Freed and should be in the libraries of every radio student, experimenter and serviceman. The fact that they are used as standard texts by many radio schools and that chapters have been reprinted in RADIO NEWS Magazine is an indication of their value.

40. *Resistor Indicator.* A description of an instrument designed by the International Resistance Co. to enable servicemen and other radio men to determine the exact resistance value of a defective resistor without the use of meters, wiring diagrams or specifications of the receiver circuit. This small, handy instrument should be in every serviceman's kit.

41. *How to Build the Economy "Eight".* A folder prepared by Wholesale Radio Service Co. giving 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. Servicemen and set builders can put in their spare time to advantage building and selling these sets.

42. *How to Build Useful Servicing and Testing Instruments With Simple, Standard Meters.* This bulletin gives data, with diagrams, to show 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. and gives both the theoretical and practical data

(*Continued on page* 47)



With the Experimenters

Improving Tone Quality of Receivers, Higher Mercury Vapor Rectifier Output, Tube "Short" Tester, Handy Screw Holder, Impedance Matching Kink, How to Make a Simple Output Meter, Improved Time Delay Relay

Conducted by

S. Gordon Taylor

Audio Tricks

Most sets have ample volume but quality, especially in older receivers, is sometimes another matter and a way to correct their deficiences is in the audio amplifier.

One well known dodge to make a radio set go down and dredge up the low notes is to connect a fixed condenser of .00025 to .008 mfd. across the secondary of the audio tranformer as shown (a) of Figure 1. This does it very nicely, but it of course cuts the signal strength quite appreciably since in the higher values of condenser capacity considerable audio frequency is by-passed.

A better scheme is shown (b) Figure 1. The condenser is connected between the plate and grid connections on the transformer. This makes the transformer work as an impedance coupling unit and as a transformer as well. The result is something that apparently has good features of both and sounds very well if the condenser is chosen properly. The condenser size cannot be predicted as it will vary with the transformers and tubes used. Try .006 mfd. as a beginning step. The advantage of this connection lies in the fact that it will increase the low frequency response as well as cut off the high frequencies.

If the set then shows a tendency to "boom" on any particular frequency, connect a resistor of about 100,000 ohms across the secondary and the trouble will be eliminated; or it may often be stopped by choosing another value for the condenser.

This brings us to the next trick. Even very excellent and high priced transformers sometimes may be improved by connecting 100,000 ohm resistors across each the primary and secondary. There is no appreciable loss in volume but a flatter frequency response results.

Some of the earlier a.c. sets had quite poor audio transformers in them, usually in order that the hum from the power pack would not get through. The hum may often be removed quite cheaply by connecting an electrolytic condenser from the center of the filter choke to the ground. After the hum is removed by this method, or some other such as using the new tubes, the low frequency response may be improved by one of the schemes mentioned above.

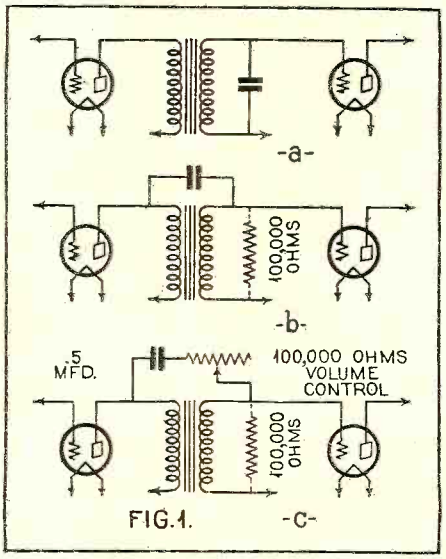


FIG.1.

A tone control of a little different type is shown at (c). It uses the same principle mentioned previously together with the expected condenser and variable resistance. It will bring the tone down very nicely, acting as both a low pass filter and coupling condenser. This system may be substituted for the cut and try system formerly recommended; although it takes a little more apparatus, it may be quickly and easily adjusted to any desired value.

F. C. EVERETT,
Delta, Ohio

Increasing Mercury Vapor Rectifier Output

By connecting a condesner of one microfarad capacity or higher (the best value can be found by trial) and of a proper voltage rating, between each of the terminals of the high voltage winding and its centertap of the transformer in a rectifier circuit using a full-wave mercury vapor type rectifier or by connecting a condenser across the winding supplying a half wave rectifier, the output voltage will be increased. The reason for this is that the current in a circuit using a mercury vapor rectifier does not flow until a certain voltage is reached which will cause ionization to take place within the tube. The current flow is then very high for a short time and then it gradually falls off with the voltage during each half of the cycle. This high current causes a large voltage drop within the winding and as a result the output voltage of the rectifier is greatly lowered. By inserting the condensers which I have mentioned they will become gradually charged during each half of the cycle and as a result a much greater current can flow during each time the rectifier is ionized without causing as large a voltage drop in the high voltage winding of the transformer because the condensers will supply some of the current which they have stored up during the first part of the cycle.

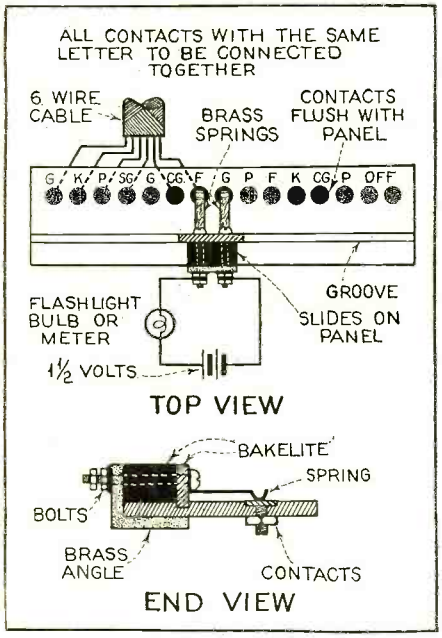
Care should be used to see that the re-

actance of the condenser used is not so low as to cause an excessive current to flow through the winding across which the condenser is connected.

LEONARD D. POOR (W1DGH),
Milford, N. H.

Tube Short Tester

Herewith are plans for a radio tube short tester which may be wired to the sockets of a set tester. The slider must be off con-



tact while the set tester is in use. A 1½ volt battery, and a flashlight bulb or a meter may be used as the indicator.

AUGUSTINE MAYER,
Akron, Ohio

Simple Screw Holder

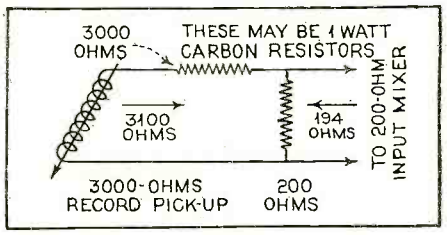
The photograph shows a little device for which I find many uses, but I made it especially for Atwater Kents 37-40. When replacing the can over the power pack of the -37's without taking it out of the cabinet, bend the screw holder at right angle, place the screw between the prongs and you can set it right in place. Give it a little start

with a screw driver, slip off the holder and tighten it up. When replacing the screws in each end of the chassis the top one is easy, by laying the receiver on its face and with the holder straightened out you can set the other two right in place. If by chance you do happen to drop a screw it is easily picked up by this device and, if you are careful to get the washer between the head of the screw and the holder, you can retrieve it also. I used just a piece of baleing wire (hay wire) doubled it and caught the two ends in a vice then twisted it tight. With a pair of long-nosed pliers I shaped the prongs to hold the screw then clipped the ends off even.

GEORGE W. MOORE,
Joplin, Mo.

Impedance Matching Without Transformers

For best results and satisfactory quality, it is usually necessary to match impedances when connecting together audio-frequency apparatus. It is not always necessary to use a transformer for this purpose. Often the problem may be solved with the aid of an impedance-matching pad, or impedance tapering network, which can be quickly assembled from fixed resistors. For example, suppose that it is necessary to connect a 3,000-ohm phonograph pickup to a mixing panel with 200-ohm channels. The sketch



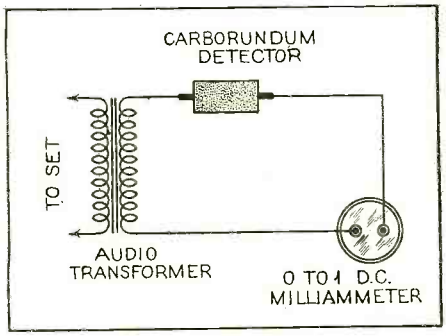
shows the method of connecting the two devices with the aid of a 3,000-ohm and a 200-ohm resistor. The same principle can be used, of course, for devices of other impedance values, remembering always that the *series* resistor points toward the higher impedance unit. While the impedances are not exactly matched (3,100 ohms facing pickup and 194 ohms facing mixer) the values are close enough for all practical purposes.

The method has the disadvantage that there is loss of power which amounts to approximately 17 decibels in the above example, while there is theoretically no loss when using a transformer. Fortunately most high-impedance pickups have a rather high output level, and the loss in the network is actually an advantage when working into the mixer, since it brings the level of the pickup down to something approximating the level delivered by the microphones to the other channels.

RALPH P. GLOVER,
Chicago, Ill.

Inexpensive Output Meter

I have something here which I believe will be of interest to many of the RADIO NEWS readers. This circuit shows how to make an output meter out of an ordinary 0 to 1



d.c. milliammeter, a carborundum detector and an audio transformer.

This simple arrangement works very well and can be made at a fraction of the cost of an expensive output meter.

J. WARREN FREDERICK,
Souderton, Pa.

Improved Time Delay Relay

In the September issue of RADIO NEWS, the author described a simple time delay relay working on the thermostat principle. This relay together with a power switch operated by an electro-magnet was installed on a "ham" transmitter for the purpose of delaying the application of high voltage to the plates of the rectifiers until the filaments have reached normal temperature. This is especially important in the case of mercury vapor rectifiers.

The main difficulty with the arrangement was that since the thermo relay remained in the circuit, it became quite hot and would not cool off quickly enough. The net result was that the thermo relay did not ade-

(*Continued on page 63*)

Radio Physics Course

LESSON NINETEEN—ELECTROMAGNETISM

By Alfred A. Ghirardi

A SIMPLE rule for determining the polarity of a solenoid is as follows:

"Grasp the coil with the right hand so that the fingers extend in the direction in which the current is flowing around each turn of wire; the extended thumb will then point toward the north pole." Figure 1.

This rule is sometimes called the Right-Hand Rule for solenoids. It should be remembered that the magnetic poles on a solenoid depend on the direction of the *current* through the coil and not on the direction in which the *coil is wound*. Attraction or repulsion exists between the poles of solenoids, just as it exists between the poles of permanent steel magnets.

Effect of Number of Turns

It is evident that since the magnetic field of force of each turn adds to that of the next turn, both in the center and around the outside of a solenoid, the more turns of wire the solenoid has, the stronger the magnetic field will be. The strength of the lines of force around each turn also depends upon the current flowing through it.

Cause of Magnetic Field Around a Wire

The magnetic field produced around a wire through which a current is flowing, is due simply to the electrons or negative electric charges moving through the wire. When considering static electricity (charges at rest), we found that bodies having like charges repelled each other, and bodies having unlike charges attracted each other. Electrons, being negatives charges, will repel each other. Also, electrons will attract a positive atom (positive ion). When electrons are in *motion* they produce forces in the space around them. These are the forces which we have learned to call *magnetic* forces. They are the forces which are responsible for the action which current-carrying conductors exert on compass needles, iron filings, etc. The passage of one ampere across any section of a wire means that 6.28×10^{18} electrons move past that section every second. The movement of these electric charges produces a certain amount of magnetic force outside of the wire. There is no perceptible displacement of the positive or neutral copper atoms. They are comparatively heavy and do not migrate, whereas the smaller, lighter electrons thread their way between them and progress with a steady average speed which is proportional to the applied e. m. f. which drives them.

The Electron Theory of Magnetism

We are now prepared to digress for a few moments from our study of electromagnetism, to find out just why some materials can be magnetized.

Shortly after Oersted discovered (1819) that exactly the same effects obtained from permanent magnets could be obtained from currents flowing in coils of wire, Ampere advanced the hypothesis that the observed actions of magnetism are to be accounted for in terms of the properties of electric currents. In the light of our modern knowledge and the electron theory, we now know that his ideas were substantially correct, and we are able to explain quite satisfactorily just what causes the mysterious magnetic forces in lodestone and iron which puzzled the ancients for hundreds of years.

