SHORT WAVE CONTEST

RADIO NEWS and The SHORT-WAVE

33

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Who will win this World's Championship DX Trophy?

A Publication Devoted to Progress and Development in Radio

Service Work
Engineering
Industrial Application
Experimental Research

Short-Waves
Broadcasting
Television
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Set Building
Amateur Activity
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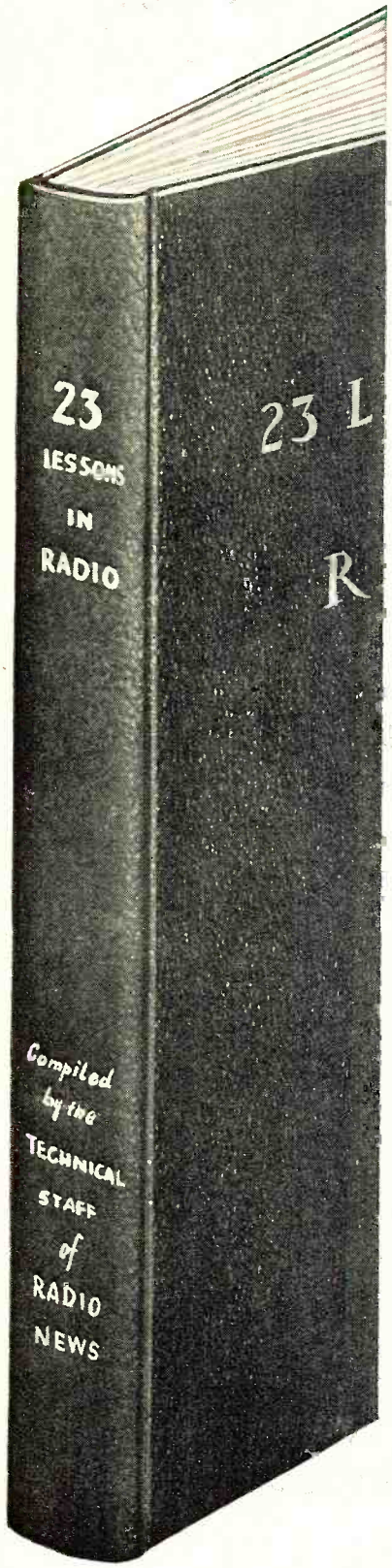

By Popular Demand!

"23 Lessons In Radio"

FREE

With

5 Issues of *Radio News* for $1

THE response to previous advertisements offering this well-known, cloth-bound reference book free with *Radio News* has been so gratifying that we are again repeating this special inducement: A free copy of **"23 Lessons in Radio"** with a 5-month subscription for *Radio News*. Act now—the supply is getting low!

Those just beginning radio training—young men needing a reference book containing the fundamentals of radio—more experienced men wanting dope on the essentials—all will find **"23 Lessons in Radio"** of special value.

You—the readers of *Radio News*—have induced us to reoffer this book, and we are pleased to present it to you *free* with a *short-term* subscription.

A Foundation for All Radio Men

All radio men know the tremendous value of a good background in this field. To be well grounded in the first essentials is the kernel which develops success!

"23 Lessons in Radio" furnishes this background. It is written in clear, concise language and contains innumerable illustrations, charts and schematic diagrams. Just for example, the first few lessons are an exposition of radio principles, and they tell how to build, step by step, a complete 5-tube radio receiver. Later lessons include instructions for building a short-wave converter for this same receiver.

There is a chart explaining the standard radio symbols used in schematic diagrams—a chart of the International Morse Code—and a thousand other things which make this book a thoroughly comprehensive training for the radio set builder, the experimenter, the service salesman and the dealer.

What Do You Want to Know About Radio?

Here are a few of the subjects covered in **"23 Lessons in Radio"**:—Elementary radio theory;—How the detector tube works;—Construction of a 2-stage audio-frequency amplifier;—How the radio-frequency amplifier works;—How to build a short-wave converter which enables you to listen to police reports, amateur stations, and other short wave stations;—Principles of transmitting and receiving;—Standard radio symbols;—How to build a 3-stage resistance coupled audio-frequency amplifier;—Breaking into the amateur game;—How to build a code test outfit;—Circuit, constructional and operating details of a low-power transmitter;—How the vacuum tube works;—How to analyze receiver circuits;—and many other outstanding radio features.

Take Advantage of This Special Offer

"23 Lessons in Radio" is not for sale anywhere! But, by subscribing to *Radio News* for a period of 5 months at the special price of $1 you will receive this great book *free!* Simply fill out the coupon below and send it to us with your remittance of $1. We will immediately mail you a *cloth-bound* copy of **"23 Lessons in Radio"** and your first issue of *Radio News*.

Mail This Coupon Today For Your Free Copy!

RADIO NEWS
222 W. 39th St., N. Y. C., N. Y.

Enclosed please find $1. Send my copy of "23 Lessons In Radio" by return mail and enter my subscription for the next 5 issues of Radio News. If renewal subscription check here ☐.

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Dealer ☐ Experimenter ☐
Address..... Radio Technician ☐
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Pioneer designer and custom-builder of superheterodyne all-wave radio receivers of superior quality

Why the SCOTT ALL-WAVE Deluxe Excels all Other RADIOS

This receiver gives clear, loud-speaker reception from stations 10,000 miles or more distant. It covers the entire wave band between 15 and 4,000 meters.

But this is no longer a distinction. Many receivers are able to tune in, with more or less regularity, short wave stations from foreign lands. Now it is not *what* an all-wave receiver can do . . . but *how* it can do it!

All automobiles have motors, wheels, frames, fenders, etc., regardless of price. Practically all radios have the same general line-up of component parts. The factors that make for superiority in motor cars or radios are scientific precision, highest quality parts, rigid inspections and tests and careful hand workmanship by highly skilled technicians. When quantity-production demands speed and more speed there must be a sacrifice of these qualities. You can get them only in a custom-built receiver.

The SCOTT ALL-WAVE Deluxe is quality custom-built in one of the most completely and modernly-equipped radio engineering laboratories in the land. Constant and gruelling tests, both in the laboratory by scientific instruments and by reception tests carried on in various parts of the world, maintain its quality.

The ultimate result is a vastly superior instrument. It demonstrates its ability not only by startling reception of far-away foreign stations on both the broadcast and short wave bands, but by consistently finer reproduction of programs from domestic broadcasting stations. Tone fidelity in the SCOTT ALL-WAVE Deluxe convinces the ear of actuality . . . laboratory tests prove its variance from actuality undetectable by the human ear.

No claim for SCOTT superiority is made without positive supporting evidence. It will be a pleasure to furnish you with these PROOFS, its moderate price and all other information regarding this radio that has won the title of "The World's Finest Receiver." Simply mail the coupon below.

E. H. SCOTT RADIO LABORATORIES, INC.
4450 Ravenswood Ave. *Department N-103* **Chicago, Ill.**

Performance!

After all, the supreme test performance is made in the hands of owners. Here are a few of hundreds of letters on file in our laboratories:

Venezuela and Germany in Minnesota

The following foreign stations being received at present: FYA, Pontoise; GSA, Daventry, England; EAQ, Madrid, Spain; YV1BC, Caracas, Venezuela; VK2ME, Sydney, Australia; DJB, Germany and CMCI, Cuba.

L. C. Melville,
Minneapolis, Minn.

A Real DXer Reports!

My Scott DeLuxe Allwave Receiver has certainly pulled in the stations. I have only had the set a little while and have pulled in 225 stations on the broadcast band from all over the North American Continent. I have received 86 stations on the short waves of which 62 have been foreign stations. On February 12 and 13 I received 27 foreign stations (short waves) of which nearly all were regular broadcasts with good loud speaker volume. In all I have received 20 different countries to date. The tonal qualities are the best. The sensitivity and selectivity cannot be beaten.

J. F. Luttmann,
Milltown, N. J.

Gets Sweden on West Coast

My set brings in stations other sets don't even show are in the air.

I have a log of over 750 in all states and around 15 foreign countries. On my log I have Motala, Sweden, which I think is extremely good from the West Coast.

Charles Maylone,
Placerville, Calif.

England and Spain Every Night

Have received both England and Spain every night for two weeks. I get them with plenty of volume.

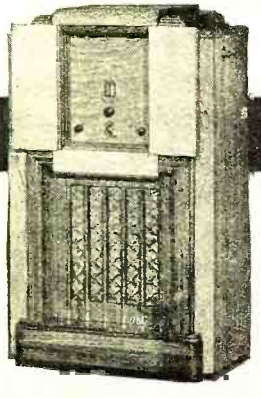
Solomon Ford,
Toledo, Ohio.

Results in Bad Location

I made it my point to try for VK3ME Australia and picked them up at 7:45 and held them to 9:00 A.M. Sunday morning April 2, 1933. I certainly am more than convinced that your receiver is the only one that I have seen that will do as you said. Also tuned in the following stations with good results, considering the cloudy and unsettled weather conditions, and my locality in which I am surrounded byall kinds of electrical machinery. The stations I have received are VK3ME, Australia; Rabat, Morocco; Pontoise, France; Germany, England, and 12RO, Italy.

Mr. Fred L. Roenbeck,
Chester, Pa.

"The Fine Things are Always Hand Made"



A super-fine receiver deserves housing in a cabinet of comparable merit. Here is one of the many distinctive and exclusive designs in consoles created for the SCOTT ALL-WAVE Deluxe. This is the Westerly Grande Model, in rare and exotic woods patterned in a theme moderne.

MAIL THIS COUPON NOW!

E. H. SCOTT LABORATORIES, INC.
4450 RAVENSWOOD AVE., DEP'T N-103, CHICAGO, ILL.

Send me, without obligation, PROOFS of the superiority of SCOTT ALL-WAVE Deluxe performance and tone together with price and complete details regarding its laboratory-construction, etc.

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Address .....

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

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RADIO NEWS

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GENERAL

RADIO CALL BOOK SECTION

DEPARTMENTS

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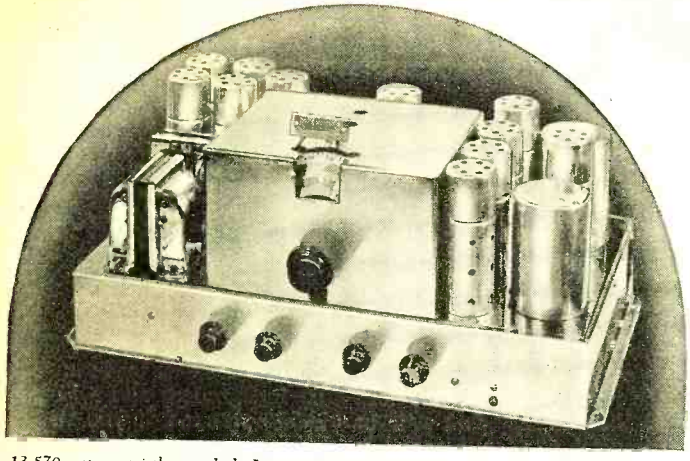
NOT JUST WORLD-WIDE RECEPTION

BUT CLEARER, STRONGER . . REALLY ENJOYABLE



13-570 meters, strictly one dial. Interstation noise suppressor, 10 watts undistorted output and giant theatre speaker four times as efficient as ordinary speakers. Sensitivity less than one-half microvolt. Selectivity — absolute 10 k.c. Each set logged on three foreign stations before shipment.

Creative genius is never content with things as they are. Ahead somewhere there is always a brighter goal that would antiquate all previous achievement.

McMurdo Silver is never satisfied with radio as it is. His official record of 40 previous major advancements in the reception art, bears witness to this simple but glittering truth. His standing in the highly exclusive field of engineering research, and his thousands of followers testify to the worth of his leadership.

It would hardly seem probable, therefore, that Mr. Silver would offer his Masterpiece unless it could readily demonstrate an unmistakable superiority over anything else available. And it would be absurd to assume that Admiral Byrd would select *two* Masterpiece receivers for his forthcoming Polar expedition, unless he, too, knew that the Masterpiece was the best he could get.

YOUR EARS WILL QUICKLY PROVE THE CORRECTNESS OF THESE FACTS

The story of any receiver is conclusively told by engineering curves plotted of its sensitivity, selectivity, fidelity and signal-to-noise ratio. The sensitivity curve of the Masterpiece shows that this receiver will give you louder and clearer reproduction of transoceanic reception than any other receiver you can buy. And your own ears will instantly bear this out on London, Paris, Berlin, Madrid or any of the other far-off stations the Masterpiece so easily receives. The signal-to-noise ratio curve of the Masterpiece shows clearly that this receiver will give you 10,000 mile reception over and above a lower noise level than has ever been reached before. Your own ears will readily bear *this* out too. The fidelity curve of the Masterpiece, as compared to the fidelity curves of other receivers, shows the Masterpiece to be responsive to a wider range of frequencies at all degrees of volume. And no critical ear is required to discern the difference as poured forth from the Masterpiece speaker. The selectivity curve of the Masterpiece shows that this receiver is exactly as you wish it to be; namely, capable of distinctly separating all channels.

10 DAY TEST OFFER

LETS YOU PROVE THE MASTERPIECE TO YOURSELF

The Masterpiece is unconditionally guaranteed to satisfy you, or your money back instantly . . . no questions asked. All of which means that you can order the Masterpiece for 10 days test without risking a dollar. In that time you can compare the Masterpiece to other receivers and thereby see for yourself why McMurdo Silver has earned international recognition as an engineering leader. The coupon will bring you the full technical story of the Masterpiece.

McMURDO SILVER, Inc.

1733 BELMONT AVENUE, CHICAGO, U. S. A.

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Send me full technical information of the Masterpiece.

Name .....