The idea that a magnet is made up of innumerable smaller magnets of molecular dimensions, was put forward by Ampere over 100 years ago to explain the fact that however much a magnet is broken up into smaller pieces, each fragment is a complete magnet with a N and S pole. He even went further than this and offered an explanation in terms of molecular current orbits that is remarkably in accordance with our present theories on the subject.

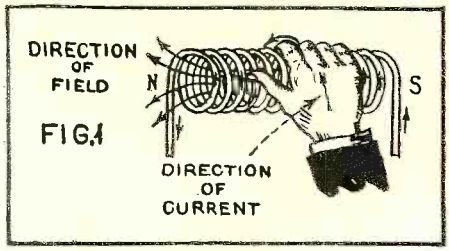


Figure 1. Right-hand rule for determining the magnetic poles of a solenoid coil

Every atom of a substance is supposed to consist of one or more electrons revolving in more or less circular orbits around a center nucleus. For simplicity we will consider a single electron in an orbit. Now an electron of charge q (coulombs) revolving in a circular orbit (see (A) of Figure 2) at a frequency of f revolutions per second, is equivalent to a current of qf amperes flowing around the same orbit or around a similar circular wire as shown at (B) of Figure 2; (since a current of one ampere is equal to a flow of one coulomb of electric charge per second). (The atoms of higher atomic weights are thought to have many such electrons rotating in each orbit.) A magnetic force or field is thus created by each revolving electron just as a magnetic field is created by a movement of electrons (electric current) through the single-turn loop of wire shown in (A) of Figure 2. (When applying the right-hand rule for determining magnetic poles, remember that the direction of current flow is opposite to that of electron flow.)

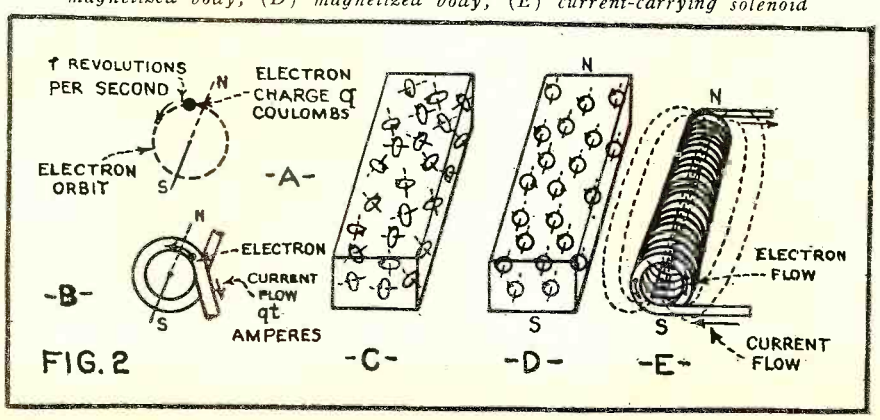
Magnetic substances contain one or more electron orbits, whose magnetic effect is not neutralized by oppositely directed orbits. When an external magnetizing force is applied to a magnetic substance it acts on the magnetic force produced by each revolving electron and thus tends to turn these atoms so that the planes of their electron orbits are parallel to each other and perpendicular to the direction of the magnetizing force, the electrons all rotating in the same direction as shown in (D) of Figure 57. The magnetic effects produced by the revolving electrons thus reinforce each other and become effective at points outside the body. (The atoms may be assumed to turn somewhat from their previous random distribution.) Thus the body as a whole exhibits the properties of magnetism. If a large number of the atoms are turned around by the magnetizing force as shown in the illustration, the resulting total magnetic force is strengthened, and we say we have a strong magnet. This is what occurs in the *ferromagnetic* substances.

It will be seen that the "electron theory of magnetism" is merely an extension of the "molecular theory of magnetism". In the former, we get down to the fundamental structure of the atom for our explanation of the magnetic effects, whereas in the latter we consider the action of the molecules each consisting of a number of atoms.

Magnetomotive Force

It is evident that the total magnetic flux (lines of force) depends upon the number of turns of wire as well as the current strength. In exactly the same way that we looked upon electromotive force (flow of electrons) through the electrical circuit, a force called *magnetomotive force* (M. M. F.) is looked upon as that which is responsible for the production of external magnetic effects in bodies. The magnetomotive force which produces the magnetic flux in a solenoid is created by means of the current flowing through the turns of wire in the coil. This quantity is really not a *force,* in any sense of the word. The name is not a good descriptive name and has no justification, except for the fact that magnetomotive force bears the same relation to

Figure 2. Electron orbits in (A) an atom; (B) a one-turn loop of wire; (C) unmagnetized body; (D) magnetized body; (E) current-carrying solenoid



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

the magnetic intensities along the path of the magnetism that electromotive force bears to the electromotive intensities at the various points along an electrical conductor.

The m. m. f. is directly proportional to the product of the current strength and the number of turns in a solenoid. If the current is expressed in amperes, the m. m. f. is expressed in a unit called the *ampere-turn*. To find the magnetomotive force of a coil (air core) in ampere turns:

Multiply the current in amperes by the number of turns on the coil, or

Magnetomotive force =ampere-turns=I×T.

For example, 6 amperes circulating around 25 turns of a coil (25 turn coil) produces an m. m. f. of 6×25=150 ampere-turns. Exactly the same m. m. f. would be produced by one ampere flowing through 150 turns, or 150 amperes flowing through one turn, or 15 amperes flowing through 10 turns, etc.; the product of the turns and current in each case being 150.

It is evident from the above, that when a magnet winding is to be designed to produce a certain value of m. m. f. there is a certain amount of choice possible for the number of turns and current to be used. It must be remembered that if the current is made large the wire must also be of large cross-section in order to carry the current satisfactorily without undue heating. If the current is small, a smaller size wire can be employed and more turns can be wound into a space. (See copper magnet wire table for turns per square inch of magnet wire.) However, the arrangement used in any case, is determined by the voltage and the current available for energizing the coil. For instance, a small magnet designed to operate directly from a 110 volt circuit would be wound with fine wire, so that its resistance would be high and the current

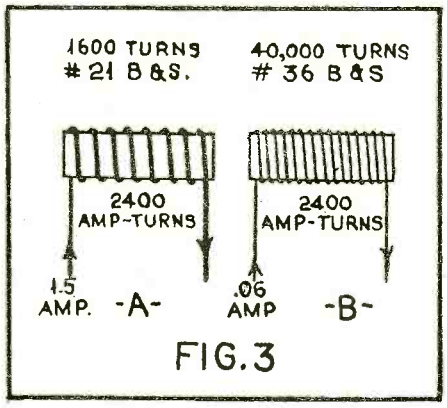


FIG. 3

requirement small, making it inexpensive to operate. Even though the current is small, considerable magnetizing force may be obtained due to the use of a large number of turns of wire. The same magnetic force could be obtained with fewer turns of coarse wire, but the resistance would be lower and more current would be taken from the source.

When only small values of current are available, a large number of turns of wire must be employed to obtain an appreciable amount of magnetism. In the magnet windings on a pair of high grade earphones for instance, the operating current is so weak that several thousand turns of very fine No. 40 or 50 enameled covered wire are employed. In the two electro-dynamic speaker field magnet windings shown in Figure 3, we have a very good illustration of the choice of proper wire size and number of turns to meet the operating conditions. At (A), is a representation of the winding for a certain make of speaker designed to obtain its field current from a source delivering about 1.5 amperes at 12 volts. This winding contains 1600 turns of No. 21 enamel covered copper wire. The m. m. f. of the winding is 1.5×1600=2400 ampere-turns. The winding at (B) is for a similar speaker designed to obtain its field current from a vacuum tube rectifier circuit which is able to deliver 60 milliamperes (.06 amps.) at 300 volts to it. To produce the same m. m. f. as the winding (A), this one contains 40,000 turns of No. 36 enamel covered wire. The m. m. f. is .06×40,000=2400 ampere-turns. Thus, the 1600 turn coil having 1.5 ampere flowing through it produces a magnetic field of the same strength as does the coil of 40,000 turns with .06 amperes flowing through it.

Technical Review

(*Continued from page* 43)

required to make all the calculations to convert or change the range or function of a given meter.

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 Jewel 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. Servicemen and experimenters, who have been working under the handicaps imposed by the use of analyzers which are no longer able to cope efficiently with the problems introduced by new tubes and receivers, will find this folder of great value. Special auxiliary units for increasing the usefulness of standard analyzers are also described.

44. *How to Add A Remote Control and Station Selector 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. The R. C. A. Victor automatic, remote-control unit used makes it possible to operate a set at distances up to 75 feet from the tuner. Information is also given on how to add a remote control unit to a P. A. tuner.

July, 1933
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What's New

A department devoted to the description of the latest experimenters, dealers and set builders will find

Conducted by The

Oscillator

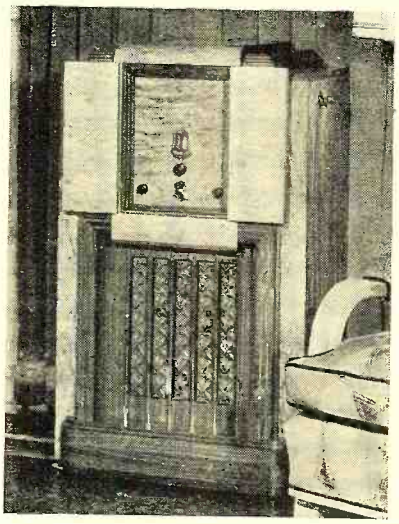
Description—This new portable "Acrocycle" model B service oscillator is a direct reading calibrated signal generator to produce frequencies from 100 to 1500 kilocycles. The instrument is designed to pro-

vide a steady modulated signal, pitched to a sound of approximately 200 cycles. The two dials combined provide a continuous scale of frequencies from 100 to 1500 kilocycles. Frequencies higher than 1500 kilocycles may be obtained by additional harmonics. The calibration from 100 to 200 kc. is 1 kc. per division, from 200 to 400, 2 kc. per division and from 400 to 1500, 10 kc. per division. All frequencies higher than 200 kc. are indicated as harmonics. The instrument is fully shielded and is self-contained with a –30 type tube and the necessary batteries for its operation. The oscillator, enclosed in the leatherette-covered carrying case, measures 10¼ inches by 6¼ inches by 4½ inches and weighs 8 pounds.

Maker—J-M-P Mfg. Co., Inc., 3417 Fond du Lac Ave., Milwaukee, Wisc.

An All-Wave Receiver in a Distinctive and Attractive Console Cabinet

Description—The Scott DeLuxe twelve-tube superheterodyne all-wave receiver is herewith shown enclosed in the new West-

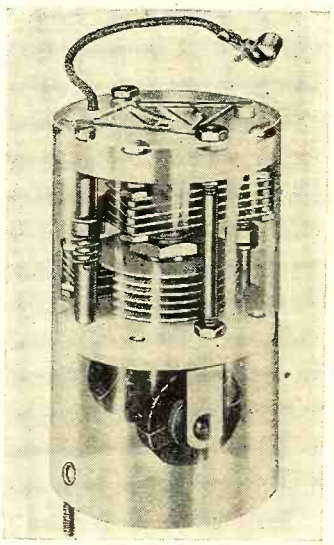


erly Grande model console cabinet. The modern design of this cabinet is very striking and it will be apparent that special care was taken to bring out the inherent beauty of the natural woods. The panels are made from Tasmanian oak and the top and upper front sections from curly and blistered maple. The grille and base are carved from American walnut and for ornamentation german silver pulls and chromium plated brass grille plates are employed. Great stress is laid on the sturdy construction of the cabinet and on the baffle area design, both of which help to effectively eliminate vibration and cabinet resonance. This console with the new Scott all-wave receiver, utilizing the new types of vacuum tubes and covering a wavelength from 15 to 550 meters, should answer the requirements of the radio enthusiast who desires a highly efficient set housed in a cabinet designed in the style of the hour.

Maker—E. H. Scott Radio Labs., Inc., 4450 Ravenswood Ave., Chicago, Ill.

Improved Air Dielectric Tuned I.F. Transformer

Description—The National air dielectric i.f. transformer has been completely redesigned so as to incorporate the following new features: a tuning range of 450 to 550



kilocycles, velvet vernier type micrometer tuning, Isolantite insulation, new constructional design which permits all peaking adjustments to be made at the top of the shield, new type of Litz wound coils and adjustable coupling. The double bearing condensers have self-locking rotors. Both rotor and stator plates are made of non-resonant aluminum material. Electron coupled beat-frequency oscillator units are available with velvet vernier knob tuning. The transformer is made for standard mounting. These improved i.f. transformers are standard equipment on the National Model AGS Communications receiver. The transformers may be had as optional equipment in other short wave receivers made by this same manufacturer. Hams and all short-wave enthusiasts will find great interest in these air dielectric tuned i.f. transformers for the high degree of selectivity they are designed to provide.