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McMurdo Silver

who is officially credited with 40 major radio advancements

1. First practical and popular superheterodynes in the world—1923.
2. First portable superheterodyne—6"x8"x12" including batteries—1923.
3. First practical and popular really portable superhet—1924.
4. First all wave t.r.f. receiver—1925.
5. First all wave superhet, 15 to 3000 meters—1925.
6. First high quality audio transformer with 5000 cycle cut-off—1926.
7. First selective power-supply filter—1926.
8. First popular one dial t.r.f. receiver kit—1926.
9. First short wave receiver—1926.
10. First plug-in coil short wave receiver—1926.
11. First B power unit to use glow voltage regulator tube—1927.
12. First shielded all wave superhet, 15 to 3000 meters—1927.
13. First shielded 200 to 3000 meter t.r.f. receiver kit—1927.
14. First shielded t.r.f. receiver kit—1927.
15. First screen grid t.r.f. receiver—1927.
16. First screen grid shielded superhet—1927.
17. First single unit shielded i.f. amplifier unit—1927.
18. First tuned i.f. amplifier unit—1927.
19. First shielded A.C. t.r.f. receiver kit—1927.
20. First A.C. superhet—1927.
21. First popular high quality push-pull audio transformers—1927.
22. First portable A.C. public address amplifier—1928.
23. First one dial, five tuned circuit t.r.f. receiver—1928.
24. First receiver to use four screen grid tubes—1928.
25. First tuned audio transformers eliminating hysteretic distortion—1928.
26. First audio transformer for screen grid tubes—1928.
27. First generally available rack and panel public-address system—1929.
28. First A.C. screen grid receiver—1929.
29. First band selector receiver—1929.
30. First screen grid power detection—1929.
31. First receiver having now universally used practical tone control—1929.
32. First A.C. short wave receiver—1929.
33. First R.C.A. licensee to announce superhets—1930.
34. First midget superheterodyne—1930.
35. First 15 to 550 meter receiver not to use plug-in coils—1931.
36. First dual tone control system—1931.
37. First receiver to use variomu or super control screen grid tubes—1931.
38. First 16 to 550 meter superhet with single accurately calibrated dial—1932.
39. First regular broadcast superhet to also be able to get police calls—1932.
40. First "Class A prime" high quality audio power amplifier.

TESTIMONY AGAIN PROVES LEADERSHIP OF SILVER ENGINEERING

OFFICIAL REPORT SAYS, "BEST"

"Possibly with our letterhead identifying us as an experimental laboratory, it might be well to mention that we are not interested in the sale or advertising of any make of radio. At present we are interested in preparing data relative to intermediate, short wave and ultra short wave reception as affected by various conditions: daylight and darkness, humidity, barometrical pressures, etc. with different types of antennae. Naturally we must have instruments built to the highest laboratory standards of selectivity, tone, sensitivity and, above all the receiver must be versatile.

We find the new MASTERPIECE the best receiver that we have purchased or used. Since reception of distant and local stations primarily interests the layman it is well to mention that receivers employing a multiplicity of controls and trimmers, dial calibration, not understood by the average person are playthings in a lab and in most cases useless to the average listener. THE MASTERPIECE is simplicity itself—All anyone has to do is pick out a station from any broadcast listing either broadcast or shortwave, take the first two figures of its assigned wave and tune in the station.

Although perhaps a slightly lengthy testimonial, let us divide the remainder of this communication into three parts covering broadcast, short wave and DX code reception. We will furnish proof of reception and remember we are within a radius of 40 miles of the most powerful broadcasting stations in the world including code transmission.

1. Broadcast 550 to 1500 kc. Daylight—WMCA, WEAF, WOR, WJZ, WGY, WEEU, KDKA, WBZA, WPG, WRVA, WOV, WCAU, WINS, WCAD, WODA, WEAN, WEVD, WHK, WOKO, WJSV, WNBF, WABC.

2. Short wave. 1 Australia; 8 England; 4 France; 4 Germany; 1 Siberia; 5 Canada; 1 Africa; 2 Italy; 5 South America; 1 Switzerland; 1 Denmark; 1 Costa Rica; and 1 Spain, etc.

3. DX signals from every country in the world can be copied.

Broadcast at night. It is impossible to list all broadcasting stations heard but outstanding performances such as 1000 watt stations 1/50 the power of KFI Los Angeles coming in with good volume, i.e., KFOX, KFPY from California. Havana, Cuba, Mexico City, Del Rio and stations all over Canada.

H. B. Miles,
17 Lenox Place, Middletown, N.Y.

"FROM" R.C.A.

"Before me is your recent letter with numerous testimonials of the wonderful results enjoyed by MASTERPIECE owners. Frankly, I see no excuse for anything but the best in a receiver designed by you. This, I explain by saying that in my twelve years of close relationship with every type of receiver and transmitter the name McMurdo Silver is frequently mentioned. When I studied and trained with R.C.A. your name was often mentioned as a foremost authority on superheterodyne tuner design."

M. O. C., Los Angeles, Calif.

EXACTLY AS PROMISED

"I cannot say too much in praise of the MASTERPIECE. My set arrived safely March 3rd and I set it upon the table for a tryout. The tone is excellent and the selectivity is wonderful. I did not have the time to properly install the set until Sunday, March 5th when at 3:30 P.M. all was ready—and right off the handle I tuned in EAQ with more volume than we could use. This was using the comparatively short indoor aerial. The reception was remarkably clear and free from static. Later on I received the same station with the squelch tube in but, of course, at times the signal 'went out.'

Germany was also received in the afternoon and at 9:45 P.M. (EST) Germany was picked about 6000 kc. and the German election returns were heard clearly.

To cap the climax I got up early today and at about 6:30 A.M. after some juggling I received VK2FC at 10520 kc. right on the button. This is Sydney, Australia. Forgot to say that Saturday, March 11th (on the short antenna) I picked up England with good speaker volume and received the news of the California earthquake at 6:20 A.M. Also one of the ambitions of my radio experience was realized. I heard 'Big Ben' in London strike by direct reception.

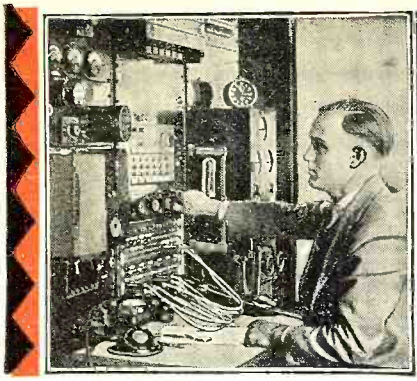
I consider your set the finest piece of radio work in the world—if the station is on the air the MASTERPIECE will get it.

I thank you for the personal interest you have taken in my set and have followed your advice with great success. Again I repeat that I am absolutely satisfied . . . all expectations have been exceeded. So I look at the tuner and say 'baby—you can bring them in.'

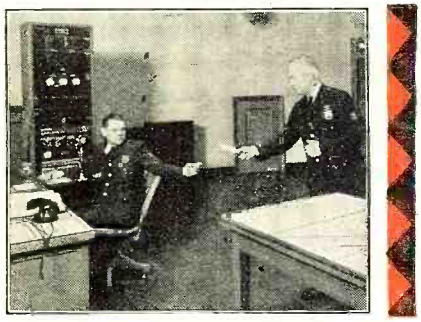
Best wishes for you and the MASTERPIECE."

G. F. B., Bridgeport, Conn.

You are invited to visit our new, greatly enlarged laboratories and demonstration rooms—made possible by the world-wide acceptance accorded the Masterpiece.

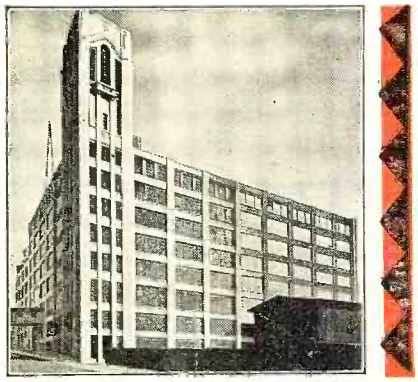


Broadcasting Stations employ trained men continually for jobs paying up to $5,000 a year.



Police Departments are finding Radio a great aid in their work. Many good jobs have been made in this new field.

Spare-time set servicing pays many N.R.I. men $5, $10, $15 a week extra. Full-time men make as much as $40, $60, $75 a week.



Radio Factories—Employ testers, inspectors, foremen, engineers, service men, for jobs paying up to $7,500 a year.

Television—the coming field of many great opportunities—is covered by my course.

I WILL TRAIN YOU AT HOME

Many Make $40, $60, $75 a Week in Radio -- *the Field With a Future*

My book, "Rich Rewards in Radio," gives you full information on the opportunities in Radio and explains how I can train you quickly to become a Radio Expert through my practical Home-Study training. It is free. Clip and mail the coupon NOW. Radio's amazing growth has made hundreds of fine jobs which pay $40, $60, $75 a week. Many of these jobs may quickly lead to salaries as high as $100, $125 and $150 a week.

Radio—the Field With a Future

Ever so often a new business is started in this country. You have seen how the men and young men who got into the automobile, motion picture and other industries when they were started had the first chance at the big jobs—the $5,000, $10,000 and $15,000 a year jobs. Radio offers the same chance that made men rich in those businesses. It has already made many men independent and will make many more wealthy in the future. You will be kicking yourself if you pass up this once-in-a-lifetime opportunity for financial independence.

Many Radio Experts Make $40, $60, $75 a Week

In the short space of a few years 300,000 Radio jobs have been created, and thousands more will be made by its future development. Men with the right training—the kind of training I will give you in the N.R.I. Course—have stepped into Radio at 2 and 3 times their former salaries. Experienced service men as well as beginners praise N.R.I. training for what it has done for them.

Many Make $5, $10, $15 a Week Extra In Spare Time Almost At Once

My Course is world-famous as the one "that pays for itself." The day you enroll I send you instructions, which you should master quickly, for doing 28 Radio jobs common in most every neighborhood. Throughout your Course I will show you how to do other repair and service jobs on the side for extra money. I will not only show you how to do the jobs but how to get them. I'll give you the plans and ideas that have made $200 to $1,000 a year for hundreds of fellows. G. W. Page, 110 Raleigh Apts., Nashville, Tenn., writes: "I made $935 in my spare time while taking your Course." My book, "Rich Rewards in Radio," gives many letters from students who earned four, five, and six times their tuition fees before they graduated.

Get Ready Now for Jobs Like These

Broadcasting stations use engineers, operators, station managers and pay up to $5,000 a year. Radio manufacturers employ testers, inspectors, foremen, engineers, service men, buyers and managers for jobs paying up to $7,500 a year. Radio dealers and jobbers (there are over 35,000) employ service men, salesmen, buyers, managers and pay up to $100 a week. There are hundreds of opportunities for you to have a spare-time or full-time Radio business of your own—to be your own boss. I'll show you how to start your own business with practically no capital—how to do it on money made in spare time while learning. My book tells you of other opportunities. Be sure to get it at once. Just clip and mail the coupon.

I HAVE STARTED MANY IN RADIO AT 2 AND 3 TIMES

$400.00 Each Month

"I spent fifteen years as traveling salesman and was making good money but could see the opportunities in Radio. Believe me, I am not sorry, for I have made more money than ever before. I have made more than $400 each month and it really was your course that brought me to this. I can't say too much for N.R.I."—J. G. Dahlstead, Radio Sta. KYA, San Francisco, Cal.

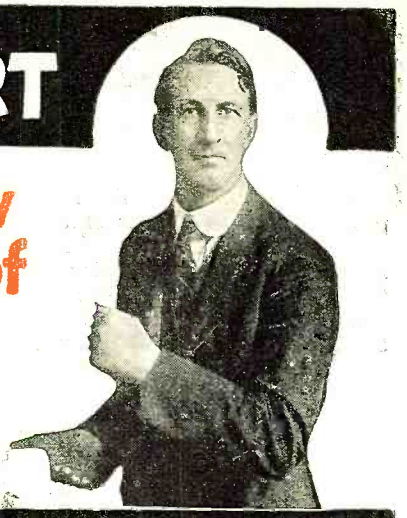
$800.00 In Spare Time

"Money could not pay for what I got out of your course. I did not know a single thing about Radio before I enrolled, but I have made $800 in my spare time, although my work keeps me away from home from 6:00 A.M. to 7:00 P.M. Every word I ever read about your course I have found true."—Milton I. Leiby, Jr., Topton, Pennsylvania.

Chief Engineer Station WOS

"I have a nice position and am getting a good salary as Chief Engineer of Radio Station WOS. Before entering Radio, my salary was barely $1,000.00 a year. It is now $2,400.00 a year. Before entering Radio, my work was, more or less, a drudgery—it is now a pleasure. All of this is the result of the N.R.I. training and study. You got me my first important position."—H. H. Lance, Radio Station WOS, Jefferson City, Missouri.

TO BE A RADIO EXPERT



Act Now --- Mail Coupon Below for Free Book of Facts and Proof

You Can Learn at Home in Your Spare Time to be a Radio Expert

Hold your job. There is no need for you to leave home. I will train you quickly and inexpensively during your spare time. You don't have to be a high school or college graduate. My Course is written in a clear, interesting style that most anyone can grasp. I give you practical experience under my 50-50 method of training —one-half from lesson books and one-half from practical experiments with equipment given without extra charge. This unique and unequalled method has been called one of the greatest developments in correspondence Radio training. N.R.I. pioneered and developed it. It makes learning at home easy, fascinating, practical.

Learn the Secrets of Short Wave, Television, Talking Pictures, Set Servicing, Broadcasting

I'll give you more training than you need to get a job—I'll give you your choice, and not charge you extra either, of my Advanced Courses on these subjects—(1) Television, (2) Set Servicing and Merchandising, (3) Sound Pictures and Public Address Systems, (4) Broadcasting, Commercial and Ship Radio Stations, (5) Aircraft Radio. Advanced specialized training like this gives you a decided advantage.

Your Money Back if You are Not Satisfied

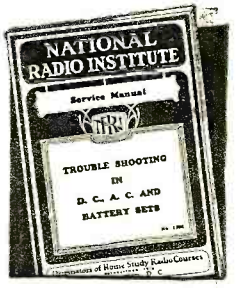
I will give you an agreement in writing, legal and binding upon this Institute, to refund every penny of your money upon completing my Course if you are not satisfied with my Lessons and Instruction Service. The resources of the National Radio Institute, Pioneer and World's Largest Home-Study Radio School, stand behind this agreement.

Find Out What Radio Offers. Get My Book

One copy of my valuable 64-page book, "Rich Rewards in Radio," is free to any resident of the U. S. and Canada over 15 years old. It has started hundreds of men and young men on the road to better jobs and a bright future. It has shown hundreds of men who were in blind-alley jobs, how to get into easier, more fascinating, better-paying work. It tells you where the good Radio jobs are, what they pay, how you can quickly and easily fit yourself to be a Radio Expert. The Coupon will bring you a copy free. Send it at once. Your request does not obligate you in any way. Mail coupon in envelope or paste on postcard. ACT NOW.

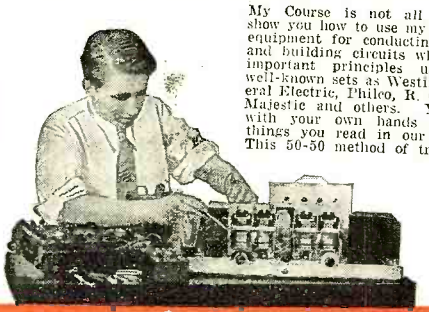
J. E. SMITH, President
Dept. 3KR, National Radio Institute
Washington, D. C.

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 our lesson books. This 50-50 method of training makes learning at home easy, interesting, fascinating, intensely practical.

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

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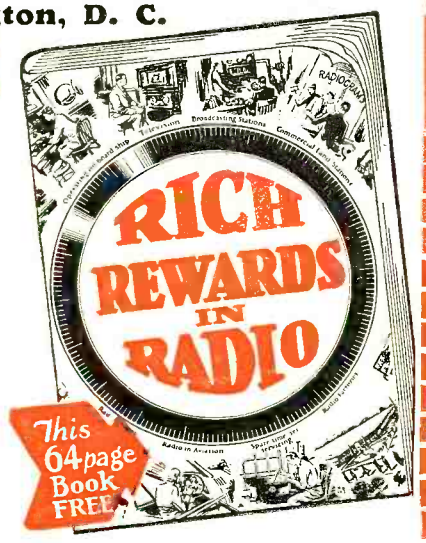
"M"

FORMER PAY

Experienced Radio Man Praises N.R.I. Course

"Before taking your course, I had worked at Radio for over seven years, doing quite a bit of servicing, but I realized that I was in need of better training. From the first lesson on I began to understand points that had had me wondering. The course has taught me what I could not have learned otherwise and I would not take many times the price it has cost me, for the knowledge I have gained. In a period of nine months, I have made at least $3,500."—C. J. Stegner, 28 So. Sandusky St., Delaware, Ohio.



The Editor—to You

A NUMBER of our readers may feel surprised to see the words Short Wave included in the title of this month's magazine. But this is not surprising, when the history of the short waves is examined, for the short waves have actually become, during the last two years, the greater part of radio. The technical reason for this is that although the average layman has become used exclusively to the broadcast band, including the frequencies of 1500 kilocycles (200 meters) to 540 kilocycles (555.2 meters), the short-wave bands below 1500 kilocycles include usable wavelengths thousands of times as great in number. In other words, the short-wave band now utilized for short-wave broadcasting, aviation, police, television and amateur transmissions from 20,000 kilocycles (15 meters) to 1500 kilocycles (200 meters) contains 1850 transmission channels, all 10 kilocycles in band width, as against only 97 channels for the regular broadcast band. This is approximately 19 times the number of wavelengths. And if we consider also the ultra-short-wave bands from 6,000,000 kilocycles (5 centimeters) upward to 1500 kilocycles (200 meters) there are 599,850 channels available or approximately 6184 times the number of channels on the broadcast band.

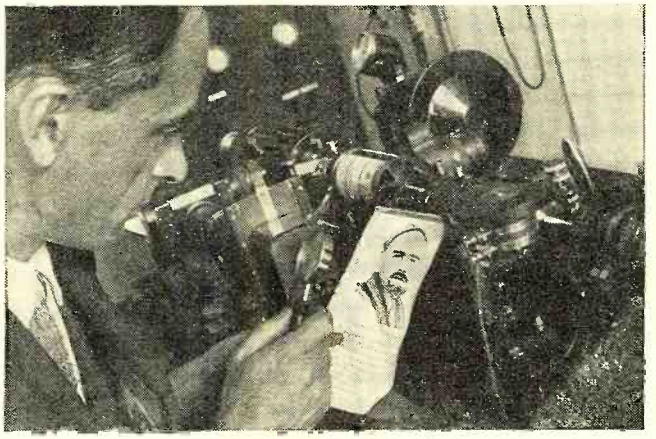
In the possibilities of these short waves for distance reception, as well as for local usage for short-distance transmission on the ultra-short waves, are thus something that interests everyone from the broadcasters to the listeners, including government officials, engineers and technicians, scientists, experimenters, servicemen and the people who actually do the puttering around with their own receivers.

Therefore, in order to bring to the attention of the multitude of new recruits to the radio game through the short waves, we have added these words to our cover and are also incorporating all the short-wave articles in the magazine in a short-wave section that will be found this month in the front of the book.

Who discovered the short waves? This is a question that has often been asked, and the credit probably should go to Heinrich Hertz, that great research worker who first demonstrated the properties of radio waves. In his experiments he actually used very short waves for transmission and reception, although he did not put them to any commercial use. But it is to the radio amateur that the first widespread investigation of the practicability and use of the short waves, for long-distance communication, is due. Being crowded to ever shorter waves, by the growing demands for ordinary channels in radio communication, he pushed his researches to the short waves and finally overcame the great problems involved to cover the world with a series of networks, from hemisphere to hemisphere. The leading article in this issue tells an interesting story of one amateur station's struggle from a small beginning to fame. This story might be applied to thousands of other amateurs who have, with very little power, been able to cover world distances in transmission and reception.

* * *

THE engineer today has to keep well informed on the short waves because of greatly increased activity in this field. The designer has new problems in developing new transmitters and receivers for this frequency band, both for commercial uses and for broadcast uses. RADIO NEWS will keep him well "up" on what is going on in this field.



A RUSSIAN PICTURE TRANSMITTER

This apparatus transmits pictures from Moscow to Tashkent, Tadjikistan, in the government newspaper service. The illustration shows M. Delacroix examining a picture that has been received

* * *

THE serviceman, if he is to realize on the growing profits to be had from installing and servicing short-wave equipment which will eventually become the main part of radio, for listener use, must keep up with the progress that is being made. An increased activity on the part of RADIO NEWS in this field will therefore add materially to the success and profits of our servicemen readers.

* * *

THE short-wave experimenter, who builds and experiments with new short-wave circuits, will find in RADIO NEWS the latest data on long-distance, short-wave receivers as well as simple sets employing the newest circuit principles and the latest type of tubes. RADIO NEWS will continue to cater to them in helping them with their problems and in giving them new designs to experiment with.

THE short-wave DX fan has had to rely, up to recently, on just happening to pick up short-wave, long-distance broadcast reception as he twists his dials. Due to the new and exclusive service that RADIO NEWS is now offering in the DX Corner, listing the complete time schedule of short-wave broadcast stations throughout the world, any listener, young or old, can determine at a glance just what stations are on the air in foreign countries or in any part of the world and on just what wavelength he has to listen for them. The high quality and authenticity of this service is vouched for by our Westchester Listening Post, in which actual reception of these stations, during the times listed, is verified. No short-wave listener can afford to do without such a service as supplied exclusively by RADIO NEWS.

* * *

PROSPECTIVE short-wave set purchasers will find, listed monthly in RADIO NEWS, at least one article describing actual tests made on the air on a new design of short-wave or all-wave set. The editors believe that such tests, listing actual results, is the best way in which the prospective set owner can determine what kind of a set will best suit his needs. Curves and charts of performance mean little to him. What he wants to know are the results!

* * *

IN outlining this campaign of increased short-wave activity in the editorial section of RADIO NEWS, we do not mean in any way that the regular technical, developmental and educational material will be dropped. This will be continued *as usual* in giving the latest information and general applications of radio, newest researches, developments in design, circuit work, new tubes, acoustics and electronics. We have always striven to give readers in each group at least one authoritative article in their field, on subjects of vital interest that alone will be worth the price of the copy in which it appears. This policy is being continued and we will be more than "choosey" in selecting these future articles for our readers.

* * *

AGAIN let us repeat our invitation to each and every reader to communicate with the editor, letting him know their individual wants in the way of articles. This has always been the way RADIO NEWS has been edited—to give our readers what they want.

* * *

COMING over the editor's desk this month are a number of letters of inter-

est from readers the world over. A few excerpts follow:

"Your new official program service, as compiled by Mr. Samuel Kaufman, is a very helpful feature to us and we are exceedingly grateful to you for publishing it. Can you tell me if there is available, anywhere, a list of stations by frequency, call letters and location? Our hospital is equipped with earphones, at each patient's bed, in addition to loudspeakers and consoles. Therefore, our radio operator caters to a variety of people. If there is such a compilation anywhere in the radio world, we would appreciate the favor if you would give us information as to where to get it." H. H. Anderson, Recreation Aide, Veterans Administration Hospital, Columbia, S. C. (A complete broadcast list of stations, such as you desire, is published approximately twice a year in RADIO NEWS.)

* * *

"SOME time ago I consulted your laboratory over a technical problem with which I had trouble and today I received your technical editor's reply giving me all the information required. I am writing to thank you and your laboratory staff for your kindness in answering my questions and to state that although I have only been a reader of RADIO NEWS since March, 1931, I have learned more about radio engineering from your publication than from any other magazine, either English or American, in the last ten years. I have one fault to find with the magazine, however, and that is that it is not published every week instead of every month. Otherwise there is nothing to touch RADIO NEWS. I am looking forward to the final installment of Mr. C. A. Johnson's article on Filters." F. Carter, Salford, Manchester, England. (The final installment appears in this issue.)

* * *

"GLANCING at the current number of the magazine, I see that 'Mathematics in Radio' is returned to RADIO NEWS. Many thanks. Keep it up. I see that the RADIO NEWS Index is also included. This is good, as it sure does come in handy. The 'Students Radio Physics Course' is going strong. Keep it that way. How about some more articles by James Millen on the ultra-short waves? Also how about an article on the latest technical news of television?" Wendell Plunkett, Stilesville, Ind. (There is a television article of the sort you request in this issue.)

* * *

"I LIKE RADIO NEWS. Some years ago I used to be a subscriber, but I like it better than ever now. There is a world of good reading in it and it is just what we servicemen need to keep up with the latest in radio." Eden L. King, Ralls, Texas.

Laurence M. Cockaday

"From Small Beginnings"

The original home-made regenerative receiver set-up is the first piece of apparatus to be used in the Philippine amateur station at Fort William McKinley. Notice the low-loss antenna insulator, consisting of a round hole cut in the wall timbers with the antenna running through the middle. The long rod projecting over the table edge is a "remote control" running to the transmitting switch in another room. It consists of a bamboo pole roped on to the switch handle. This photograph was taken about ten years ago and shows Lieut. Roberts copying code

Radio News

VOLUME XV October, 1933 NUMBER 4

AMATEUR RADIO ON THE SHORT WAVES

An interesting narrative of the growth of a tiny station along the path to fame that epitomizes the development of the short waves by radio amateurs. Too great praise cannot be given to these natural researchers into the scientific hinterland for the success of short-wave communication

By Haydn P. Roberts*

WAS it the buzzing of a mosquito? Was it my imagination? Or was it a radio signal from the United States, 7500 miles away?

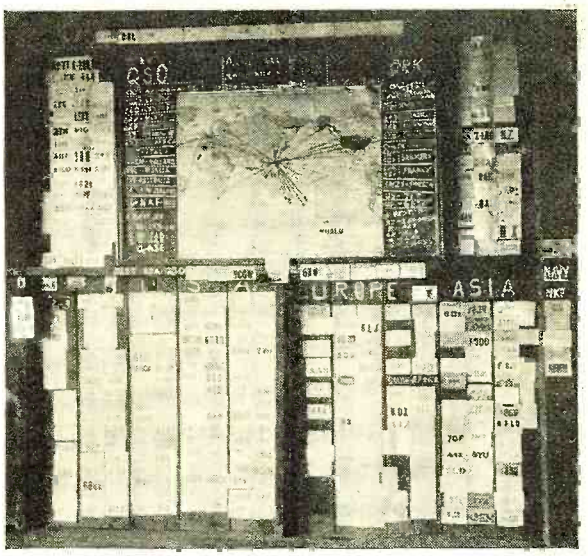
The sun had already sunk into the Pacific, and a welcome tropical breeze was providing its usual relief to a hot afternoon. A little wooden shack stood, on "Signal Hill," at Fort McKinley, not far from Manila. The crimson rays of the afterglow of sunset threw colored sheets of light through large cracks in the wall. A gekko that had been raucously calling had "run down" and finished his song with the last mournful "gek-o-o-o-o-o-o-o." When it stopped there was silence, save for the constant background of noise from millions of insects.

I pressed the headphones closer to my ears. What a thrill. Here were dots and dashes, extremely weak, but partially readable by straining the ears. At last I was able to make out the call letters of 6AWT, of San Francisco, California. Today, 7500 miles range and short-wave amateur communication between the Philippines and the United States is almost commonplace. But let us go back, for a moment, and get a picture of what it meant eight years ago.

The story of KA-IHR starts in 1924, when the writer was ordered to duty in the Philippine Islands. At this time, 200 meters was a wavelength still in vogue, although work had been done on the 80-meter band, and experimental work had been started at even lower wavelengths. Don Mix was up north on WNP (Wireless North Pole), using about 220 meters, mostly. Amateur spark stations were still blasting the "ether," although "highbrows" had already been using tube sets. The amateur band was from 150 to 200 meters, but only those with "Z" licenses could use the whole band, and d.c.-c.w. was required. An "X" license was required for the use of waves below 150 meters, and "quiet hours" were quite the thing for everyone, from 8 to 10:30 p.m., in order not to interfere with the broadcast listener. We were beginning to hear about "super" wonders being performed experimentally on low waves, and the 1924-1925 season was looked forward to with great interest.