Maker—National Co., Inc., 61 Sherman Street, Malden, Mass.

In Radio

developments in radio equipment. Radio servicemen, these items of service in conducting their work

Technical Staff

Midget Electrolytic Condenser

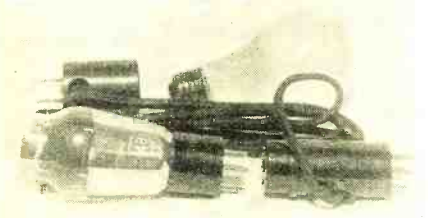
Description—A new line of small size electrolytic condensers, hermetically sealed in a one-inch round aluminum can. This type of condenser should find wide application in

the design of mantle type and motor car receivers as well as the larger and more expensive sets. The condenser is available in a large variety of capacities and d.c. working voltages. It is semi-dry, has a low power factor and is designed for long life. The metal container is the negative terminal, and where the can is of different potential from the radio chassis, insulating washers can be provided. The condenser illustrated is 8 microfarad capacity with a peak working voltage of 500 volts d.c. Its overall length is 4½ inches.

Maker—Dubilier Condenser Corp., 4377 Bronx Blvd., New York City.

Tube Adapter

Description—The old style tube checker can be brought up-to-date for checking the 25- and 30-volt type tubes by using the new No. 965 a.c. adapter. The –48 type tube has a 30-volt heater and it can be checked in a –27 type tube socket of any tube tester, by using an ordinary 60-watt 115-volt lamp in this series lamp socket adapter. With this same adapter it is also possible to check the –43 type tube with its 25-volt heater,

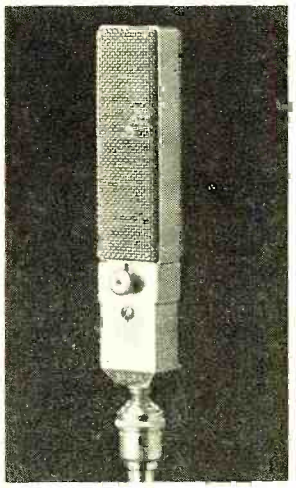


by employing a 40-watt 115-volt lamp. This company also announces the No. 965-25Z5 type adapter which checks separately both plates of the new 25-volt double plate heater-type rectifier tube.

Maker—Alden Manufacturing Co., Brockton, Mass.

Crystal Microphone

Description—The model G-20, Grille-type microphone, consists of twenty crystal sound cells, assembled and in a cage in the form of a grill, to provide the required output. The piezo-electric sound cells are crystal energy converters, having two active crystal surfaces measuring less than one-half square inch each. These crystal surfaces are mounted on a bakelite frame ⅛ inch thick overall and each cell constitutes in itself a complete microphone. This type of microphone design has the advantage that any number of sound cells may be combined in a single microphone according to the output required. As the piezo crystal carries its own field, it eliminates the necessity of any polarizing voltage or field current. The microphone is said to be non-directional and especially adapted to studio work. It is designed to be water-proof and shock-proof. The microphone illustrated measures 5 inches by 1¼ inches by 1⅛ inches and weighs six ounces. This company makes a condenser head substitute for replacing the present con-

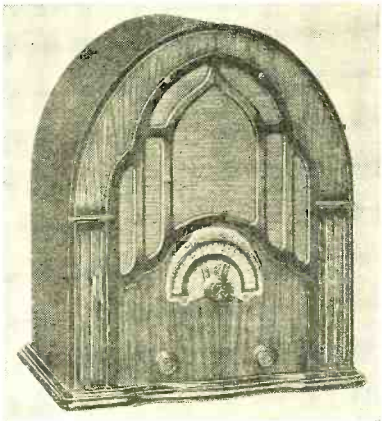


denser head to a crystal type microphone.

Maker—The Brush Development Co., 3715 Euclid Ave., Cleveland, Ohio.

Mantel Type Receiver

Description—The Fordson Goldentone model 6T superheterodyne receiver is equipped with automatic volume control, tone control and a dynamic type speaker of new design, called the "Sonochorde". It is a six-tube circuit and employs the following type vacuum tubes: two –58, one –55, two –59 and one –80 type rectifier. The receiver and speaker are housed in a walnut veneer hand rubbed cabinet measuring 16



inches high by 14 inches wide by 9 inches deep. The total weight of the set is 17 pounds.

Maker—Fordson Radio Mfg. Corp., 11702 Livernois Ave., Detroit, Mich.

A New Choke Coil for Transmitters

Description—Announcement is made by this manufacturer of a new choke coil, de-

(*Continued on page* 55)

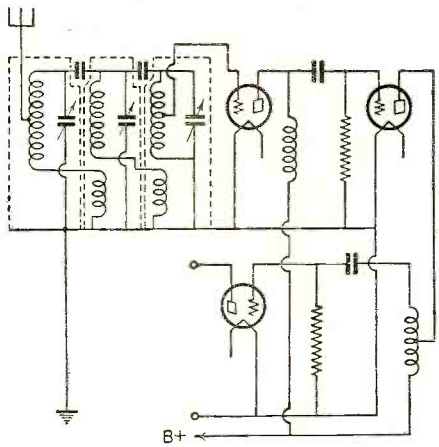
Latest Radio Patents

A description of the outstanding patented inventions on radio, television, acoustics and electronics as they are granted by the United States Patent Office. This information will be found a handy radio reference for inventors, engineers, set designers and production men in establishing the dates of record, as well as describing the important radio inventions

By Ben J. Chromy*

1,881,284. WAVE SIGNALING SYSTEM. WILLIAM A. MACDONALD, Little Neck, N. Y., assignor to Hazeltine Corporation, Jersey City, N. J., a Corporation of Delaware. Filed Dec. 1, 1930. Serial No. 499,229. 8 Claims.

1. In a radio receiving system, in combination, an untunable radio-frequency amplifier and a frequency-selecting arrange-



ment comprising a plurality of coupled tunable circuits, said amplifier comprising a thermionic repeater having an output load which is capacitive over the receiving frequency range whereby said amplifier operates in a stable condition, said selecting arrangement being connected in tandem, ahead of said amplifier whereby said system is selective and free from cross-talk.

1,880,239. RESISTOR. GEORGE B. CROUSE, Newark, N. J., assignor to Hardwick, Hindle, Inc., Newark, N. J., a Corporation of New Jersey. Filed July 24, 1930. Serial No. 470,380. 5 Claims.

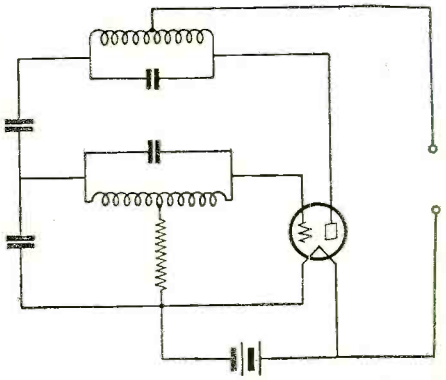
4. The method of producing a resistor which consists in winding a wire upon a refractory form, completely coating the wire and form with vitreous enamel slip, brushing off the slip from the outer portions of the turns of wire over an area to expose the wire while leaving some of the slip between the turns and subjecting the slip to high temperature to fire the same.

1,861,387. AUDION AMPLIFIER CIRCUIT. HAROLD A. SNOW and LEWIS M. HULL, Boonton, N. J., assignors, by mesne assignments, to Radio Corporation of America, New York, N. Y., a Corporation of Delaware. Filed Aug. 13, 1925. Serial No. 50,114. 9 Claims.

5. An anti-regenerative audion amplifier stage of the type in which the impedance net work is arranged in the form of a Wheatstone bridge circuit having as conjugate arms thereof the input and the output circuits of said stage, characterized by the fact that one input terminal of the amplifier stage is directly connected to the filament of the tube, and that the other input terminal of the stage is connected to the grid of the tube through a coil in inducive relation with the output circuit of the tube.

1,881,472. OSCILLATION SYSTEM. FELIX GERTH, Berlin-Tempelhof, Germany, assignor to C. Lorenz Aktiengesellschaft, Berlin-Templehof, Germany. Filed Apr. 14, 1927, Serial No. 183,810, and in Germany Apr. 16, 1926. 6 Claims.

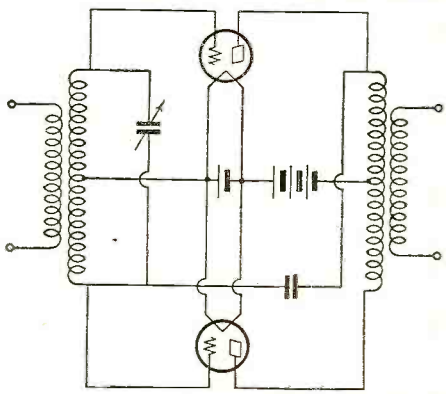
1. In a vacuum tube oscillation circuit, comprising a single vacuum tube, having cathode, anode and control electrodes, an oscillatory circuit connected between said cathode and said anode, a control circuit connected between said control electrode and said cathode, a grid leak resistance placed between a symmetry point of said control circuit and said cathode and high tension



supply leads for said tube connected to said cathode and a symmetry point of said oscillatory circuit.

1,882,128 RADIO FREQUENCY AMPLIFICATION SYSTEM. EDWARD W. FEARING, East Orange, N. J. Filed June 1, 1927. Serial No. 195,829. 17 Claims.

13. The method of preventing the output



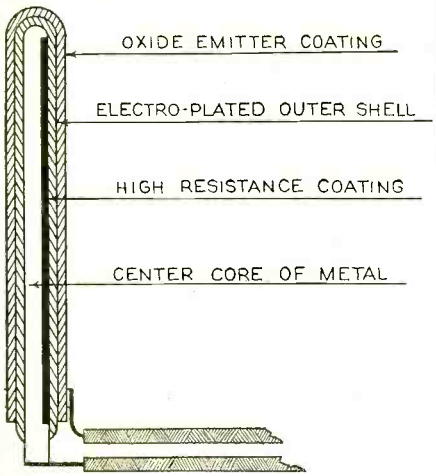
circuits of a push-pull amplifying stage from affecting the input circuit of said stage,

* Patent Attorney, Washington, D. C.

which comprises balancing the retroactive effects in one tube by impressing on its grid a voltage opposite in phase to its alternating plate voltage, and balancing the retroactive effects in the other tube by transferring a voltage from its plate to a point in its grid circuit of opposite alternating voltage to its grid, through a single coupling common to the two tubes.

1,881,644. ELECTRON DISCHARGE CATHODE. LESTER L. JONES, Oradell, N. J. Filed Feb. 28, 1929. Serial No. 343,255. 10 Claims.

1. A heater comprising a conductive core,



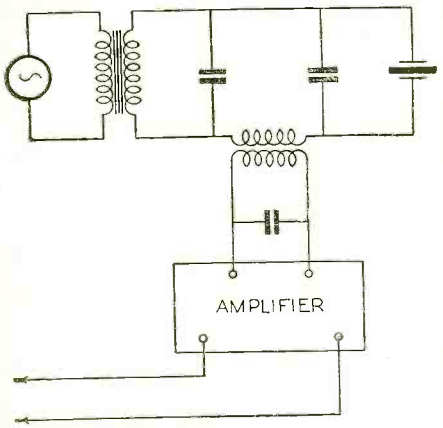
a conductive shell having one closed end and surrounding said core, a resistor element disposed between and forming the sole conductive path between said core and shell, and lead-in wires connected to the core and the shell at one end only of the said heater.

1,882,395. FREQUENCY INDICATOR. GEORGE W. PIERCE, Cambridge, Mass. Filed Apr. 23, 1928. Serial No. 272,033, and in Canada Dec. 31, 1927. 16 Claims.

2. A frequency-indicating body having magnetostrictive activity, in combination with an exciting circuit therefor, the relation between the body and the circuit being such that the current flowing through the circuit is subjected to the reaction of the body due to magnetostrictive effects, and means for indicating the said reaction in the said circuit.

1,886,815. METHOD AND APPARATUS FOR GENERATING ELECTRICAL OSCILLATIONS. AUGUST HUND, Bethesda, Md. Filed Mar. 5, 1929. Serial No. 344,563. 6 Claims.

2. The method of generating high frequency oscillations which comprises subjecting a piezo electric crystal element, adapted to sustain oscillations at a beat frequency of its plurality of natural fre-



quencies, to oscillations corresponding to said beat frequency and, deriving from said piezo electric crystal element electrical oscillations having a frequency corresponding to one of the natural frequencies of said piezo electric crystal element.

1,882,397. MAGNETOSTRICTIVE VIBRATOR. GEORGE WASHINGTON PIERCE, Cambridge, Mass. Filed Aug. 17, 1928. Serial No. 300,249. 18 Claims.

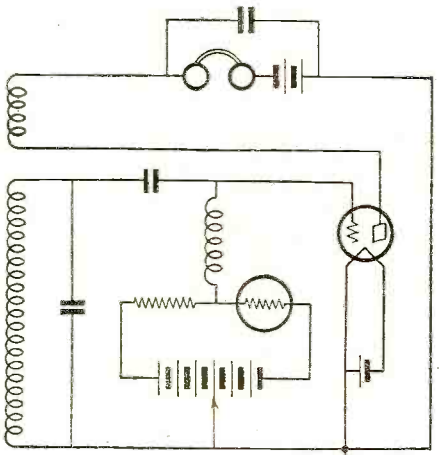
1. A magnetostrictive vibrator having a substantially constant frequency with variations of temperature.

1,882,398. MAGNETOSTRICTIVE VIBRATOR. GEORGE WASHINGTON PIERCE, Cambridge, Mass. Original application filed Aug. 17, 1928. Serial No. 300,249. Divided and this application filed May 9, 1930. Serial No. 451,050. 4 Claims.

1. A composite magnetostrictive vibrator constituted of mechanically connected members of different magnetostrictive material, one of the members being constituted of an outer shell in which other portions of the vibrator are disposed.

1,886,813. LIGHT CONTROL CIRCUIT. EDWARD O. HULBURT *and* WILLIAM H. CREW, Washington, D. C. Filed Dec. 23, 1927. Serial No. 242,266. 1 Claim.

A light controlled circuit comprising an electron tube having grid, filament and plate electrodes, an input circuit interconnecting said grid and filament electrodes, an output circuit interconnecting said plate and filament electrodes, means interlinking said circuits, a light sensitive element, a resistance and a high potential source of energy constituting a looped branch of said input cir-



cuit and a choke coil connected to said looped branch and forming, together with the latter, a series-connection between the grid and filament electrodes of said input circuit, the respective elements of said light controlled circuit being so disposed in relation to one another that high frequency currents are excluded from said looped branch and variations in the intensity of light impinging upon said light-sensitive lement are caused to control the grid bias of said electron tube.

1,887,185. SOUND REPRODUCER. EDWIN JAY QUINBY, Yonkers, N. Y., assignor to Radio Corporation of America, a Corporation of Delaware. Filed Feb. 20, 1929. Serial No. 341,337. 9 Claims.

1. A housing for a sound reproducer comprising a box-like member adapted to be positioned within a wall, a detachable cover plate secured to said box-like member and covering an entire side thereof, an opening in said cover plate, and a sound reproducer fastened to the inside of said cover plate adjacent said opening.

?QRD?

A column devoted to the commercial operator and his activities

Conducted by GY

THE V.W.O.A. have sponsored a movement to observe a silent period of one minute on Memorial Day in memory of the ops who have lost their lives at sea. The radio communication companies, Army, Navy and Coast Guard authorities are expected to favor the suggestion. It is proposed that all radio communication cease for one minute immediately after the noon-time signals, P.S.T. for the Pacific and E.S.T. for the Atlantic. Marine and Coast station operators are requested to ask foreign ships in American waters to remain off the air during the period we are paying homage to our dead. In conjunction with this, the organization is to hold services in Battery Park, New York City, where the Wireless Operators Monument stands.

This paragraph should be headed with "CLEARING TR'S", due to the enquiries coming to this department because ship ops have five or six pet ways of sending their TR'S which results in some confusion to the receiving op. As has been remarked, although the mill is a great improvement over the old stick, it has not, as yet, been perfected to such a degree that it will type backwards or spell correctly. There is but one set form for copying TR'S for delivery and that is: SS Malolo Honolulu for San Francisco 212 miles from San Francisco. When sent, the QRF and QRD should if possible, be abbreviated to shorten the transmission; TR 8PM WMCE SS Malolo HU SF 212 SF. Of course, the call letters are not forwarded to the newspapers as they are added to the station's QSO list. And now that that's all settled we will continue onward.

There is music in the air! From the little village of Artesia, N. M., one lad by the name of so-and-so was working in an isolated oil field near here and he heard faint sounds of music. Then he heard someone say "This is Witchita, Kan." The news leaked out that the man had found something or other and all the great minds of that community gathered there, and after due investigation it was proven that the steel derrick of 85 feet height was acting as a radio receiver. Hoot Mon, what it means to live near an oil field! C. N. Carlton, who testifies to the above, suggests that all masts aboard ship be equipped with transmitter remote-control switch and key, as a precautionary measure, permitting the lightning Jerker to carry on communication from the crows nest in the event that his receiver becomes disabled at sea. You tell him gang!

For the benefit of Short-wavers we wish it to be known that there is a DX contest now being held and conducted by the New York chapter of the International Short Wave Club. To the listener who exhibits the greatest number of verification cards received between March first and June first of this year will be awarded a miniature replica of his successful receiver as built to a scale of one-in-twenty-four by Captain H. L. Hall expert model maker and short-

wave enthusiast. The second and third winners will receive medals. Just a word to the boys. Don't get ear strain and don't rub the paint off the edge of the receivers trying to squeeze out another "listen" to those far-off stations.

Something should be done about this, what! Little Joan Hudson, 8 years of age, daughter of an amateur op can copy radio code text on a typewriter at the speed of fifteen words-per-minute, but she cannot draw diagrams. She expects to take out her op license just as soon as she is of age and that is the only thing that saves the hide of her old man who has a license of his own. It wouldn't be nice to tell the kid to QRT after she got into an argument with you, eh?

There is expected to be quite a battle over the allocation of wavelengths at the scheduled meeting of the North American radio conference some time in April, and which is to be held in Mexico City. The question, which confronts the nations attending, is whether the present broadcasting frequency range of 550 to 1500 kcs. should be enlarged to accommodate more stations or whether the demands of neighboring stations should be met by taking away some of the channels from this country. The U. S. uses ninety of the ninety-six waves and Canada uses the other six exclusive channels and also shares a few others with the U. S. Mexico and Cuba want to have some waves as they have no real allocated frequencies thru which they can broadcast. But the real trouble lies in the battle the American broadcasters are waging for spreading of the present facilities so as to get below the 550 kc. band. As this would interfere with the Commercial, Army and Navy bands there seems to be no end in sight for those in on the controversies. May we have the loudest voice in the argument and Justice will prevail.

The old story of the wheel turning round is brought to mind by the mail received from Art Huotari, who most of the RCA gang remember and who also held down the key on KDKK, KDOW, WPBW, etc. His operating included the acting of an op in the RKO picture, "Suicide Fleet," during the destroyer scene. Also, in Paramount's production "Luxury Liner," and "Woman Accused." In both of these he was Technical Adviser for the set-ups, and after finding that he screened so well he was put to work by the studios as a Gob in "Sailor's Luck." He is now down on his luck and is looking for a good old-fashioned berth on some tramp. He signs his letter with "me for regular hours and pay and 73s to the gang!"

Memory recalls the one about the discussion of the Chandler System and the bringing in of the name of Julius A. Benn, ex-chief op of KHK. Benn, then CRM USN, an op of extraordinary ability at receiving, had a habit of copying a line or two behind. While on a long A. P. dispatch from 'Diego his detector tube became defective. He hung up the cans, drew a new tube from the store room and when the NPG op finished, Benn had a solid copy. Some say that he questioned the check and caused the NPG man to recount and correct his. It has also been told that Benn had to waste time filling out form SA-57 before being issued the tube.

H. C. Chetham has been keeping in the limelight from the newspaper angle, as fourteen or fifteen writeups have been given to him because of the disqualification proceedings having been instituted against him. But so far, Mayor J. J. Murphy of Salem and Commissioner J. F. Knight say that the old maestro will keep his job. Now that is what we call "having the inside track," and we are

darn glad of it. He writes in to say that one of his fans wrote him recently that, "My name is not Olive but Oliver, if you please, but I have two good looking sisters if that will help any." And H. C. married! That is just the luck. He who haseth geteth and him who haseth noteth . . . oh, well, you guess.

Brother G. H. Clark at 153 West 24th Street, N. Y. C., wishes me to post this on the bulletin board. "To those of you who remember back to the time when the only radio tube was a flock of filings in a glass tube and when the only broadcast listener was Marconi listening to himself, this SOS is directed. The VWOA will be represented at the Chicago Fair with a complete set up of all the old apparatus and diagrams if we receive your help. The display will be called the 'Growth of Wireless.' Bennie Klessner sent in the first 'catwhisker' point for a crystal detector. We want pictures of old installations, with dates. Any old apparatus, especially early American Marconi or United Wireless. Clippings or stories of the old days, etc., and etc. This display is expected to be placed in a Museum after this exhibit." Therefore ye old timers, gather 'round and rally 'round with the old scrap-books and logs for the aid of Brother Clark and Auld Lang Syne. Ship in all stuff that might be acceptable, to his address and receive his and our thanks for cooperation.

Ray Meyers sends in his contribution with the remark that it is dedicated to the brave radiomen who stayed at the key to the last.

THE DEEP SEA SAND

We sit in our cabin evenings, far away from the nearest land,
Wondering who'll be the next one, to settle in the deep sea sand.
Ofttimes our watch is dreary, and we think of loved ones home,
When a faint spark interrupts us, so we tighten on our 'phones.

He might be calling someone, or in trouble would confess,
Or sending out that signal—"All ships hark, S-O-S."
Then we start our sets agoing, with an "O-K—hear you well."
And he sends out his position, like the chime of an old church bell.

He keeps up conversation with you and all the bunch,
'Til his spark dies out completely—and we all have got a hunch.
The crew put out in lifeboats, and make a hasty flight,
But one poor man is missing, and they say it served him right.

We told old Sparks to beat it, but he stayed right at his key,
And the skipper says I called him but he wouldn't come with me.
Then they swear and call him bonehead with a brain of a monkey's brand,
And soon forgot who saved them from a grave in the Deep Sea Sand.

And so onward to the hay, with mention in passing, of Willie Berens who dashes in from Washington with the announcement that we've got a great President there (as if we didn't know that) and then we hear from Alaska through the medium of Charley Falk who sez that, due to the ice floes, the mail was held up for months and his RADIO NEWS copies came in all at once—4 copies, and then we catch a bit of dope from Dallas, Texas, and Johnny Bush who sends 73s and then—oh we'll be seeing yuh, so with 73s ge . . . GY.

Road to Fame

(*Continued from page* 9)

In the Whiteman instance, the winning vocalist of each week does not get any monetary award but gets a program "spot" on the air with Whiteman and the resulting prestige certainly means a lot when seeking a sponsor.

In addition to radio appearances, there are many opportunities for supplementary income. The field of electrical transcriptions —recorded radio programs—is a lucrative side-market for radio entertainers. These programs are recorded in big cities where plenty of big-name talent is available and the disks are routed to "small, non-chain" stations as well as many of the larger stations. Vaudeville and the Talkies also are profitable fields for established radio entertainers.

In recent seasons there has been an influx of stage celebrities to the air. Such headliners as Eddie Cantor, Ed Wynn, Jack Pearl, Al Jolson and Georgie Price have entered broadcasting for huge earnings. Likewise, such products of the radio studio as the Boswell Sisters, the Mills Brothers, Stoopnagle and Budd, The Rollickers and countless others have gone on the stage and into the talkies as a result of their broadcast reputations.

Announcers to Be

Many persons have asked the writer what procedure they should follow to become a radio announcer. It seems that there is no set procedure at all. Almost every successful announcer known to the writer did not set out to be one, but just accidentally landed in an announcer's berth and made good at it. However, if a person has that set ambition, he should have a good microphone voice, an excellent command of English, knowledge of foreign languages and a broad general education.

Announcing today is largely *reading*. Most announcers merely read their lines from prepared manuscripts. In some exceptions, such as running accounts of sports and news events, an announcer has no script and must give an original and hastily-conceived description of the event. It is an announcer who can handle such an assignment effectively that usually rates among the leaders of the announcing clan.

Auditions for Announcers

Most stations conduct auditions for announcers just as they do for other talent. In many instances—particularly on the smaller stations—an announcer must have another *forte* besides announcing. If he can play the piano and act as an accompanist as well as an announcer, his value to the station is greater than if he could announce only. In a great number of cases, announcers are singers also and have regular program "spots" on the station.