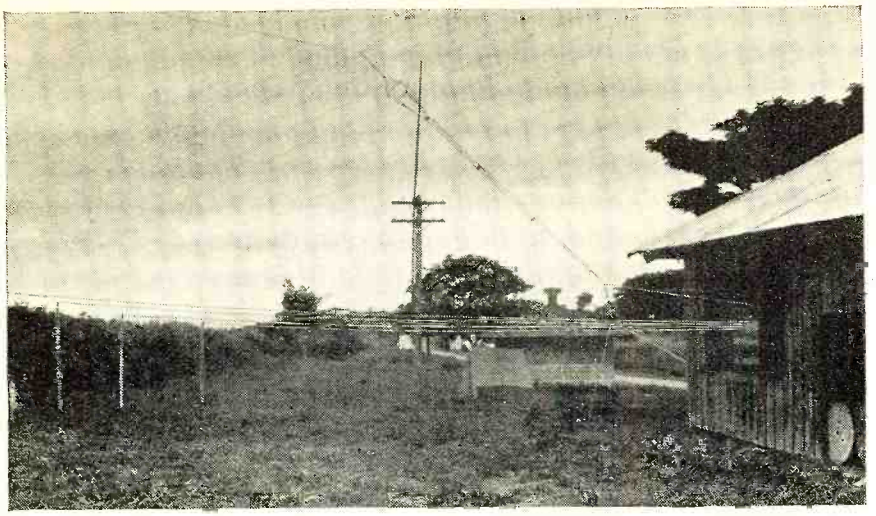
QSL CARDS IN 1925

Each of these cards hung on the wall represents a verification of reception of signals of the amateur transmitter KA-IHR from all over the world



Before leaving for Manila, the American Radio Relay League's headquarters at Hartford, Conn., was visited, with a view of getting a few ideas, or perhaps, some encouragement on the idea of attempting two-way communication with the Philippines. Mr. Hebert, well-known ARRL officer, stretched a string around his globe, from New York to Manila, to see how it looked. We both shook our heads rather gloomily, and admitted that it looked like a pretty big order. I decided to try it, anyway, by relaying through Hawaii. However, a look at the great circle map showed that Seattle was just as close as Hawaii,

*First Lieutenant, Signal Corps. U. S. A.



A FAMOUS ANTENNA AND SHACK

The illustratinn above shows the KA-1HR antenna and counterpoise. At right Staff Sergeant Cabiling, winner of the second Robert's Cup, inside the transmitter room at the amateur station Fort William McKinley, Rizal, P. I.

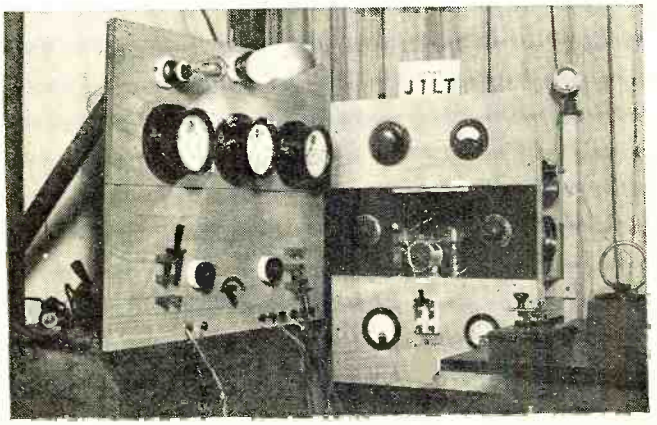
and that Siberia, or even Alaska, would make a better relay point than Honolulu. Ten thousand miles, in those days, was DX that could hardly be hoped for.

It was shortly after I had arrived in Manila when I learned that New Zealand had been contacted by 6CGW and 6CBP, on about 150 meters. This was a distance of 6900 miles, and immediately my spirits were raised. However, they were quickly lowered again when I learned that there was no radio supplies that could be purchased there. A home-made variometer with attached tickler coil was constructed and hooked on to an Army VT-1 type tube, and this became the first tuner at KA1HR. With no way of measuring the wavelength covered, various sizes of variometers were tried, which undoubtedly covered the band between 100 and 250 meters. About the only thing heard with this receiver was static, and plenty of that.

Soon afterwards I met an American amateur, living in the Philippines, by the name of Fred Elser, who later signed PI3AA. Elser was the proud possessor of a Grebe 200-meter receiver, and we decided we ought to try the "real" short-wave band of 75 to 80 meters wavelength, that we had heard so much about. We clipped off some turns and finally arrived at where we thought this band should be covered. We were rewarded in some degree by hearing station HVA in French Indo-China. Not so far, to be true, but at least encouraging. Hearing anything at all made my fingers itch for a transmitter with which to do some two-way work. Permission was received to remodel a long-wave, unserviceable Signal Corps field set, and soon the first short-wave signals were sent out of the Philippine Islands, on a band between 50 and 100 meters.

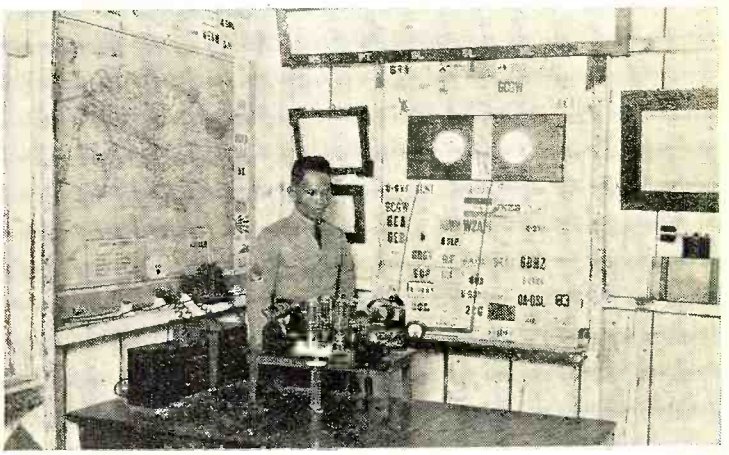
A JAPANESE TRANSMITTING SET-UP

This JILT'S transmitter and power panel often worked and visited by KA-1HR



We had no licenses at that time, and a convenient call letter was used, making use of my initials; and since there also was no "prefix" assigned for the Philippines, the call letter PI1HR were used. My efforts were soon rewarded by a two-way contact with HVA, who informed me that I was transmitting on approximately 80 meters. I sent him the first short-wave message out of the Philippines; he answered with the first to be received here. Finally several Australian and New Zealand stations were heard, and much energy was expended in calling them, but no results were obtained.

About this time it was necessary for me to leave this experimental work for a few weeks, to make a radio reconnaisance of the Island of Luzon. Upon my return, I learned of wonderful things being done on wavelengths of 50 meters and below.



The home-made tuner was trimmed down some more, and another stage of audio-frequency amplification was added to it. Antenna coupling was improved and a new antenna erected, and finally I heard some sounds, as though some baby mosquitoes were trapped in my headphones.

Finally, 6AWT's signal was copied and read. It occurred to me that if I could hear him, he ought to hear me. The transmitter of IHR was therefor sliced down again, to the 40-meter band, and then began hours and hours of calling. Night after night this station called and called, but got no answer. Two other California amateurs were heard in the meantime, but neither could be worked. Everything possible was tried to increase both antenna and transmitter efficiency, in the meantime.

The Army-Navy Radio "Battle"

One night, while listening to 6AWT (and secretly cussing him out for not being able to hear me), my eardrums were nearly blasted by a screeching signal, on this band, calling 6AWT. It finally signed NPO, and I knew that now I had competition, since NPO was the Naval station at Cavite, P. I. Gunner Durkee had been getting this set whipped into shape and finally had it on the air. Night after night we took turns giving 6AWT (the strongest signal of any U. S. station heard to date) a long call. I felt at the time (and found later that I was right) that whenever I signed off a long call and said "K," that Durkee was secretly praying I would get no answer until he got through first. And I must admit that I had the same idea whenever he signed off. Each of us wanted to be first to bridge the Pacific on amateur short-wave equipment. Nights passed into weeks, and finally I heard the famous call NRRL, and knew that Fred Schnell had "shoved off" from San Francisco, bound for Australia, with nothing on his mind but working all the amateurs he could from his seagoing "shack" on a Navy ship. What an opportunity! Here was an amateur station, getting closer to me each night, and surely I could hope to get through a message, when he got as far as Honolulu or beyond. We now had two stations to call, and Durkee at NPO, and 1HR batted out call after call far into the night, since it was now merely a matter of time before one of us

would surely be heard.

Finally, one night I heard 6AWT calling NPO, and although I hoped Durkee wouldn't hear it, he did. He answered and got a report on his signal strength, after which 6AWT asked if there were more stations in the Philippines. I could have sworn I heard Durkee laugh, when he came back with the information that there were not. However, I started out once more, and after a few long calls, succeeded in "hooking" 6AWT finally. It occurred to me, however, that although words had been exchanged, no actual message had yet been sent between the Philippines and the United States, and with this one consoling thought, I sent 6AWT the first message, of 38 words, and got the OK, and after a little conversation, made regular schedules with him, which were kept without much further difficulty.

Sidelights

6AWT told me, during the course of our conversation, that his name was Bartholomew Molinari and that he was a baker. He remarked that it was very cold there, but that his radio room was quite comfortable, being situated right over the bake ovens. This had little appeal for me, since I had all the heat I desired at the time. So I told him how many million bugs were crawling down my neck, getting burned in the condenser plates, and how it was occasionally necessary to take time out to remove a few lizards which had dropped from the ceiling down the back of my neck. One such lizard became the station pet a little later. He was a peculiar little shaver and had no tail. We called him Mike, for no good reason. Mike's favorite hangout was on a large map of the world, over which was a light that attracted many a delicious morsel of food in the way of bugs of all colors, sizes and shapes. Max waxed fat, and many a station, later, from various parts of the world, has inquired concerning Mike and where he was tonight. We would look on the map and answer, maybe in Russia, maybe in Egypt, and occasionally he was parked in California or somewhere on the Pacific, in between. Mike had probably the longest neck we have ever noticed on a lizard. He never got any closer than three to four inches from his victim, and then he would wag his stub tail as a cat might when watching a mouse. Suddenly his head would snap out on the end of a three or four-inch neck, and like lightning the victim was in his jaws. I have seen Mike tackle bugs whose bodies were three times the size of Mike's head, and he never failed to catch them, or to slowly swallow them, bit by bit. Many another lizard tried to "horn in" on Mike's world, on the map, but all were chased right off the world, excepting one. We finally had to come to the momentous decision that this one particularly appealed to Mike, and so we called it "Bedelia."

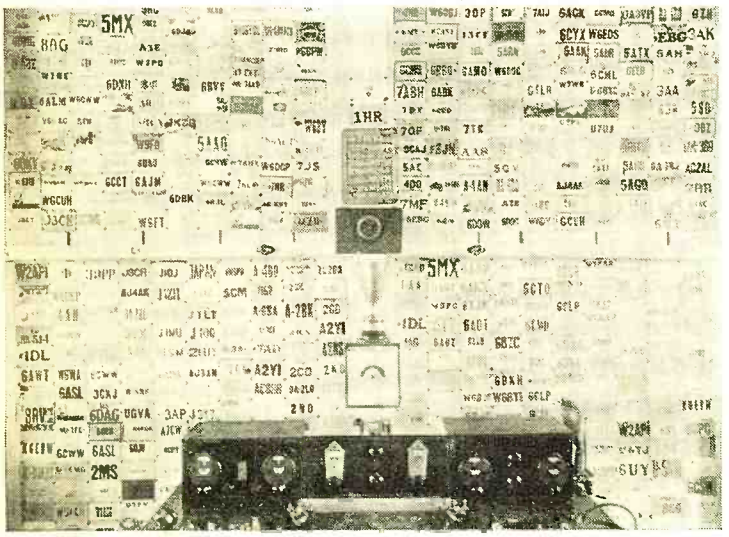
Before NRRL got to Hawaii, 1HR was in communication with her, and Schnell kept regular schedules with us the rest of his trip, and as a matter of interest, 1HR was the last entry on the log of NRRL as she arrived home in San Diego. NRRL gave us valuable information on our signals. All stations which reported 1HR's signals with good strength were marked on the map with red pins, while places where our signals were weak were marked with white pins. NRRL being a mobile station, helped us to find out that our antenna was markedly directional. The red pins finally looked like a comet's trail in the sky, and when this was laid out on a globe it, of course, made a "V," instead of a curved comet shape. The northern edge of this V was slightly north of San Francisco, while the southern end was in the vicinity of Panama, or below. The Marconi type of antenna used was giving us, therefore, good results for United States stations south of a line from San Francisco to New Orleans, including Mexico and all of South America. However, although this area was more easily worked, the directional effect was not marked enough to prevent operation in any other direction, and we soon had contacted Australia, Japan, Hawaii, Russia, Africa and Alaska.

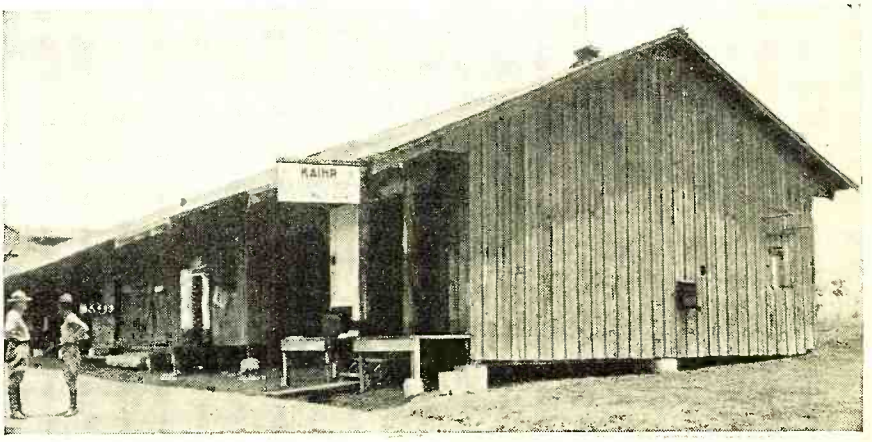
WELL-KNOWN LOS ANGELES AMATEUR

E. O. Knoch, owner and operator of W6BJX, winner of the first Robert's Cup and often working direct with the Philippines

A few interesting experiences while operating 1HR include the first contact had with station FX1 in Hawaii. This station proved to be an Army station, operated by Signal Corps personnel. One night I heard an operator on this station whose "fist" I felt certain I had heard before. After a brief talk, I learned that it was none other than "QN," Captain Hoppough, whose call was familiar to commercial operators 25 years ago and who taught the writer radio more than 20 years ago.

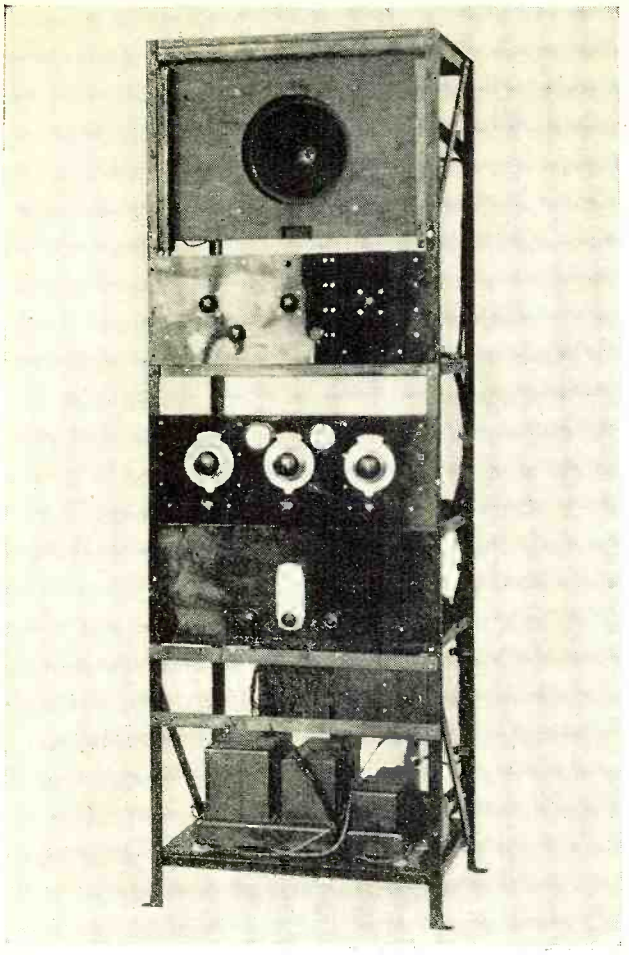
One night an extremely faint signal was heard calling 1HR. It proved to be WJS, the Rice Expedition in Brazil, South America, some 12,000 miles away. We had an interesting conversation, in which we were informed that they were deep in the interior, where no white man had been before, and they were delighted at the results they obtained with this portable transmitter. A little later we succeeded in (*Continued on page* 241)





HEARD ALL OVER THE WORLD

At left, "Wall paper" made of a few more QSL cards received by KA-1HR. Below, another view of the radio shack showing its well known amateur sign



FRONT VIEW OF COMPLETED RECEIVER

The units, from the top down, are: loudspeaker; push-pull, tuned r.f. input tuner; fixed crystal oscillator and a.v.c. system; tuned i.f. amplifier; power supply consisting of one small pack and one heavy-duty pack

A Crystal Controlled Short-Wave SUPER

This article introduces a new series which will include a description, with constructional data, of an unusual type of short-wave receiver designed by the author and employed by him to pick up foreign programs for rebroadcast over his 790 kc. broadcast station, CMJK, Camaguey, Cuba

By Frank H. Jones

Part One

EXPERIMENTS have shown that a high-grade tuned r.f. short-wave receiver with no regeneration gives better overall quality than most previous designs of the superheterodyne type. This is especially true in a well-designed band-pass receiver in which there is absolutely no side-band cutting, at least below 5000 cycles.

Why should this be so?

Frequency stability in a transmitter directly affects the quality (audio) that the transmitter is able to deliver. Crystal control and careful design have made it possible to transmit an almost perfect signal in the frequency bands used by the broadcasters, namely, 550 to 15000 kc. But the picture changes materially when you try to transmit on 10,000 or 15,000 kc. Whereas, on the longer waves slight frequency variations in the carrier wave affect only slightly the quality of reception, similar frequency variations in a short-wave transmitter are generally exaggerated and affect in a horrible manner the quality of the signals and the final results of reception.

The large companies in recent years have perfected to a high degree the frequency control of their short-wave broadcast transmitters, and they really put out a very high-class signal. But short-wave receiver design has not kept pace.

True, simply controlled and wonderfully sensitive short-wave receivers are now common, but most of them leave much to be desired if their outputs are compared with the output of a studio input audio amplifier, resistance or impedance-coupled, and working out of a high-grade condenser or electrodynamic microphone.

When one is considering utilizing the short-wave transmissions from these high-grade stations it is naturally essential to receive the signals and deliver them to the rebroadcast transmitter as nearly perfect and noise-free as possible, otherwise the retransmission has no merit in these days of rigid quality requirements. Also the same criterion of quality may apply if the receiver is used only for listening enjoyment. Naturally, for home listening only, much of the real fine possibilities may have to be sacrificed due to cost or lack of space for proper antenna structures. However, there are always a great number of people who are not satisfied unless they can have the best and they are able and willing to pay for the better article.

The short-wave receiving apparatus described in this paper meets the above demands, and while it is rather costly, there are undoubtedly many who will want to duplicate at least the receiver part even though the special antenna structures may not be possible, due to lack of space. The receiver functions to excellent advantage on any good antenna, but of course there are many advantages in using the directional antenna described, such as much better signal-to-noise ratio (about 15 to 1).

TABLE 1	
1971 K.C.	FUNDAMENTAL
3942 KC.	2ND HARMONIC
5913 KC.	3RD HARMONIC
* 7884 KC.	4TH HARMONIC
9855 KC.	5TH HARMONIC
11,826 KC.	6TH HARMONIC
* 13,797 KC.	7TH HARMONIC
15,768 KC.	8TH HARMONIC

TABLE 2		
SIGNAL FREQUENCY	CRYSTAL OSCILLATOR HARMONICS	TUNED I.R.F. AMPLIFIER
* 15,340	13,797 (7TH)	* 1543 KC.
15,000	13,797 (7TH)	1203 KC.
14,000	11,826 (6TH)	2174 KC.
14,000	15,768 (8TH)	1768 KC.
13,000	11,826 (6TH)	1174 KC.
12,000	13,797 (7TH)	1797 KC.
* 11,870	13,797 (7TH)	* 1927 KC.
11,000	9,855 (5TH)	1145 KC.
10,000	11,826 (6TH)	1826 KC.
* 9,530	7,884 (4TH)	* 1646 KC.
9,000	7,884 (4TH)	1116 KC.
8,000	9,855 (5TH)	1825 KC.
7,000	5,913 (3RD)	1087 KC.
* 6,140	7,884 (4TH)	* 1744 KC.

Generally speaking, the sensitivity and selectivity of even a multi-stage t.r.f. receiver are way below the possibilities of the superheterodyne receiver. Also, t.r.f. receivers for short-wave signals are hard to build so as to get much signal voltage on the detector grid. This has led to the design of push-pull t.r.f. amplifiers which allow a much higher inductance-to-capacity ratio in the tuned-grid input circuits. In push-pull circuits, the grid-to-filament capacities are in series and the balanced coil circuits, using split-stator condensers of small capacity, have taken full advantage of the above facts to get a larger signal voltage on the grids. I am not sure, but I believe that Thomas A. Marshall was one of the first to develop in the navy a tuned-radio-frequency receiver using a balanced push-pull circuit.

A superheterodyne receiver for quiet operation requires a strong signal on its first detector. The two stages of push-pull balanced t.r.f. amplification in our receiver provide this. From this stage on is where we develop our signal strength and selectivity.

Previous articles of my own in RADIO NEWS have shown that an intermediate frequency of between 1500 and 2000 kc. gives good gain and and also good insurance of image-frequency rejectivity, and as you will see as this description develops, the i.r.f. amplifier will function in that range.

The moment we change the signal frequency by mixing it with a local oscillatory current, we are laying the receiver open to possibly defective results. If the oscillator were absolutely steady, it would be no trick to get the desired results, as superheterodynes are almost easier to build than straight t.r.f. sets. And here is the rub. For long waves, slight instability of the oscillator is not extremely serious. It most certainly is serious when working on short waves. But, you will say, you can't use a separately controlled crystal oscillator for every wave you want to tune in. Of course not. That would be impractical except in cases of where a commercial station only wanted to receive one particular wave with a given receiver.

Tuning the I.F.

However, the solution is relatively simple, and also I may mention that the idea is not new. The answer is, just use one fixed-frequency, crystal-controlled oscillator and tune variably the i.r.f. amplifier. For example, when you mix a 13,797 kc. oscillator output with an incoming 15,340 kc. wave to produce a 1543 kc. beat frequency for the i.r.f. amplifier, it works out just as well electrically to take that same 13,797 kc. oscillator wave and mix it with an 11,870 kc. incoming signal to produce a 1927 kc. i.r.f. wave, only in this case you simply retune the i.r.f. amplifier to the 1927 kc. frequency.

By having a three or four-stage, high-grade t.r.f. amplifier, with ganged tuning condensers, that will cover the range from say 1000 kc. to 2200 kc., we have all that is needed and it is just as convenient to quickly tune the i.r.f. amplifier to the proper frequency as in the old case it was to tune the oscillator.

MANY will remember with interest a previous short-wave superheterodyne design described by Mr. Jones in the August, 1931, issue. Since that time he has been at work evolving a completely new receiver which, as completed, and now in constant use as a rebroadcast pick-up, incorporates the advantages of both the push-pull, tuned r.f. and the superheterodyne type receivers, but eliminates certain objectionable features inherent in each of these types. The completed design, which Mr. Jones will describe in the following articles of this series, will provide the experimenter a fund of ideas which he will be able to apply in part or in full to his own experimental designs. While Mr. Jones' receiver was designed primarily to meet the rigid requirements for picking up transatlantic s.w. programs for rebroadcast by his own broadcast station at Camaguey (Cuba), it is, of course, equally applicable to the purposes of any short-wave listener who desires unusual results.

—*The Editors.*

REAR VIEW OF RACK ASSEMBLY

This is the rear of the unit shown on opposite page and shows the receiving equipment described in these articles as installed by the author at CMJK, Cuba

Crystal Control

By using an extra tube for developing various harmonics that you will see later are required, we will kill two birds with one stone. This tube also serves as the coupling tube and acts as a buffer to prevent reactions from the first detector from working back and affecting adversely the frequency stability we are looking to maintain in the oscillator.

Recent developments in oscillator design have shown that the multi-grid tubes such as, for instance, the -47 type, when connected in a self-oscillating circuit using what is known as "electron coupling," have a higher inherent stability than is possible of attainment with three-electrode tubes. In other words, variations of plate and screen potentials, filament voltage, temperature, etc., have such effects in the circuit used as to be more or less compensating so that the inherent stability of an oscillator such as this, even without crystal control, is much higher than a triode.

Now when you add to this a crystal control and keep the light load constant on this oscillator, you have an ideal oscillating current that is almost as good (but not quite, due to lack of temperature control) as the signal wave, say, of W8XK.

Personally, we are only interested in the reception of signals from 16 to 50 meters.

A study of the heterodyning possibilities of frequencies between 1000 kc. and 2200 kc. with some fixed crystal oscillator wave shows some slight difficulties and complications. Also, it is not very practical to grind crystals (quartz) for the very high frequencies such as, say 10,000 or 15,000 kc. So we must use a lower frequency in our oscillator and then with a harmonic amplifier pick out the frequencies that we can conveniently use. After some study, it appeared desirable to make the crystal oscillator function on 1971 kc. (this is an easy crystal frequency to grind) and then, through the agency of the frequency multiplier or harmonic amplifier, pick out the desired frequencies which will be used in our receiver. It turns out that the fourth and seventh (*Cont'd on page* 248)

How to Build A Five Meter Receiver

This article gives constructional data on a five-meter receiver which has demonstrated its effectiveness in suburban, rural and city locations during tests by the* RADIO NEWS *staff

[*By* Garo W. Ray*]

THE transmission and reception of radio signals at frequencies in the order of 56 megacycles or higher has long been the subject matter of discussion and experimenting, so that the comparative merits of such high frequencies and their possibilities for communication are now familiar to most experimenters. Particularly, the 56-megacycle region, to which we will refer as the 5-meter band and which is open for amateur experimenting, offers a great fascination, not only to the licensed transmitting amateur, but also to other experimenters who wish to listen in.

While it is apparent that no extravagant claims may be made as regards the DX possibilities of the 5-meter band, these possibilities being particularly limited by geological and physical factors, there is little doubt but that for local communication this wave range is highly practical—so much so that it is actually being put into broadcast service in field work, where metallic circuit facilities are limited or not available.

Work on these ultra-low waves offers some interesting advantages found in none of the higher wave ranges. There is a complete absence of atmospheric "static" and almost as complete absence of static of the man-made variety. In locations where wavelengths between 15 and 200 meters are practically useless because of interference caused by automobiles, power lines, household devices, etc., 5-meter reception will be notable for its quietness. Likewise, at times when broadcast-band reception is well-nigh ruined by atmospherics, not the least bit of this trouble will be found on 5 meters. Fading is also conspicuous for its absence on 5 meters. This means not only constant signals, but also the absence of distortion so commonly encountered on higher waves as the result of fading phenomena.

The 5-meter receiver we present herewith is intended to give the 5-meter enthusiast an inexpensive but highly efficient unit. Its circuit components embody principles long applied to receivers of many types, and while no claim is made of extraordinarily novel circuit design, the general get-up of the outfit has proven completely worthy of whatever time and money is spent on its construction, because results have proved to be very gratifying.

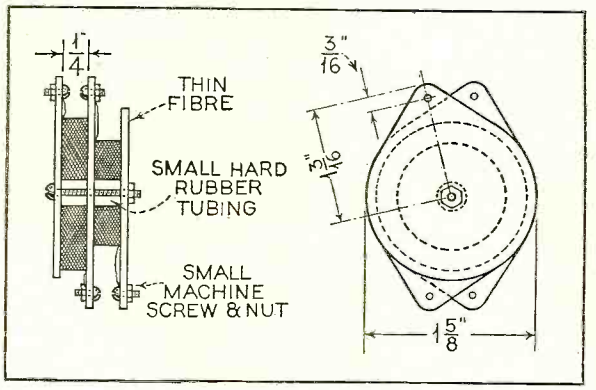
The circuit comprises a simple regenerative detector using a type –37 tube, an auxiliary low-frequency oscillator using also a type –37 tube and finally a simple pentode audio stage using a type –38 tube, which for all purposes provides sufficient amplification for moderately strong signals to be received on a loudspeaker.

The receiver is of the well-known super-regenerative type, embodying an auxiliary oscillator which provides an unusually high degree of sensitivity without the inherent spilling over of the ordinary regenerative detector circuit.