Next to newspaper and magazine publicity, the radio entertainer's greatest boon is Fan Mail. Despite many belittling statements concerning fan mail that spring up every now and then, these letters from listeners mean a lot when looking for a sponsor.

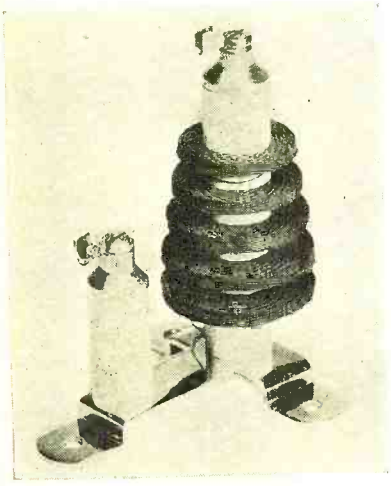
In concluding this article, the writer must urge you not to be over-optimistic about your chances in radio. If you think you have talent and an idea that should "click" on the air, try your best to "put it over." But it should all be done in a sporting spirit. If you put yourself over, all the better. If you fail, none the worse. After all, the listener is gambling just as much as you are when he tunes in your program. He doesn't know whether it will be good or bad entertainment until he hears it.

At any rate, try your best and hope for the best!

What's New in Radio

(*Continued from page* 49)

signed for use in medium and high power transmitting equipment. The coil is made with a continuous universal winding in five tapered sections, it is constructed on Isolantite material and is mounted on a metal base, insulated for 10,000 volts. The inductance value of the choke coil is 4 millihenries, distributed capacity 1. mmfd., and its d.c. resistance 10 ohms. The continuous current rating of the choke is .6 amperes and the intermittent current rating .8 amperes.



Maker—National Co., Inc., 61 Sherman Street, Malden, Mass.

Condensers

Description—Announcement is made by this company of a complete line of paper dielectric condensers for filter, bypass and transmitting requirements. The type MB, 1.0 mfd. bypass condenser illustrated, is a small size unit measuring only ⅜ of an inch thick by 1¾ inches wide by two inches high, designed for use in equipment where space is limited. This style condenser is rated at 300 volts d.c. and is available in other capacities from 0.1 to 4.0 microfarads.

Maker—Wego Condensers, Inc., 729 Seventh Ave., New York City.

A Test Oscillator

(*Continued from page* 15)

accurate test for selectivity of any portion of the receiver as the work progresses, as well as providing a means for adjustment to some of the less used intermediate frequencies.

A further advantage of this system is that it results in the use of higher values of tuning capacities at the higher frequencies, where it is more difficult to preserve accuracy of calibration and the high ratio of capacity to inductance is a great benefit. This feature is easily observed in practice where a variation in line voltage from 95 to 120 produces a shift in signal of only .2 kc. when operating on the 1500 kc. position.

The model shown is provided with working frequencies of 175, 262.5, 456, 472.5, 550, 1000, and 1500 kc. The construction is such that these frequencies can be altered at any time and with very little expense should new or other frequencies be desired. The output of the oscillator is sufficiently rich in harmonics so that other points can be obtained in the broadcast band by multiples of the i.f. frequencies and the 1000 kc. position provides most convenient 1 megacycle harmonics down through the short-wave band.

The coils in the oscillating circuit are manufactured to very rigid specification and are treated to prevent the absorption of moisture which is detrimental to the frequency calibration. The trimmers for final adjustment of the various frequencies are specially selected and of the isolantite base type, conveniently located along the back edge of the chassis assembly. Every precaution is taken to secure the utmost mechanical stability of the circuit parts and after operation for 48 hours continuously, the frequencies of the various ranges are set to zero beat against crystal oscillators. Each trimmer is then individually sealed while still beating the oscillator to be certain that no shift in frequency occurs due to the shrinkage of the sealing wax while cooling.

Obviously, the signal generator type calibrated attenuator for quantitative determination of the sensitivity is out of the question for service work. It has been found possible, however, to consider the top setting of the output control, R1, to be approximately 5000 microvolts. The dial on this control is divided into ten equal parts, making it possible to obtain a very good estimate of the receiver sensitivity from the dial setting necessary to produce standard output in the output meter. This linearity of output control prevails over practically the entire range due to the careful shielding of the coils and the completed instrument. That this shielding is effective is demonstrated by the fact that with a receiver having a measured sensitivity of 3 microvolts, it was possible to barely detect by ear the signal with the attenuator at the minimum position and the output was so small that it was not indicated on the output meter.

Connection between the receiver and the oscillator is made with a shielded cord which connects into jacks in the face of the panel. In addition to the jack for connection to the regular attenuator, a third jack provides a high output (about ¾ volt) for neutralizing or for "finding the way" on an i.f. amplifier that is badly out of line.

Due to the manner of introducing the modulation voltage, the high tap just mentioned provides sufficient pure 1000 cycle current, as well as r.f., so that tests on the audio end of the receiver can be made without going through the detector. This has been found a great convenience in checking a faulty receiver step by step from the power tube grid, forward.

The completed instrument, as seen in the photograph, is finished in a baked black crystal which has been found so serviceable in the past on equipment of like nature. The panel data are processed into a white pyralin panel for good legibility, even when the instrument is used in dark corners. This panel may be cleaned at any time with a cloth dampened in gasoline, without affecting the processing, which is protected.

It is believed that this design sets a new note in the design of oscillators for service work and that the use of it will permit of more certainty in testing work done than has been possible with average equipment.

In conclusion, the writer wishes to thank Mr. R. MacGregor, Service Manager of Transformer Corporation of America, for his suggestions during the design of this product, as well as for access to his notes on a paper "A New Plan for Service Testing" presented at the January meeting of the Advisory Board of the Radio and Television Institute.

THE END

Four Pentodes

(*Continued from page* 13)

tubes. This type is expected to replace the present type –39 because of its improved characteristics. The suppressor grid of this pentode is connected to the cathode inside the bulb. Therefore, the tube has only five prongs. The control grid terminates in a

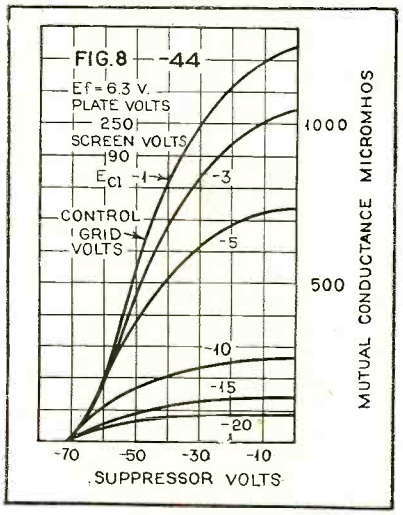


FIGURE 8

cap on top of the bulb. The filament is of the new "triple fold" type. It is claimed that this reduces hum when operated on a.c. The heating-up period is reduced to 8 or 9 seconds. The potential difference between the cathode and heater should be kept as

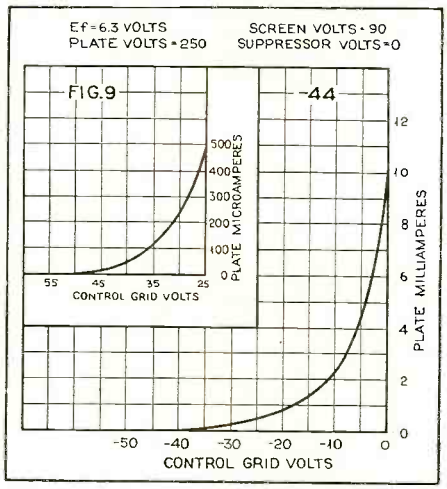


FIGURE 9

low as possible and should never exceed 45 volts. The heater should be biased negative with respect to the cathode.

The –44 type pentode tube may be employed as a radio-frequency amplifier, an intermediate-frequency amplifier or as a first detector in superheterodynes. It is not suitable as a second detector or as a detector in tuned radio-frequency circuits.

Variable bias may be employed when the tube is employed as a first detector; the minimum bias, however, should be one volt more than the peak oscillator voltage. This practice will help eliminate cross modulation. The load resistance should be as high as possible; this would imply a tuned circuit. Therefore the highest gain is obtained in intermediate amplifiers, where both plate and grid circuits are tuned. In tuned radio-frequency circuits this is usually impractical. The circuit of Figure 7 illustrates a possible application of the –44 type in a d.c. receiver. Curves of the type –44 tube characteristics are shown in Figures 8 and 9.

DX Receiver Design

(*Continued from page* 23)

cessive adjustment of the parallel and series condensers and coil inductance regulator. This latter adjustment, regulating (by reduction) the inductance of the coil to the thousandth of a turn, aids greatly in securing alignment. The parallel condenser may conveniently first be adjusted to secure alignment on some very high frequency, say 1450 kilocycles, then the series condenser adjusted for alignment on some very low frequency, say 600 kilocycles. The process is repeated until the adjustment is satisfactory over the entire scale.

For all but exceptional uses both regeneration controls should be set at zero (with the second detector regeneration switch SW2, in the neutral position). Regeneration in the second detector is useful in locating weak stations quickly by their carriers (the first detector regeneration in the meantime being set at zero). It is important to keep the gain of the amplifying stages reasonably low when regeneration is being used. The volume control regulating the signal-frequency gain should be adjusted for the best position, independently of the second control. The superior results obtainable justify the use of the double volume control. When tuning in very weak signals with a background of noise, it will be found that by narrowing the selectivity curve by the use of a high degree of regeneration in both first and second detectors (with simultaneous retardation of volume controls) one can eliminate much of the noise and obtain satisfactory reception from many stations *that otherwise could not be received.* This method is effective, and without destroying intelligibility of speech, because of the high order of flat topped selectivity already present and the inherently low noise level of the receiver. The tuning curve may be peaked to the degree desired, from flat topped to very sharply peaked, by the use of regeneration.

It is highly important, if best results are to be secured, to properly balance the signal and intermediate frequency and feedback and amplifier gains. The switch, SW8, on the center panel changing the number of turns on the antenna coil may easily be flipped to increase the inductance as one proceeds to lower frequencies than about 660 kilocycles, and vice versa. The difference in results is well worth the extra trouble.

When very weak signals are being received it is essential to success that the antenna circuit be fully and accurately tuned, directly with the variometer or inductively in conjunction with the tapped antenna coil and antenna compensating condenser. In inductive tuning (with aerial 130 feet on the flat top) the full antenna coil should be used from 550 to about 660 kilocycles, the 10 turn tap from 660 to about 1000 kilocycles, and the 5 turn tap from 1000 to 1500 kilocycles.

The antenna compensator need be used only when weak signals are being received, but with very weak signals its use is essential to success. The other compensators are of some value when fullest efficiency is required on the very highest frequencies, above 1400 kilocycles, but they need never be touched otherwise. In the reception of very weak signals, on the lower frequencies, tuning the antenna circuit by means of the variometer puts a stronger signal into the receiver. When the variometer is used the inductance switch should be set at the lowest value. The stage of audio (designed to suppress the very low notes, thus especially useful in connection with regeneration) is available for headphone use by throwing SW4 to the right.

Handy S.W. Portable

(*Continued from page 28*)

ting speech or music. The detector tube should now be brought out of oscillation so that the voice can be heard. It will be found that by varying the regeneration controls the tuning changes slightly and the tuning condenser will have to be reset. In fact, this might have to be done in several small steps to prevent losing the station.

The writer, on this portable, received several European stations such as DJC, EAQ, GSB and most of the American stations which are usually heard on other receivers. Among the police stations, Cleveland, Minneapolis, etc., were brought in clearly.

The antenna-coupling condenser should be adjusted for best results on the antenna being used. Then it need not be touched again. The reader will find it to his advantage not to change this condenser often, for it will change the dial settings.

List of Parts

C1—100 mmfd. Powertest antenna trimmer condenser.
C2, C3—140 mmfd. Powertest variable condensers.
C4—100 mmfd. Powertest fixed condenser.
L1, L2—Powertest set of five plug-in coils, 15-550 meters.
R1—Powertest 10-ohm rheostat with switch.
R2—Powertest 5-megohm gridleak.
T—Powertest audio transformer.
3—four-prong sockets.
2—Kurz-Kasch 3-inch vernier dials.
1—85 millihenry r.f. choke.
2—insulated phone-tip jacks.
1—Try-Mo carrying case, approximately, 12¼ inches by 8¾ inches by 6 inches, inside dimensions.
1—Try-Mo punched-metal panel, 12¼ by 8¾ inches.
1—"General" battery, 3 volts, type P-2-X.
2—"General" batteries. 45 volts, type V-30-AA.

Harbor Radio

(*Continued from page 11*)

used for monitoring the output of the transmitter.

Power for the radio transmitter is furnished by the rectifier associated with it, and both the transmitter-rectifier and the radio receiver are arranged for operation from the usual alternating current mains. A motor-generator set, with the necessary filter equipment located on the same mounting, furnishes filament and plate supply for the voice-frequency control equipment, the monitoring receiver, and the codan.

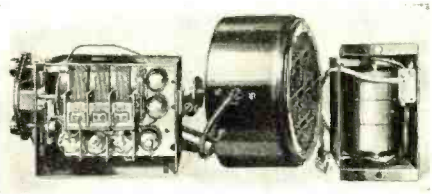
Present Usage

The present service at Boston makes use of the site and buildings at Green Harbor formerly owned by the laboratories. From this point, on the shore of Massachusetts Bay some thirty miles south-east of Boston, it is expected that it will be possible to communicate with ships from Point Judith, on the coast of Rhode Island, to beyond Cape Ann on the northern Massachusets coast, and from these points some 200 to 300 miles easterly over the ocean. This service should be helpful to other craft than those engaged in the fishing business. Pilot boats, tow boats, oil tankers, coastal steamers, private yachts, coast guard boats, and similar small craft are all potential candidates for this service.

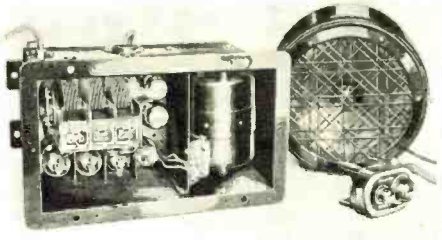
Auto Radio

(*Continued from page 19*)

mounted in the most convenient car location. The model 756 set and the B eliminator are enclosed in the same container. This set can be mounted under the floor of the car or through the opening, provided for



radio in the floor of many cars, by means of an adapter plate furnished with each set. The remote control for this receiver fastens to the steering column by means of half-round metal clamps. The receiving circuit utilizes the following type tubes; one –39 for the r.f. stage, one –36 for the first detector and oscillator, one –39 for the i.f.

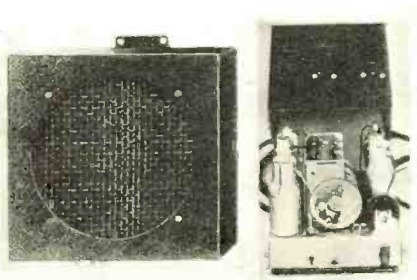


stage, and one –85 as the second detector, control and first a.f. tube. Two –41 type power tubes are employed in the second audio frequency stage. The receiver has a tuning range from 540 to 1750 kilocycles. Both models feature automatic volume control and a large size dynamic type speaker. The receivers are designed so that either one or the other will fit in any make of car.

Maker—Atwater Kent Mfg. Co., 4700 Wissahickon Ave., Philadelphia, Pa.

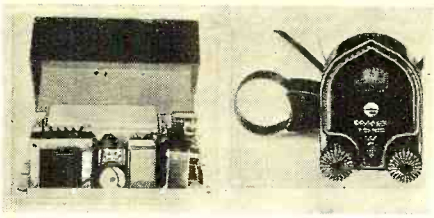
Motor Car Receiver With Class B Output

Description—The Crosley "Roamio" model 98 automobile superheterodyne receiver is designed for easy installation, convenience in operation and for pleasing appearance. The six-tubes in this set are employed as follows: one –78 type as an oscillator and first detector, one –78 type as a radio frequency amplifier, one –78 type as an intermediate-frequency amplifier, one –85 type as a diode-detector and audio frequency amplifier, one –89 type for the second audio frequency amplifier and one –79 type for Class B output. The receiver is equipped with automatic volume control, a full floating moving coil dynamic type speaker, Class B audio



amplification and the new Syncronode power unit. The upper illustration shows the speaker and receiver chassis while the lower photograph illustrates the remote control

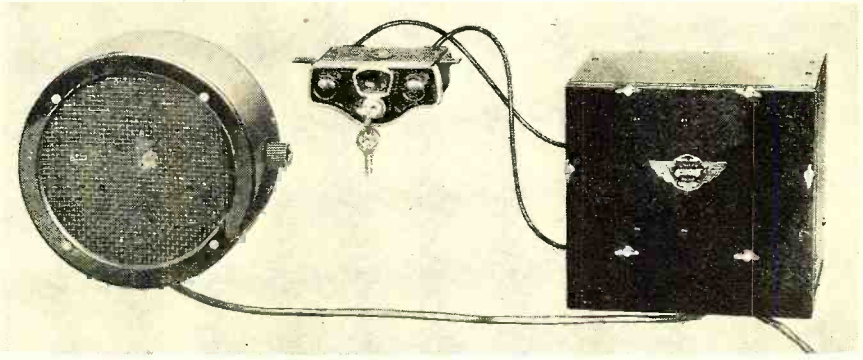
and power unit. The receiver measures 7⅛ inches wide by 7⅛ inches deep by 6⅛ inches high. The power unit measures 4¼ inches deep by 7¾ inches wide by 2¾ inches high and the dimensions of the speaker are: 8⅞ inches wide by 8⅞ inches high by 5¾ inches deep. The manufacturer also announces the new Tennaflex antenna for those cars that are not equipped with a built-in antenna system. This car aerial fastens to the car frame, is inexpensive and easily installed.



Maker—Crosley Radio Corp., Cincinnati, Ohio.

Compact Superheterodyne Receiver

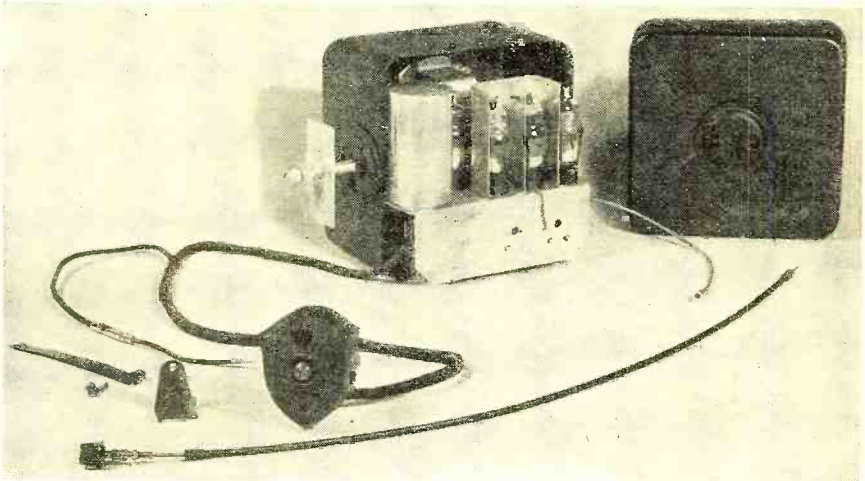
Description—The new United Motors Model 2035 automobile radio is designed for universal application to all types of motor cars, to be free from engine interference and to provide the utmost in selectivity, sensitivity and quality. It is a six-tube superheterodyne set using the following tubes: one –36 type as the r.f. amplifier, one –36 type as the first detector and oscillator, one –39 type as the i.f. amplifier, one –85 type as the second detector, automatic volume control and a.f. amplifier and two –89 type for the push-pull output power stage. The set is equipped with an electrodynamic type speaker, automatic volume control and a tone selector. The receiver can be furnished with a B eliminator or for operation with B batteries. The B eliminator can be supplied separate or furnished in the same housing with the loud speaker. The receiver unit measures 8 inches by 8 inches by 6½ inches.



Maker—United Motors Service, Inc., 3044 W. Grand Blvd., Detroit, Mich.

New Set Simplifies Installation

Description—It is said that the new RCA-Victor Model M-34 motor car set can be installed in less than thirty minutes. The receiver chassis, speaker and B eliminator are enclosed in one compact metal case which may be mounted on the firewall of the car frame or any other convenient place, by means of one bolt. The dimensions of this small set are 8¾ inches high by 8¾ inches wide by 7⅜ inches deep. The control box can be mounted in any position on the steering column or it may be mounted on the instrument panel board. The switch, lock and volume control are combined, the switch key is used to adjust volume. It is a four-tube superheterodyne receiver and makes use of the new type tubes which include one –78 type for the r.f. stage, one –6A7 type as a detector and oscillator, one –6B7 type as a combined i.f. and second detector tube, also functioning as an automatic volume control and audio amplifier tube, and one –89 type tube utilized in the audio output stage. The receiver is equipped with a two position tone control, dynamic type reproducer, a new vibrator type B eliminator and automatic volume control. The output of the set is approximately 2.0 to 2.5 watts and its current consumption is 5.5 amperes.



Maker—R. C. A.-Victor Co., Inc., Camden, N. J.

Clear Channel Super Power

(*Continued from page* 24)

broadcast allocation problem that has been the subject of spirited debate from the time that the establishment of clear channels was first suggested; namely, the relative advantage of increasing the total number of broadcast stations capable of being in operation at any one time by making multiple assignments to some of the existing clear channels; or looking toward the opposite course, the relative merit of increasing the number of clear channels by deleting or transferring shared-channel stations. The consequences of proceeding in either direction are evident:

1. Decreasing the number of clear channels by assignfing additional stations (for night time operation) to channels now used by only one station at a time would have the effect of affording additional services to certain localized urban groups but at the expense of decreasing the service to rural listeners and to those at remote points.
2. Increasing the number of clear channels at the expense of the shared channels would have the opposite effect, assuming that assignments for the stations thus displaced could not be provided for on the remaining shared channels.

The foregoing statements are based on radio considerations of a very fundamental nature. However, in view of the industry's growing appreciation of the complexity of radio transmission phenomena and the store of experience that is the result of the past eleven years in broadcasting, the question naturally arises as to whether our increased knowledge and vastly improved technique do not now warrant modifications in these earlier generalizations. After a careful review of the situation the Broadcast Committee is forced to the conclusion that the clear channel is still essential to the extension of broadcast service to the populations of our rural areas and is likely to remain so for some time to come. Further, it is felt that many of the limitations that have been ascribed to the clear channel are the direct result of existing power limitations rather than of any inherent characteristic of clear-channel coverage. The engineering case of the clear channel has always been based on the assumption that adequate power would be employed. There appears to be no technical reason why greatly increased power (in excess of 50 k.w.) should not now be permitted to suitably equipped and appropriately located or relocated stations holding clear-channel assignments.

Assuming that service to distant listeners is to be maintained, it is evident that continued provision must be made for an adequate number of clear channels. Whether the number should be forty, or more, or less, however, is a matter that can be determined only by careful study. The balance of service between the rural listener and the urban listener is determined in considerable measure by the relative number of allocated clear and shared channels. Decision as to the correct balance point is a matter of general policy.

Traffic Control

(*Continued from page* 25)

by a transcription studio. On valuable big-city channels, the providing of the radio transmission service becomes more and more an incidental matter: a licensee, even if he has no plant of his own, can usually buy transmission service from some other concern which has a suitable station. In cases where as many as four licensees in one locality divide with each other the time on a channel (as on several channels in New York City), it obviously makes no direct difference either to listeners or to advertisers whether three of the licensees buy transmission from the fourth one, who owns the station, or whether all four buy their station service from an electrical-operating concern which owns a suitable transmitter—and which might just as well own a dozen other transmitters, and sell their service by the hour to various channel holders or "licensees". The notion that a broadcast licensee must be a station operator is as unfounded from the engineering as from the business standpoint, and apparently, from the legal standpoint as well. Essentially, at least in big-city practice, the "licensee" is a person or organization appointed, by a legal instrument called a "license," to the privilege of controlling program traffic on certain channels during certain hours in a certain territory.

That suggests the tremendous importance of the growing tendency to separate the *broadcast-traffic* (channel-hour control) business from the *transmitter-operating* business. The successful operation of either of these lines of business requires indeed a very different set of qualifications from the other. Clearly, there is no good reason why the government should require *any* license applicant to operate his own radio-transmission service (though most licensees now do it) any more than his own wire-transmission service (practically none of them do that). Nor is there any particular reason why a broadcast licensee need be confined to one station or one channel, any more than to one studio or to one day of the week. Broadcasting runs along in these grooves simply because nobody has yet lifted it out!

Who Should Be Licensed?