The schematic diagram, Figure 1, illustrates the method of wiring the various components making up the receiver. Most of the parts are standard. The only parts not available on the market and which must be made are the grid and plate coils (L1, L2) for the detector, the radio-frequency transformer (L3-L4) of the auxiliary oscillator, and a high-frequency choke (L5) for the detector plate. This choke may be made by winding 25 to 30 turns of number 36 wire on a piece of ¼-inch-diameter bakelite or hard rubber rod. The spacing between turns should be such that the winding is about 3 inches long. The grid and plate coils of the detector may be wound with round bus bar, using a large-diameter pencil for a form. Six or seven turns for each coil is generally satisfactory. The spacing between turns, which must be fairly large, has a great deal to do with the frequency range covered, so that the actual readjustments of these coils to the 5-meter band can best be made after the set is ready for a tryout. The capacity, C8, which tunes the receiver is a 100 mmfd. midget variable condenser. This condenser is connected to the inside terminals of the grid and plate coils, while the outside terminals of these coils are connected respectively to the grid and plate terminals of the detector tube socket. Another small capacity, a neutralizing condenser, C9, is connected across the grid and plate terminals of the detector tube socket. This condenser serves to readjust the set until the 5-meter band has been located, and once this is done, this adjustment need not be touched or altered.

LOW-FREQUENCY OSCILLATOR COILS

Figure 2. Details for the construction of the transformer. Winding data are given in the text



FRONT VIEW OF THE RECEIVER

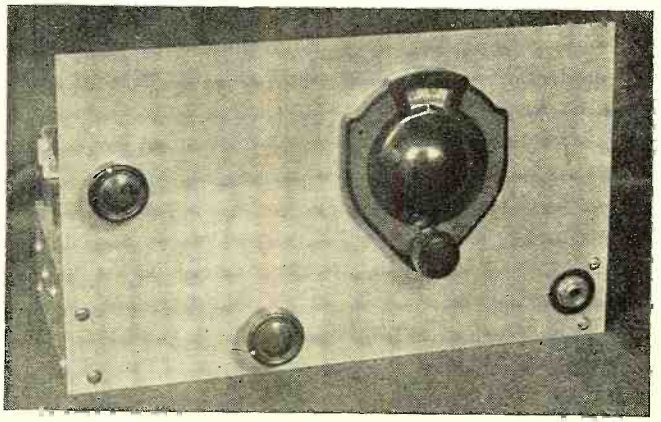


Figure 2 shows the specifications for the radio-frequency transformer for the auxiliary oscillator. The plate coil is wound with approximately 800 turns of number 36 wire, jumble wound, while the grid coil is wound with approximately 1400 turns of the same size wire, also jumble wound. The fixed condenser C1, placed across the grid coil, tunes this oscillator to its proper frequency, which is not critical.

The antenna condenser, C7, plays an important part

* Chief Engineer, Broadcast Station WICC.

in tuning the set properly. As shown in the photograph of the receiver, the antenna series and tuning condensers (C7, C8) are placed as far away from the front panel as possible and are equipped with bakelite extension shafts. All variable condensers must be maintained above ground potential, so it is necessary to mount these on insulated pillars as illustrated in the photograph.

All the tubes are biased through resistors — the values of these resistances being given in the list of parts. The regeneration control, R4, is a potentiometer used as a straight variable resistor. The value of this resistor is in the order of 50,000 ohms and any good variable resistor of this value should be entirely satisfactory.

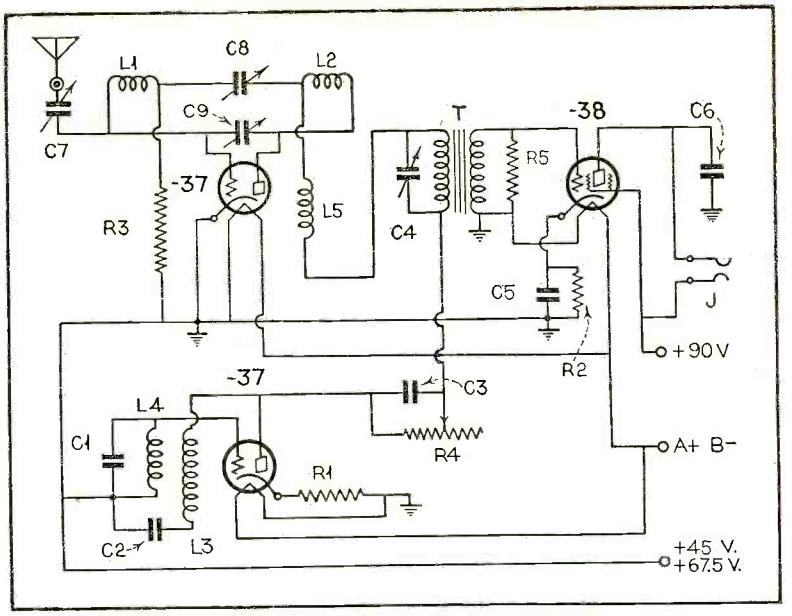


FIGURE 1. THE SCHEMATIC CIRCUIT DIAGRAM

The audio transformer can be any of the commonly used types, preferably of a three-to-one ratio. A high resistance value, in the order of 100,000 to 300,000 ohms, should be connected across the secondary of this transformer to provide a definite load termination and eliminate any tendencies toward audio howling.

Preliminary Adjustment

After the set is made ready for operation, it is only necessary to determine whether the set will tune to the 5-meter band. If it is found that the set tunes too low or too high, it is necessary to adjust the trimmer condenser (C9) across the grid and plate of the detector tube in order to bring the tuning of the set into the 5-meter band. If this condenser will not accomplish this, try increasing or decreasing the spacing between turns of L1 and L2. Once this adjustment is reached, it need never be changed.

The antenna requirements may prove rather critical. In some cases a regular antenna may be used effectively, but in some tests made with this receiver a wire about four feet long produced the best results. Experiments with antennas ranging between 2 feet and 20 feet will be worth while.

Characteristic of super regeneration, in operation the set will manifest a hissing sound in the loudspeaker or phones, over the tuning of the greater part of the dial. This hiss will, however, be suppressed as soon as the carrier of a station is tuned in. receiving fairly loud signals the hiss disappears entirely and the signals come in with amazing clarity and fidelity. The outstanding merit of this receiver, besides its being simple and sensitive, is that it is not at all critical in tuning, under the proper conditions of operating. B batteries are recommended for the plate supply because they make for quiet operation of the receiver. However, throughout the tests the writer used a power pack with very fine results and little or no induced noise.

The most fascinating use that a 5-meter set can be put to is in two-way communication, in much the same manner as a telephone. In actual use, over a period of weeks, this receiver has been put through its paces in conjunction with a 5-meter phone transmitter, making it possible for the writer to carry on reliable, hour-after-hour communication with an associate, in very much the same manner as using a house telephone. It is entirely possible to use both receiver and transmitter at the same time—neither one interfering with the other, except when the frequency of the received signal is extremely close to that of the signal being transmitted; even then it is altogether possible to butt into the conversation of the incoming transmission just as though the widely separated operators were talking within arm's reach of one another.

In a following issue of RADIO NEWS, the description of a phone transmitter complementary to this receiver will be offered. The combination of the two units ought to make for a very interesting installation for the 5-meter telephone enthusiast.

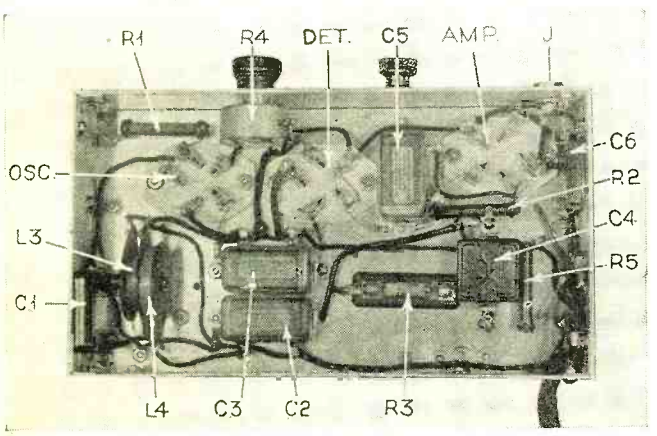
Parts List

C1—Aerovox type 1450 fixed condenser, .002 mfd.
C2, C3, C5—Aerovox type 260 by-pass condensers, .1 mfd.
C4—Aerovox type 1460 fixed condenser, .005 mfd.
C6—Aerovox type 1450 fixed condenser, .001 mfd.
C7—Hammarlund type MC-20-S, 3-plate midget condenser
C8—Hammarlund type MC-140-M, 19-plate midget condenser
C9—Hammarlund type MICS-140, adjustable padding condenser, 70-140 mmfd.
J—Single-circuit (open) phone jack
L1, L2, L3, L4, L5—See text for constructional data
R1, R2—Resistors, 2000 ohms

(*Continued on page 256*)

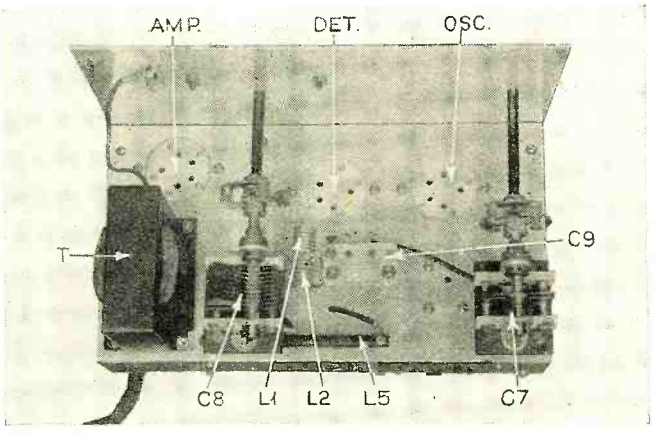
UNDER THE CHASSIS

The arrangement as shown here is neat and ship-shape, with ample access to all parts for wiring



TOP VIEW OF CHASSIS

The tiny coils in the center are in strange contrast to the larger coils ordinarily employed in radio receivers. It is important that all leads in the tuned circuits be kept to minimum length



The DX Corner

IN this seventh 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**
30.5	J1AA	
31.2+ Sun.	VK2ME	
31.5 Wed., Sat.	VK3ME	
70.2	RV15	
6 A. M. Eastern Standard Time		**Local Time**
16.9	GSG	
19.8	GSF	
30.5	J1AA	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5 Wed.. Sat.	VK3ME	
49.4+ Irregular	W8XAL	
70.2	RV15	
7 A. M. Eastern Standard Time		**Local Time**
13.9+	W8XK	
16.9	GSG	
19.6	FYA	
19.8	GSF	
23.3+ Sun.	RABAT	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
49.2 Mon.. Tues.	VE9GW	
49.4+ Irregular	W8XAL	
70.2	RV15	
8 A. M. Eastern Standard Time		**Local Time**
13.9+	W8XK	
16.8+ Irregular	PHI	
19.6	FYA	
19.7	DJB	
19.8	GSF	
23.3+ Sun.	RABAT	
25.4	I2RO	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
4.94+ Irregular	W8XAL	
31.8+	PLV	
49.0+	VE9HX	
49.2 Mon.,Tues.Sun.	VE9GWJ	
31.5+	GSB	
49.9+	VE9DR	
70.2	RV15	
9 A. M. Eastern Standard Time		**Local Time**
13.9+	W8XK	
16.8+ Irregular	PHI	
19.6	FVA	
19.7	DJB	
19.7	W8XK	
19.8	GSF	
25.4	I2RO	
25.6 Except Sun.	VE9JR	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.8+	PLV	
49.0+	VE9HX	
49.2 Mon.Tues.Sun.	VE9GW	
49.4+ Irregular	W8XAL	
49.9+	VE9DR	
10 A. M. Eastern Standard Time		**Local Time**
13.9+	W8XK	
16.8+ Irregular	PHI	
19.6	FYA	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
19.8	GSF	
25.4	I2RO	
25.5 Irregular	DJD	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.5+	VV3BC	
31.8+	PLV	
49.0+	VE9HX	
49.2 Mon..Tues.Sun.	VE9GW	
49.4+ Irregular	W8XAL	
49.9+	VE9DR	
11 A. M. Eastern Standard Time		**Local Time**
13.9+	W8XK	
19.6+	W2XE	
19.7	W8XK	
19.7	DJB	
19.8	GSF	
25.2	FYA	
25.2	W8XK	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Except Sun.	VE9JR	
26.8+ Sun.	CT3AQ	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.5+	YV3BC	
49.0+	VE9HX	
49.2 Mon..Tues.,Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.9	VE9BJ	
49.9+	VE9DR	
12 NOON Eastern Standard Time		**Local Time**
13.9+	W8XK	
19.7	W8XK	
19.7	DJB	
19.8	GSF	
25.2	FYA	
25.4	I2RO	
25.5 Irregular	DJD	
25.6 Sat.	VE9JR	
31.2+	W3XAU	
31.2+ Sun.	VK2ME	
31.3+	W1XAZ	
31.5+	GSB	
31.5+	VV3BC	
49.2 Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.9	VE9BJ	
49.9+	VE9DR	
1 P. M. Eastern Standard Time		**Local Time**
16.8 Except Sat.	W3XAL	
19.7	W8XK	
19.7	DJB	
25.2	FYA	
25.4	I2RO	
25.5	GSD	
25.5 Irregular	DJD	
25.6 Sat.	VE9JR	
30.4 Sat.	EAQ	
31.3 +	W1XAZ	
31.5	GSB	
31.5 +	VV3BC	
49.2 Sun.	VE9GW	
49.3 + Sun.	W9XAA	
49.4 + Irregular	W8XAL	
49.5	W3XAU	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.0+	HVJ	
2 P. M. Eastern Standard Time		**Local Time**
16.8 Except Sat.	W3XAL	
19.5 Sun.	W2XAD	
19.7	W8XK	
19.7	DJB	
25.2	FYA	
25.3	I2RO	
25.3+	W2XE	
25.5 Irregular	DJD	
25.5	GSD	
25.6 Ex. Sat., Sun.	VE9JR	
30.4 Sat.	EAQ	
31.2+	XETE	
31.3	HBL (cc de)	
31.3+	W1XAZ	
31.5+	GSB	
31.5+	YV3BC	
49.2 Sun.	VE9GW	
49.3 + Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5	W3XAU	
49.5 Temporary	OXY	
49.6+ Sun.	W1XAL	
49.9+	VE9DR	
3 P. M. Eastern Standard Time		**Local Time**
16.8 Except Sun.	W3XAL	
19.5+Ex.Tu.Th.Sat	W2XAD	
19.7	W8XK	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5 Irregular	DJD	
25.5	GSD	
25.6	FVA	
25.6 Ex. Sat. Sun.	VE9JR	
30.4 Sat.	EAQ	
31.2+	XETE	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
31.5+	YV3BC	
32.3 Sun.	RABAT	
45.3+ (chimes)	REN	
48.8+	W8XK	
49.1+Except Sat.	W9XF	
49.2 Th.Fr.Sat.Sun.	VE9GW	
49.3 + Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5 Temporary	OXY	
49.6+ Sun.	W1XAL	
49.9+	VE9DR	
50.0	RV59	
4 P. M. Eastern Standard Time		**Local Time**
16.8 Except Sun.	W3XALJ	
25.2	W8XK	
25.3+	W2XE	
25.4	I2RO	
25.5	GSD	
25.5	DJD	
25.6	FYA	
31.2+	XETE	
31.2+ Tues., Fri.	CT1AA	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
31.5+	YV3BC	
49.5 Temporary	OXY	
32.3 Sun.	RABAT	
46.7 Irregular	W3XL	
48.8+	W8XK	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1 Except Sat.	W9XF	
49.2 Thu.Fri.Sat.Sun	VE9GW	
49.3+ Sun.	W9XAA	
49.4+ Irregular	W8XAL	
49.5	W3XAU	
49.9+	VE9DR	
50.0	RV59	
5 P. M. Eastern Standard Time		**Local Time**
16.8 Except Sun.	W3XAL	