If then the licensing of broadcasters is not to be confined to station operators, and if there is thus no particular limit either way on their number, who is to be licensed? When the channels used in any city have been rendered far more valuable by being reduced in number, who shall receive them? Shall the government encourage the formation of a single responsible civic body in each large city, and grant it a license to control all the channels used. Or shall the Commission grant a valuable channel or two to some responsible body of music lovers as an endowment to the broadcasting of good music? And another block of channel-hours to some farmers organization to encourage the broadcasting of useful agricultural information? And one to the local radio dealers' association to finance the continuous broadcasting of programs most effective for demonstrating sets? And one block to the educational institutions, and one (perhaps five or six channels for Sundays only) to the churches? How much preference shall be given to officially-created bodies—city or state—as compared to unofficial ones? Shall entertainment channel accommodations be granted by license to competent commercial sound-studio operators ("networks", transcription agencies, etc.) on some sort of stipulation that will furnish to such concerns a strong financial motive for broadcasting as much good entertainment as they can afford to, with the least amount of advertising required to finance the job, instead of vice versa? Or shall commercial promoters simply be left free to buy whatever channel hours they want from strictly public-interest licensees?

Questions like these are of course for the licensing authority to answer as they present themselves. It would be foolish for anybody to attempt to prophecy what form or forms of organization are most likely to pre-

(*Continued on page* 61)

RADIO NEWS INDEX

Traffic Control

(*Continued from page* 59)

dominate in the broadcasting business if the privilege of applying for licenses to control program traffic is thrown open to all, instead of being confined almost entirely to the radio transmission trade. While the number of licensees who can economically "divide time" on a channel is subject to no particular limits if they are not expected to do their own station-operating, it is clear that to license too many would be to increase confusion for listeners, and defeat the achieving of more effective traffic management. More probably the number of licensees in a city should be kept small enough so that they can and will coordinate their efforts to the extent of maintaining a single expert Traffic Director, or at least to the extent of pooling together all the hours they plan to offer on the commercial market, and offering them through a single sales office—thus making unbroken channels available to "networks" and other commercial concerns, and realizing for the licensees themselves the highest possible hourly rentals for their "paid advertising columns."

Other Benefits in Prospect

With high-power (wide-area) licenses placed in the hands of bodies having a public rather than a dividend-earning motive, there would no longer be much economic need for limiting station power to 50 kilowatts. Unless the somewhat dubious "construction permit" be retained as a measure of "economic planning," any transmission company could be set perfectly free to build a plant of any wattage, whenever it saw a prospect of sufficient contracts with high-power licensees, to justify it in making the investment. Our country could thus take its place with other nations in the use of modern high power. The diminished number of channels required for well "traffic-managed" broadcasting would greatly simplify the now-pressing problem of Canadian and Mexican wavelengths, and would obviate any supposed need for widening of the broadcast band, while perhaps opening up at the same time the possibility of creating two or three extra-wide channels for symphonic broadcasts at say 500 kw. power levels in great population centers, with resulting opportunities for the sale of thousands of quality receivers designed for ample audio range.

Clearing Radio of Legal Debris

Enough has been said to suggest the boundless possibilities that organized traffic management would throw open, for better programs that would sell far more radio sets everywhere and *keep them turned on*—and do it *without special taxation or restrictive legislation of any kind.*

Electricity and X'tals

(*Continued from page* 18)

under the influence of temperature changes—changes in length almost unrecognizable by themselves—bend and twist considerably.

This displacement under the influence of electro-static forces is of the greatest importance for the electro-acoustic industries.

This displacement is so accurate that with it an electrical micrometer could be built as it follows so exactly the electrical impulses in the mechanical reproduction.

Here is an unusual chance for the new electro-static voltmeter, electric pickup and record cutters, new type telephones and loudspeakers with excellent frequency characteristics, relays, oscillographs, etc.

The crystal for this purpose is securely held on three corners while the fourth is free to move. The double curvature bimorph element developed by the Brush Laboratories as the standard speaker driver is 2½ inches square by ¼-inch thick. The three corners, as mentioned above, are clamped between rubber cushions, the fourth corner being used to drive a small cone by means of a lever. The impedance of such an element at 500 cycles is about 25,000 ohms.

In the piezo electric loudspeaker, as shown in Figure 5, one or more twisting elements may be used. While for lower frequencies a mechanical transmission is used so that a larger displacement of the moving part takes place, for a loudspeaker enhancing the upper frequencies up to 10,000, the cone is attached directly to the crystal.

The sensitivity of these type speakers, in spite of their very excellent frequency response characteristics, is so high that *about five times as many crystal speakers as magnetic speakers can be used with the same* output of the amplifier, a great advantage in public-address systems.

Such a loudspeaker is comparable to a condenser, the only difference being that the space between the two condenser plates is not filled by air or liquid, but by a crystaline substance.

The reversed process is also possible. In exposing small grids of Rochelle Salt elements to sound waves, electro-static charges are developed upon opposite plates which are proportionate to the sound waves which fell upon them.

This makes possible the use of these crystals as microphones, which have the great advantage of eliminating battery currents, and have polarizing voltage as in the carbon microphone. No field current is necessary as in the ribbon microphones. Figure 6 shows a microphone of this type. On account of its high impedance, a special transformer or resistance coupling is necessary as shown in Figure 7. The coupling to the grid of the input tube is effected by a special transformer TR as shown at A. Or, a resistance coupling is possible as shown at B.

As this microphone works similarly to a condenser microphone, a special head was designed which makes it interchangeable with the normal condenser microphones connected to the amplifier head. Figure 8 shows a photograph of this outfit.

In addition to being able to reproduce small mechanical forces such as sound waves faithfully, it is possible to design piezo crystals in a set-up of such a type that with it mechanical forces up to many thousand pounds can be registered. As force and mass action are fundamental in the design of all mechanical machinery, and because of the wide range of applications of the piezo-electric methods, this new device is proving invaluable for the investigation and development of all types of machinery. It can be used also for a new type seismographic equipment.

On account of the absence of inertia and the instantaneous response of the crystal, power diagrams taken with this method make visible and enable one to measure all the small superimposed pressure waves in internal combustion engines, and high-pressure steam engines.

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* For exact data of the method and wiring of this most interesting experiment see:
Curie Radioactivité 195 u. 106. 1910.
Ann. chim. phys. 17, 392. 1889.
Oeuvres de P. Curie. p. 554.
Röntgen, Ann. de Ph 41, 449, 1913

† For more details see United States Patents 1450246 and 1472583.

‡ Harald Straubel, Jena, Physikalische Zeitschrift XXXII, 1, 1931.

§ A method of growing and working Rochelle salt is given in E. Schwartz. Experimental investigations on the piezo-electric and dielectric properties of Rochelle salts, Elek. Nach. Techn., 9, pp. 481-495, December, 1932.

A Ribbon "Mike"

(*Continued from page 21*)

clamped in place. The other end is then picked up with a pair of tweezers and the ribbon loosely stretched, just enough so that it will hold itself in position. While holding it in this position the top part of the second clamp is put in place. Slight readjustments may be necessary to properly center the ribbon. The tension on the ribbon is such that the natural period is below the audible range. The ribbon should appear to float freely in the gap when gently blown.

The microphone is now ready for use. It may be mounted on a small stand as shown or suspended by a cord.

A metal screen in the form of a rectangular tube is made to slip over the "Mike". To the under side of this is sewed a piece of voile cloth. This will protect the ribbon from heavy drafts. Be sure the sound waves are just as free to enter the back of the "mike" as they are the front.

An amplifier suitable for use with a ribbon microphone is essentially no different from one that would be used with a condenser microphone. To change one to the other all that is necessary is to replace the condenser coupling resistors with a ribbon coupling transformer.

Figure two shows the circuit of such an amplifier. This uses the standard, non-microphonic, UX–864 tubes. These tubes draw one-quarter of an ampere filament current at a potential of 1.1 volts. Thus running the three filaments in series takes only 3.3 volts which leaves 2.7 volts bias for the first tube when a six volt source is used. The second tube has a bias of 2.7 plus 1.1 of 3.8 volts. Likewise the bias on the last tube is 4.9 volts. As the plate voltage on the first two tubes is less than on the third, due to the resistance coupling, they should have less bias.

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 large ratio between the two, the impedance of the microphone being only a fraction of 1 ohm. (Transformers for this purpose have recently been placed on the market.—The Editors.)

If two wire shielded cable is used as the microphone cord then both terminals of the ribbon should be insulated and the microphone frame grounded to the cable shield which in turn is grounded to minus A at the amplifier. If twisted lamp cord is used one side of the ribbon should be grounded to the frame and the wire connecting this to the amplifier is grounded to minus A at the amplifier. The two wire shielded cable is preferable.

In the interest of readers who may find difficulty in obtaining suitable magnets and other parts for this microphone (as was the case with the Argabrite condenser microphone described in the April, 1932, issue) arrangements have been made with Bruno Laboratories to make all parts available, cut, drilled and tapped in readiness for assembly.

Receiver Performance

(*Continued from page 39*)

accounted for by the use of the four power pentodes connected in a push-pull parallel circuit. This high output level makes this receiver a particularly satisfactory one for installation in restaurants, dance halls, etc., where the noise background requires a relatively high loudspeaker output.

INDEX TO ADVERTISERS

"Backstage"

(*Continued from page 35*)

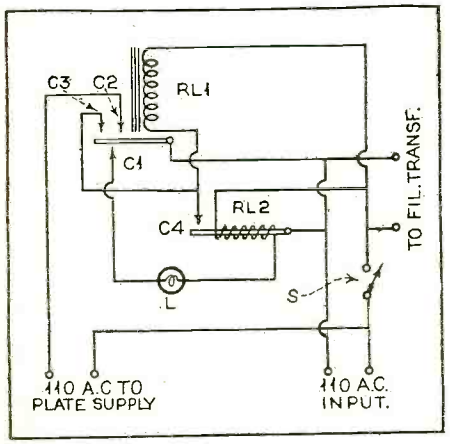
the radio ladder was a booking on one of Rudy Vallee's variety hours and, before long, he was given a weekly spot on the Wednesday night CBS Old Gold hours. Despite his constant Greek portrayals on the radio, Givot is a native American. He was born in Omaha and raised in Chicago. He studied at Chicago University, majoring in dramatics, singing and public speaking. He spent several years in vaudeville and made some joint engagements with Correll and Gosden, the Amos 'n' Andy of present radio fame. He appeared with Mae West in "The Constant Sinner" and more recently was in the revue, "Americana."

With the Experimenters

(*Continued from page 45*)

quately protect the circuit when switched off and then on again while still warm.

An improved arrangement is shown herewith. Relay RL1 is a remodeled power switch of the magnetic operated variety. A



switch of this sort is easily made by remodelling a telegraph sounder for 110 volts operation as was suggested in the February, 1932, issue of RADIO NEWS.

RL2 is the thermo relay which was described previously. It consists of a strip of brass and one of iron, riveted together. A layer of mica is wrapped around this then the heater, consisting of 35 turns of nichrome wire taken from a 30 ohm rheostat, was wound over the mica.

The lamp L is included to regulate the current in the heater windings of the thermo relay. The choice of closing time can be regulated by this lamp. A 100-watt lamp will give closure in about 5 to 10 seconds, so any time relay required can be secured by the use of smaller lamps. It also acts as a pilot light showing the closing time visually.

The action of the device is as follows:

When the switch S is closed, current flows through the windings of the thermo relay, through the contacts C1. As the strip heats up, it bends away from the brass side, and closes contact C4 which excites the windings of the power switch, RL1. This in turn closes contacts C3 and C2 and breaks contact C1. The current for the power switch now flows through contact C3, that is, the relay is self locking. Since the current no longer flows through the heater coil of the thermo relay, this relay cools down and returns to normal position thus recycling itself. The switch S can now be opened and immediately closed, and the timing cycle will again take place. The only time the device fails is when the switch is tripped off and on while the thermo relay is still warm, but this is a condition not likely to be encountered in ordinary operation.

C. BRADNER BROWN,
Kansas City, Mo.

The Service Bench

(*Continued from page 27*)

can be gathered from the illustration, Figure 5. A 9 by 12-foot picture is projected at 70 feet, with sufficient amplification to cover an audience of 2000 persons. The investment should prove profitable to many progressive service organizations.

For Summer Income Don't Overlook Public Address Systems

Elsewhere in this issue is the story of a big sale of Webster Model P T amplifiers made to a progressive chain store outfit which has plans for using the devices in special sales work in members' stores. This order ran to several thousand dollars and was secured not by an established radio dealer or supply firm as one might expect, but by a live wire free lance service-salesman.