19.8	HVJ	
25.2	W8XK	
25.3+	W2XE	
25.4	12RO	
25.5	GSD	
25.5	DJD	
26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.0	TI4NRH	
31.2+ Tues., Fri.	CT1AA	
31.2+	XETE	
31.3 Sun.	HBL	
31.3+	W1XAZ	
31.3+	DJA	
31.5+	GSB	
31.5+	YV3BC	
32.3	RABAT	
38.4+ Sun.	HBP	
46.7 Irregular	W3XL	
48.8+	W8XK	
49.0	W2XE	
49.0+	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Th.Fri.Sat.Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.5 Temporary	OXY	
49.9	VE9DR	
50.0	RV59	
50.6 Irregular	HJ4ABE	
6 P. M. Eastern Standard Time....Local Time		
19.8	GSF	
25.2	W8XK	
25.6	FYA	
26.8+ Tues., Thurs.	CT3AQ	
30.4	EAQ	
31.0	TI4NRH	
31.2+ Tues., Fri.	CT1AA	
31.2+	XETE	
31.3+	W1XAZ	
31.3+ Irregular	DJA	
31.4+	W2XAF	
31.5+	GSB	
31.5+	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Ex. Sat., Sun	W9XF	
49.2 Th.Fri.Sat.Sun.	VE9GW	
49.3+	W9XAA	
49.4+ Sun.	W8XAL	
49.5 Temporary	OXY	
49.9+	VE9DR	
50.6 Tues.,Thurs.Sat	HJ4ABE	
7 P. M. Eastern Standard Time....Local Time		
19.8	GSF	
25.2	W8XK	
25.6 Except Sun.	VE9JR	
25.6	FYA	
31.0	TI4NRH	
31.2+	XETE	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
31.5+	GSB	
31.5+	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.2 Sat., Sun.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.8	DJC	
49.9+	VE9DR	
50.6 Except Sun.	HJ4ABE	
8 P. M. Eastern Standard Time....Local Time		
25.2	W8XK	
25.6	FYA	
25.6 Except Sun.	VE9JR	
31.2+	XETE	
31.3+	W1XAZ	
31.3+	DJA	
31.4+	W2XAF	
31.5+	YV3BC	
48.8+	W8XK	
49.0	W2XE	
49.0+	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat	W9XF	
49.2 Sat.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.8	DJC	
49.9+	VE9DR	
50.5	HJ1ABB	
50.6 Except Sun.	HJ4ABE	
51.0	HJ2ABA	
73.0+	HCJB	
9 P. M. Eastern Standard Time....Local Time		
25.6	FYA	
25.6 Except Sat.	VE9JR	
31.0	TI4NRH	
31.2+	XETE	
31.3+ Irregular	DJA	
31.3+	W1XAZ	
31.4+	W2XAF	
31.5+	YV3BC	
40.5+	HJ3ABD	
45.3 Thurs.	PRADO	
48.8+	W8XK	
49.0	W2XE	
49.0+	VE9HX	
49.1+	YV1BC	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Sat.	VE9GW	
49.3+ Sun.	W9XAA	
49.4+	W8XAL	
49.5	W3XAU	
49.8 Irregular	DJC	
49.9+	VE9DR	
50.5	HJ1ABB	
50.6 Mon.Wed.Fri	HJ4ABE	
51.0	HJ2ABA	
73.0 Except Mon.	HCJB	
10 P. M. Eastern Standard Time....Local Time		
25.6	FYA	
31.0	TI4NRH	
31.2+	XETE	
31.3+	W1XAZ	
40.5+	HJ3ABD	
45.3 Thurs.	PRADO	
45.0 Fri.	TGW	
48.8+	W8XK	
49.0	W2XE	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Sat.	VE9GW	
49.4+	W8XAL	
49.5	W3XAU	
49.9+	VE9DR	
50.5 Thurs.	HJ1ABB	
50.6 Mon. Wed. Fri.	HJ4ABE	
11 P. M. Eastern Standard Time....Local Time		
19.8	GSF	
25.6 Sat.	VE9JR	
31.2+	XETE	
31.3+	W1XAZ	
45.0 Fri.	TGW	
48.8+	W8XK	
49.1+ Sat.	W3XAL	
49.1+ Except Sat.	W9XF	
49.2 Sat.	VE9GW	
49.4+	W8XAL	
49.5	W3XAU	
49.9+	VE9DR	

Station Locations

Wavelength	*Call Letters*	*Dial Settings*
13.9+	W8XK	Pittsburgh, Pa.
16.8+	W3XAL	Bound Brook, N. J.
16.8+	PHI	Huizen, Holland
16.9	GSG	Daventry, England
19.5	W2XAD	Schenectady, N. Y.
19.6	FYA	Pontoise, France
19.6+	W2XE	New York, N. Y.
19.7	W8XK	Pittsburgh, Pa.
19.7	DJB	Zeesen, Germany
19.8	GSF	Daventry, England
19.8	HVJ	Vatican City
23.3		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	EAQ	Madrid, Spain
31.0	TI4NRH	Heredia, Costa Rica
31.2+	XETE	Mexico City
31.2+	W3XAU	Philadelphia, Pa.
31.2+	VK2ME	Sydney, Australia
31.2+	CT1AA	Lisbon, Portugal
31.3	HBL	Geneva, Switzerland
31.3	GSC	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+	YV3BC	Caracas, Venezuela
31.5+	GSB	Daventry, England
31.8+	PLV	Bandoeng, Java
32.3		Rabat, Morocco
38.4+	HBP	Geneva, Switzerland
40.5+	HJ3ABD	Bogota, Col.
45.0	TGW	Guatemala
45.3	PRADO	Riobamba, Ecuador
45.3+	REN	Moscow, U. S. S. R.
48.8+	W8XK	Pittsburgh, Pa.
49.0	W2XE	New York, N. Y.
49.0+	VE9HX	Halifax, N. S.
49.1+	YV1BC	Caracas, Venezuela
49.1+	W3XAL	Bound Brook, N. J.
49.1+	W9XF	Chicago, Ill.
49.2	VE9GW	Bowmanville, Can.
49.3+	W9XAA	Chicago, Ill.
49.4+	W8XAL	Cincinnati, Ohio
49.5	W3XAU	Philadelphia, Pa.
49.5	OXY	Skamleback, Denmark
49.6	GSA	Daventry, England
49.6+	W1XAL	Boston, Mass.
49.8	DJC	Zeesen, Germany
49.9	VE9BJ	New Brunswick, Can.
49.9+	VE9DR	Montreal, Can.
50.0	RV59	Moscow, U. S. S. R.
50.0+	HVJ	Vatican City
50.5	HJ1ABB	Barranquilla, Colombia
50.6+	HJ4ABE	Medellin, Colombia
51.0	HJ2ABA	Tunja, Colombia
70.2	RV15	Khabarovsk, Siberia
73.0	HCJB	Quito, Ecuador

Short-Wave Reception Conditions

During the last month the short-wave bands of 16 and 19 meters have been exceptionally fine and seem to be working up to a peak of efficiency. The 25-meter band, as well as the 31-meter band, has improved considerably and although static is still bad on the 48-meter band, signals have been improving. It is interesting to note, however, that a few of the local short-wave stations on the 31-meter band have been "fluttering" quite noticeably. The next month should show a decided improvement on the 48-meter band.

HJ4ABE Transmissions

An official communication from radio station HJ4ABE at Medellin, Colombia, shows that this station will be on the air on 5750 kilocycles on Mondays from 7:30 to 11 p.m., on Tuesdays, Thursdays and Saturdays from 6:30 to 8 p.m., and on Wednesdays and Fridays from 7:30 p.m. to 11 p.m. They are on the air daily from 11 a.m. to 12 midnight.

Station HCJB Transmissions

An official communication from station HCJB shows that this transmitter maintains the same schedule the year round. They broadcast on a wavelength of 73 meters (4107 kilocycles). They are on the air every day, except Monday, from 8 to 9:30 p.m. (Quito time is 14 minutes behind E.S.T.) The station is located in Quito, capital of Ecuador, some 15 miles south of the Equator, at an altitude of 10,000 feet. The station identifies itself in Spanish and in English, with a two-tone chime.

YV3BC Transmission Data

An official communication from radio station YV3BC, Radiodifusora, Venezuela, shows that this transmitter is on the air daily at 1200 kilocycles from 11 a.m. to 2 p.m., and from 5 to 10:30 p.m. and on 6134 kilocycles from 11 a.m. to 2 p.m. and from 5 to 10 p.m. and on 9510 kilocycles from 10 p.m. to 10:30 p.m. On Sundays they are on the air, on 1200 kilocycles and on 6134 kilocycles, from 9 a.m. to 12:30 p.m., from 3:30 p.m. to 6:30 p.m., from 8 to 10 p.m. and on 9150 kilocycles from 10 p.m. to 11 p.m. They will be glad to verify reception of their programs.

Station W8XAL Transmissions

An official communication from the technical supervisor at station W8XAL tells us that short-wave station W8XAL has been undergoing some major alterations and that they are transmitting at present with an auxiliary 500-watt transmitter. They are operating approximately in accordance with the transmission data published herewith. They expect the station will be on the air with full 10 kilowatts shortly.

British Empire Transmissions

We have received an official communication from the British Broadcasting Company stating that their transmissions will be those shown in the DX Corner this month, except for some possible future variations as follows: Station GSE may be substituted at any time for station GSD and GSC may be substituted at any time for station GSB. In the India zone transmissions, either stations GSE, GSF or GSG may be substituted, without notice, for those shown. No changes are contemplated at the present date, however.

The New Spanish Mexican Station

Mr. F. K. Boyd of Guanajuato, Gt., Mexico, transmits the information that the new Mexican station mentioned last month is

(*Continued on next page*)

FINAL RULES GOVERNING PARTICIPATION IN THE Short-Wave Contest

DX fans will be interested to learn the final rules for participation in the Denton Trophy World's Championship Short-Wave Listeners' Contest as sponsored by the International Short-Wave Club

THE Denton Trophy Contest for short-wave listeners was announced in the August, 1933, issue of RADIO NEWS on page 100 in the DX Corner. In this announcement ten preliminary rules were tentatively adopted for governing the conduction of the contest.

The contest committee has finally adopted the following twelve regulations. Anyone owning a short-wave set, except the judges and members of their families, is eligible. This applies to short-wave listeners in foreign countries as well as in the United States. All will have an equal chance, no matter who they are, where they live, or what kind of set they received their verifications with.

1. Any short-wave listener-in in any part of the world is eligible to take part in this contest without entry fee or any other obligation or expense whatsoever.
2. The prizes will be awarded to the contestants presenting the greatest number of verifications from short-wave broadcast stations. In case of a tie, mileage will be computed and the question of superiority will be decided upon the basis of total number of miles received. This will be the air-line distance between the receiver and each of the transmitters. The finding on this question of mileage will be made by the judges and will be considered final.
3. All rulings of the judges are to be final. Only one prize will be awarded to any one winner. Judges will not be permitted to compete in this contest, nor members of their families.
4. The judges of the contest will include: O. H. Caldwell, former Federal Radio Commissioner and editor; H. G. Cisin, radio writer; Laurence M. Cockaday, editor of RADIO NEWS; Clifford E. Denton, consultant, lecturer and author; Arthur J. Green, president, International Short-Wave Club; Capt. H. Hall, Lt.-Commander, U. S. Navy, retired; Jacob Kleimans, member Advisory Board of the International Short-Wave Club; Arthur H. Lynch, originator the first International Broadcasting Contest in 1923; Joseph G. Reaney, president, N. Y. Chapter, International Short-Wave Club; Joseph B. Sessions, Sessions Clock Company.
5. The contest begins August 1st, 1933, and terminates February 1st, 1934. Ample time is thus provided so that fans in any part of the world have an equal chance to participate in the contest.
6. All verifications must be submitted by April 15th, 1934. Prizes will be awarded at the earliest possible moment after April 15th, 1934, depending upon the amount of work involved in the compilation of the records. The date of the awards will be suitably announced in the press.
7. Judges will assume no responsibility for any verifications unless they are listed and receipted for, or sent by registered mail. Verifications must bear post-marks or dates, indicating that the program was received by the contestant between August 1st, 1933, and February 1st, 1934.
8. Verifications will be accepted for entry into the contest from any part of the world. The verifications and lists should be forwarded to The Trophy Committee, care of RADIO NEWS, accompanied by a self-addressed, stamped envelope or container, together with sufficient postage or international reply coupons to cover return by registered mail. Judges will not be responsible for any loss of verifications. All letters and cards of verification, together with envelopes or other wrappers, should be presented. Stamps should not be removed or post-marks defaced.
9. In cases such as English, Swiss or German stations, where different call letters and wavelengths are used for the same stations, and where the call letters covering the frequency being transmitted and received are not mentioned on the verification, these will be counted as only one verification. If verification is received from several sets of call letters and several frequencies, then each verification will count as an individual station.
10. All prizes will be awarded with the stipulation that they may be displayed for one month after the award is made, in any appropriate place or places that the judges may select. A short description of the set or sets used in obtaining verifications for the contest should accompany the verifications when these are submitted.
11. No code stations, amateur, aircraft, police, ship or commercial stations will be considered in this contest.
12. Only one verification from each short-wave broadcast station will be allowed.