This is an excellent example of the fact that servicemen are not sufficiently awake to the fact that big money can be made quickly and cleanly in the public address field. At the same time it affords many opportunities to pick up steady additional income through rental and servicing of installations of amplifiers at banquets, conventions and large outdoor gatherings of all sorts where the speaker or the music wants to be heard.

A little study of the subject and survey of local possibilities will usually uncover an unsuspected wealth of prospects, places and occasions where it is desirable to attract crowds, talk or sell to many people at once, make announcements, etc., indoors or out of doors. With summer coming on, the many outdoors events requiring loud, clear, announcements present good opportunities for business and welcome additional income during a season ordinarily quiet in the radio retail and service fields.

Some dealers and servicemen find it pays to put someone on this work exclusively, someone who can not only follow up the more obvious applications of portable public address amplifiers but also work out merchandising stunts involving their use, and sell the ideas to local stores. This field has hardly been scratched. A factor of first importance in developing Public Address System business is the matter of equipment selected.

Experience seems to indicate that best results, from a sales and rental standpoint, come from selling and using only first class equipment, well-known makes on whose performance you can safely stake your reputation. Furthermore, the imposing list of big events, handled on the known equipment and the neat professional look of the outfits themselves inspire confidence in prospective users, and swing the business your way. Advertisements of the leading manufacturers of Public Address Systems appear in this magazine regularly or we will be glad to supply information along this line.

The DX Corner

(*Continued from page 37*)

has been heard very loud (R8) on the evening on 49.83 meters. Other stations he lists are HJ4ABE, TI4NRH, HBP, VK2ME, GSC, W1XAZ, DJA and DJD. He also says the station we listed recently as

VE9CS is really VE9BJ at St. John, New Brunswick.

Short Waves at Mason City, Iowa

Mr. C. R. Anderson of this city reports loudspeaker reception of the following stations, KGU, HJN, 2YA, 5CK, 2BL, 3LO, 4RK, 4BC, 3DE, 4QJ, WKAQ, CMK, CMCD, CMCN, YU1BC and CMAF. The best received short-wave stations he gets are: GSE, GSC, I2RO, HVJ, PRADO, EAQ, T1TR, TI4NRH, DJC. He says the station we listed as VKPR is really a harmonic of CKPR. He also includes a letter from the German Central Post Office in regard to the German Around-the-World radio programs. The transmitter is in Zeesen, near Berlin, and uses an antenna power of 5 kilowatts. The maximum modulation is 50%. DJA transmits on 31.38 meters. DJB uses a wavelength of 19.737 meters. On 25.51 or 49.83 the calls are DJD and DJC respectively. The programs for the following day are given at 10 a. m. E. S. T., 19.737 meters or DJB, in German and in English.

A Report from Arlington, Mass.

I have a home-built regenerative receiver using two tubes and I regularly receive best GSC and GSB, London and EAQ, Spain. I also hear station VE9GW extremely well and heard them announce their schedule as follows: Fridays 4 p. m. to midnight, Saturdays, noon to 4 p. m., Sundays 11 a. m. to 8 p. m. B. Eldon Short, Arlington, Mass.

Regular Reception in Goldsboro, N. C.

Mr. Jasper Forehand reports the following list as heard regularly: DJD, CKI, EAQ, LCI, CMB (Canton, China), EAM (Madrid, Spain), EAV, IRM, LSX and LSN (Buenos Aires), KTS (Lazy Bay, Alaska), FYC, SKZ, TIR, DIK, XBB, JAP, MRT, LCJ, HHA, HBQ, CMR, GIK, PJS, FTF, GSB and GSA (Daventry, England).

Here Is China!

Mr. D. L. Trenary of Colorado Springs, Colorado, says he first read of XGOA at Nanking, China, being on the air in the May issue of RADIO NEWS and receives them strongly, with fine quality and tone. He hears the station at 2 a.m., 2:35 a.m., 3 a.m., 3:45 a.m. and 4:50 a.m. M.S.T.

JULY, 1933

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.....

"Movie House Murders"

by Allan Saunders

THE Tivoli Theatre is in complete darkness. A thin ray from a spotlight flashes on the center of the yawning orchestra pit. Slowly, unseen except for the light-drenched conductor, the orchestra appears on a rising platform.

As the spotlight falls on the violinists, a gasp of horror runs through the audience. One of the violin players is sprawled forward against his ornate music rack, the metal handle of a knife protruding between his cramped shoulder blades.

Bill Davis, theatrical columnist for the Evening News, rushes to the orchestra pit and begins an exciting series of adventures that finally leads to the solution of the *"Movie House Murders."*

How was the musician stabbed while the orchestra was rising—in complete darkness—without a sound being heard by his comrades? Read the *"Movie House Murders,"* a complete booklength novel, and see how Bill Davis finds the answer!

***In the July* Complete Detective Novel Magazine**

"Cavern of Thunders"

by Harl Vincent

JULES VERNE, in his wildest imagination, never wrote such a story as *"Cavern of Thunders."* Harl Vincent takes us ahead more than 2,000 years to the 42nd century. Mankind has been driven off the face of the earth by a sudden lack of life-giving oxygen. Far under the earth are huge cities in sealed artificial caves where the men of the 42nd century live—breathing manufactured air.

An earthquake is in progress—liquid fire belching forth from unexpected quarters—suffocating gases pouring from the bowels of the earth—walls toppling over—fissures opening in the streets—the populace fleeing to the upper levels!

Read this graphic description of a terrifying earthquake and mankind in the 42nd century. Read *"Cavern of Thunders"* and watch for the dramatic climax. Also in this issue: "Hibernation" by Abner Gelula; the smashing conclusion of "The Intelligence Gigantic" by John Fearn; and other stories.

***In the July* Amazing Stories**

"Son of Steel"

by A. P. Nelson

WHAM! The staccato crack of a rifle shot crashed through the night. The hidden rifleman mounted his horse and galloped over the damp, silent prairie. Close behind rode Bob Hackett, bending low, rowelling his pinto's flanks with sharp-filed spurs.

Over the brink of the canyon they hurtled at what seemed a dizzy speed. Six-shooter in hand, Bob gradually caught up to the fleeing rifleman. *Crack! Wham!* Two shots split the awed hush of the canyon and . . .

Read this exciting story of adventure under western skies—stage coach hold-ups—cattle rustling—bank robberies—powerful bandit factions—lawless ranch holders—and romance amid the din of gunfire.

Read *"Son of Steel"* and enjoy breathless moments in the atmosphere of the old West.

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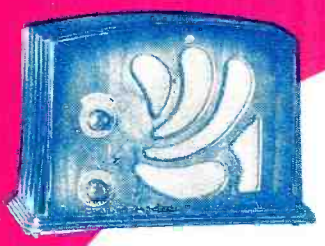


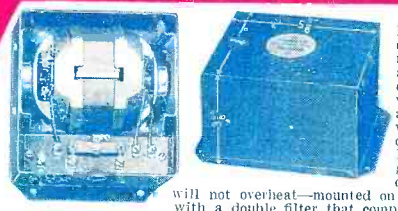
The Champion Radio is the most beautiful and compact radio ever built. It is portable—can be placed anywhere—and it plays in an automobile—simple installation—write for particulars—you now can have an auto radio at very little cost.

The Champion is interchangeable—AC or DC current or with batteries. Latest type tubes, heatless cord and latest features are employed in making this set the most versatile and economical set ever built. Tubes used are 1-1Z3; 1-36; 1-38; 1-78.

Price complete with tubes..... **$8.95**

The International Tube Tester and Rejuvenator has heretofore only been known to the most able critical radio tube engineers the world over. Concentrated efforts of our engineers over a period of three years of hard laboratory experiment has enabled us to achieve a simple mechanical device such as we offer. The construction of the instrument is very simple and does not confuse the user in operation. The instrument does the job! It tests and rejuvenates tubes! It is a two unit outfit in one!

Size 8x10x4 inches.
Shipping weight 10 lbs.
Price..... **$15.00**
Dealers: Write for quantity prices.



The original Gen-E-Motor. A highly efficient improved dynamotor for auto-radio and farm use. Very economical. Converts 6 volt current from storage battery into high voltage current for "B" circuit of Auto Radio Receivers. Nothing to get out of order—requires no oiling—tubes will not overheat—mounted on rubber it is equipped with a double filter that completely eliminates noise. Dimensions are 3⅝" high; 5¾" wide; 5⅞" long. Weighs only 10 lbs. Your Price..... **$9.70**

International Short Wave Converter. Our own version of Calpitz's oscillator with our own method of coupling to the mixer tube which gives greatly increased sensitivity. Can be made on special order to operate on 220 volts, 32 volts, or 6 volts. Will operate on any type of antenna and radio having a normal broadcast range of 500 miles or over. Actually operates on ten meters wavelength. Operates on AC or DC, 60 cycle or 25 cycle—4 position wavelength switch. Comes in attractive metal cabinet (Beautiful Walnut Cabinet $1.00 extra). Complete with tubes..... **$6.95**

Audio Transformer No. 9593R—

carries the following tubes—7-24 or 27; 2-45 or 47; 1-80 and 750 V.C.T.
This transformer fully shielded and can be used for as many as 12 tubes.
Your Price **$1.95**

Limited Quantity

Audio Transformer 3 to 1—small size, will fit anywhere. Your price..... **25c**

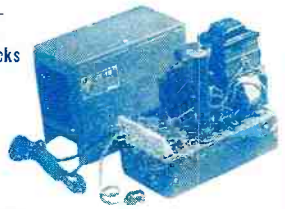
Thordarson 3¼ to 1 fully shielded transformer Your Price..... **25c**

Sangomo—push pull speaker output transformer. Your Price..... **45c**

Jefferson sealed Audio frequency transformer 2 to 1 and 3 to 1 ratio.
Your Price **65¢**

A 25% deposit required with each order. Balance C. O. D. All items advertised. Satisfaction guaranteed.

Power packs—Filter packs—Power supply packs



ZE—182—25 Cycle—Power Pack
ZE—18—60 Cycle—Power Pack
ZE-18X—60 Cycle—Power Pack
ZE—16—Filter Pack—25 cycle
ZE—15—Power Pack—25 cycle
ZE—13—Power Pack—25 cycle
ZE—12—Power Pack—60 cycle
ZE—12X—Power Pack—60 cycle
ZE—10—Power Pack—60 cycle
ZE—8—Filter system for 8 tube loop electric set
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ZE—4—Power supply for Model 27 receiver
ZE—3—A Battery Eliminator 15 volt—60 M. A. Your Price. **$3.95**

Service Carbon Resistors—RMA Color-Coded.

Can furnish in all values for 100 ohm to 3 meg ohm.
1/5 and 1/3 watt....3c each. $2.50 per 100
½ watt.....4c each. $3.25 per 100
1 watt.....5c each. $3.95 per 100
Assorted sizes in 1000 lots.....$29.50

AC Grooved Toggle Switch ½" sleeve—single pole
Your Price **9¢** each

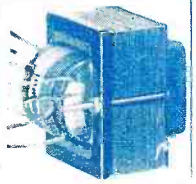
E-Z Toon Vernier dial
Black and Brown—3" 10c
¼" hole ... shaft—5" 17c

Duncan all enclosed Push-Pull out push and inpush transformer .....Your Price 65c
Duncan chokes to match.....Your Price 45c
800 volt condenser block total 800 M.F.D. Your Price 75c

Tung-Sol multiple condenser in cans. 4 to 1 and 1 to 5.....Your Price 19c
Dual-condensers—1 to 30 volts....Your Price 19c
Condenser—small size in cans .1.....7c
Condenser—small size in cans .3.....5c

Transformer No. 1443—2½ volt set 8 amps.—5 volt at 2 amp. 750 V.C.T.—60 cycle. **$1.45**

Same as above in 25 cycle— **$1.65**



Balkite Audio Transformer—with bracket—Balkite 30 henries choke—80 M.A.
Your Price **49c**

Thordarson No. 3022A—carries the following tubes—4-26's; 2-27's; 2-71's; 1-80. Limited Quantity. Your Price $1.75

Thordarson No. 3773—fully shielded carries the following tubes—2-50's; 2-81's; 6-484's—1200 V. C. T. Your Price $1.95

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Latest midget set for AC. Here's a real buy—and a real radio enjoyment. Gets long distance as well as local stations. Tubes used are 1-47; 1-80; 1-58; 1-57. Has a dynamic speaker with fine selectivity.

Complete with tubes **$8.95**

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