The silver trophy constituting the first prize has been donated by Clifford E. Denton and the contest will be known as the "Denton Trophy Contest." The second prize will be a medal suitably engraved, stamped or designed. It will bear the name of the winner and will mention the circumstances under which it was awarded. The third prize will be a medal similar to the second prize. Second and third prizes will be awarded by the New York Chapter of the International Short Wave Club. The fourth to one hundredth awards will consist of engraved scrolls in the form of honorable mention certificates, suitably inscribed with the name of the winner and calling attention to the excellence of their receiving ability.

In writing to the various short-wave stations for verifications, it is suggested that the listener-in mention the fact that such verifications are to be used in the "Denton Trophy Contest." The co-operation of the various stations is being arranged for by the Trophy Committee to assure prompt confirmations of reception reports.

(*Continued from preceding page*)

XETE, operated by the Ericsson T. and T. Company of Mexico City. He states that their daily transmission is from 9 a.m. to 11 p.m., C.S.T. They come in, he says, near W1XAZ. Their wavelength, is 31.2 meters.

Best Reception in Ohio

Mr. R. W. Evans of Lima, Ohio, reports that the following stations are best received in his location: DJD, GCW, WEA, CT1AA, EAQ, TI4NRH, GSB, XETE, DJC, W2XAF, W8XK, YV11BMO, YV1BC, W2XE, VE9HX, W1XAZ, GSD, VK3ME. He neglected to mention the type of receiver he made the reception on.

Reception Reports from Atlanta, Georgia

Mr. C. H. Armstrong of Atlanta, Georgia, reports that, using a Lincoln De Luxe SW33 receiver, he has received the following short-wave stations best, during the period of July 1st to July 20th inclusive: I2RO, W1XAL, DJD, GSB, PRADO, W3XAU, W8XAL, DJC, W1XL, YV1BC, XETE, EAQ, VK2ME, W1XAZ, W2XAF, GSA, DJA, WEF, LSX, WEA, W8XK, W2XE, W3XAL, GSA, GSB, XAM, XDA, DJB, W9XAA, CT1AA, HJ1ABB, HJ3ABF, PHI, VE9DR, FYA, W3XA. He reports that those stations in the United States come in loud and clear, European stations with a good volume and good clarity, South Americans were not received very clearly. The Australian station was heard with excellent volume but sometimes noisy. He says he is sending this information so that the state of Georgia will be represented in the next issue of the DX Corner in RADIO NEWS.

The Short Waves in Wisconsin

Mr. Willard Hardell of Rhinelander, Wisconsin, reports that using a seven-tube Air-line model No. 811 receiver with a four-tube Gem converter, he receives programs daily, barring exceptional weather conditions, from the following stations: DJB, DJC, DJA, DJD, GSF, GSD, GSB, GSG, EAQ, YVQ and all the short-wave United States and Canadian stations.

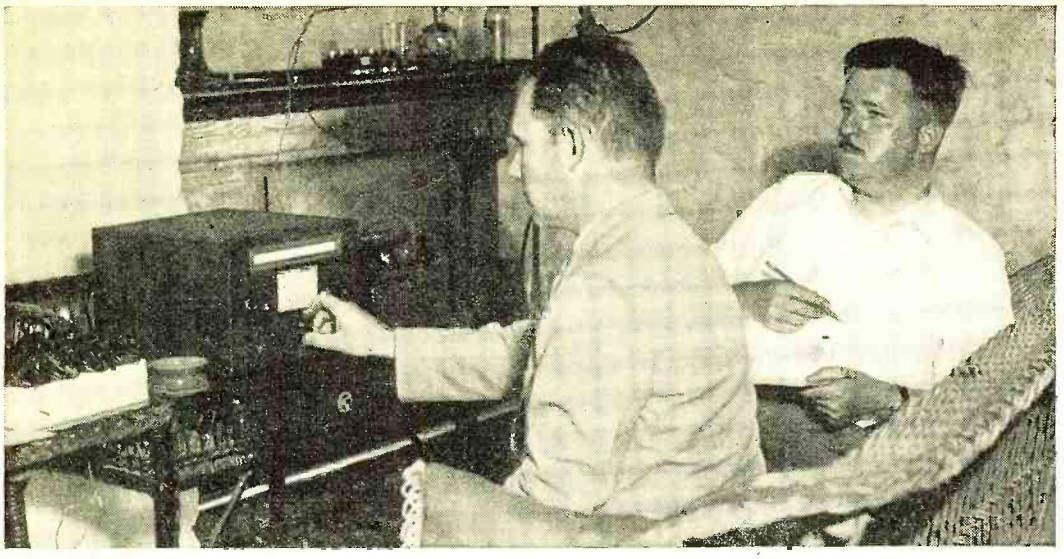
Best Reception in Massachusetts

Mr. Arthur Hamilton of Somerville, Massachusetts, reports the following stations as received best: VK2ME, VK3ME, LSX, I2RO, EAQ, DJA, XETE, CT1AA, HBP, YV1BC, GSA, GSF, VE9GW, VE9DR, W8XK, W9XF, DJD, GSD, VE9JR, GSB, HBL and DJC. Mr. Hamilton neglected to state the type of receiver he uses.

Report from Tooele, Utah

Mr. George W. Martin of Tooele, Utah, writes to the DX Corner and says that through it he has been able to reach many distant stations that he had never found before with a Midwest 16-tube all-wave set. The best distance he has been able to get are stations VK2ME and VK3ME. He says the chimes come in here at 6 o'clock a.m., just as clear and loud as if next door. The best short-wave stations in the Eastern parts of

(*Continued on page 252*)



ONE-MONTH'S TESTS ON A NEW SEVEN TUBE

SHORT-WAVE SUPER

The National FB-7

THIS compact but very sensitive superheterodyne short-wave receiver has been in use now at the RADIO NEWS Westchester Listening Post for a period of more than a month. During that time it has been used consistently as a "checking" receiver, with others, in compiling the log of stations for this month's DX Corner. It will remain a permanent piece of equipment.

The receiver itself is a seven-tube short-wave superheterodyne utilizing five sets of plug-in coils. It was originally designed for use by the discriminating amateur, who required the latest modern design for short-wave work, including all the amateur bands of reception. As will be seen from the photograph above, the plug-in coils set into the face of the panel, which makes wave-changing an instantaneous and almost automatic action. All that has to be done is to place the forefingers of the two hands in the rings in the coil ends, pull them out, grasp the two new coils in the same manner and plug them in. No shields have to be removed. Each coil is lettered A to E inclusive; they come in sets of two and one is marked "Osc" and the other is marked "Det." Looking at the panel, the left-hand coil is the oscillator coil.

THIS report on results obtained with this new receiver is based on tests made by the RADIO NEWS staff, under the direct supervision of Laurence M. Cockaday and S. Gordon Taylor.

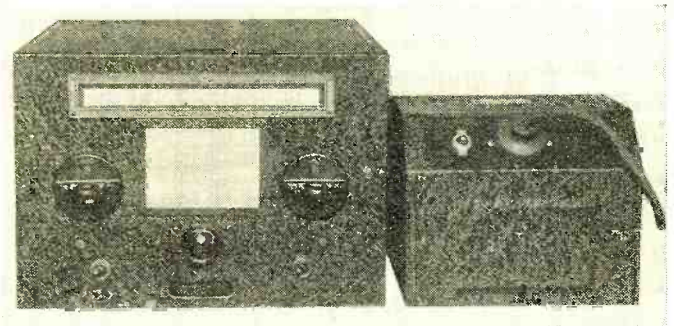
These coils have a complete range from approximately 15 to 200 meters. The specific frequency ranges are shown, in the curves for the five coils, in a diagram herewith. The actual range of each coil is as follows: Coil A from 15 to 26 meters. This is the range taking in the 20-meter amateur band as well as the 16, 19 and 25-meter short-wave broadcast bands. Coil B runs from 25 to 43 meters, including the 40-meter amateur band, the upper part of the 25-meter broadcast band as well as the complete 31-meter broadcast band. When using the 25-meter broadcast band, it is sometimes advisable to change coils to see which produces the loudest results. Coil C runs from 41 meters to 72 meters, including the 48-meter broadcast band and a number of amateur 'phone stations as well as aircraft stations. Coil D runs from 70 meters to 125 meters, taking in the 80-meter band as well as the police bands, including special amateur telephone stations, many broadcast station harmonics, etc. Coil E covers the band running from 120 meters to approximately 200 meters, although the highest wavelength broadcast station we actually received on it was WHOM at 1450 kilocycles. This came in at about 5 on the dial.

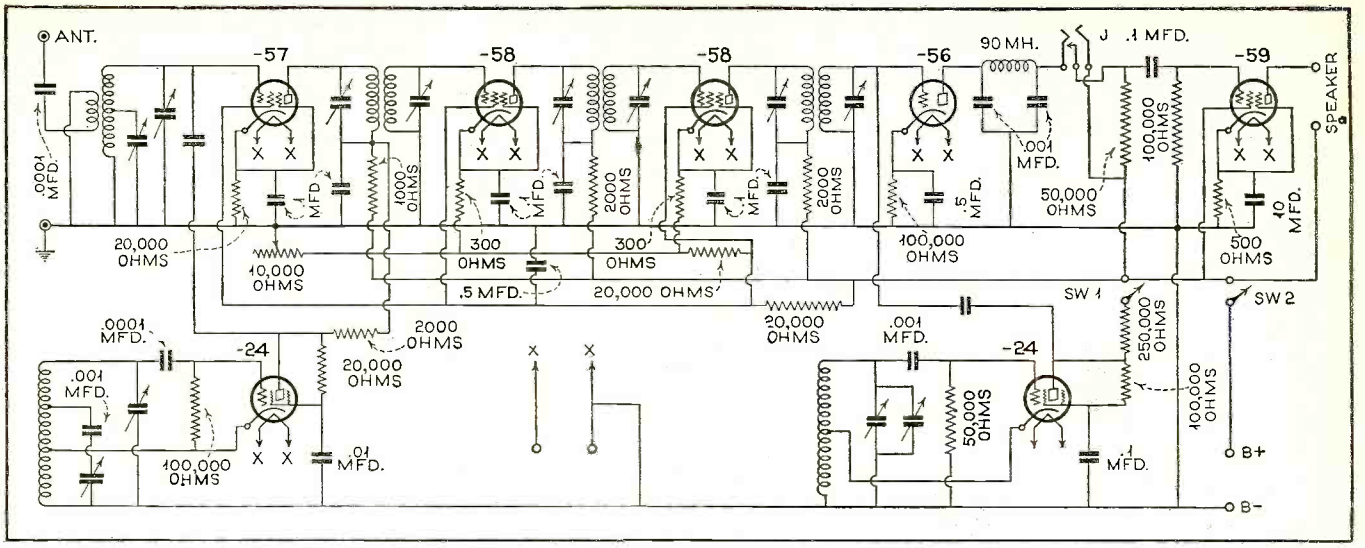
The circuit diagram for this receiver accompanies the article. It will be noticed that the detector tube is of the type –57, with a type –24 tube used as oscillator in a very stable circuit. Two type –58 tubes serve as intermediate-frequency amplifiers, with the grid and plate circuits tuned by the latest type air-dielectric condensers. The second detector is a type –56 tube employing a plate-filter circuit and resistance-coupled to a type –59 pentode output tube. A jack in the output circuit of the second detector automatically disconnects the pentode tube and speaker. A type –24 tube is used as a beat-frequency oscillator for reception of c.w. signals.

During our tests we have found that the receiver was of high sensitivity and excellent in selectivity, so that we had no trouble at all in logging all of the short-wave broadcasting stations of the world while they were on the air. Even the most distant stations came in with plenty of volume on the loudspeaker. We have found it advisable, when using a loudspeaker with this receiver, to use a filter circuit in the output of the pentode tube to prevent damage to the windings of the loudspeaker transformer coils (or the loudspeaker windings themselves) due to the heavy plate current. This filter may consist of a 30-henry choke connected directly across the output terminals and with the speaker itself connected in series with a 1-microfarad condenser and both connected in shunt across the output circuit. This allows the plate current to flow through the choke while the signal

THE RECEIVER AND POWER UNIT

This view shows the panel appearance of the receiver with the long horizontal tuning scale. The whole set may be turned "on and off" with the toggle switch on the panel of the power unit at right





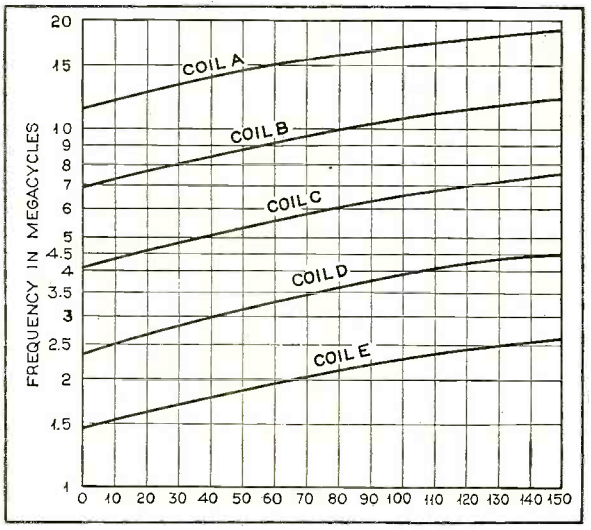
SCHEMATIC CIRCUIT

The schematic wiring diagram for this seven-tube receiver is shown above

frequencies will go through the condenser and speaker. And while we are talking about the loudspeaker circuit, we might state that the quality of reception on broadcasting is excellent.

During the tests we have made we used a power supply, the National type 5897-AB unit, which supplies around 240 volts at full load. Inside and outside views of this power supply are shown in the illustrations.

After getting about everything there was to be heard on the short-wave broadcast band, one of the operators was lured, by



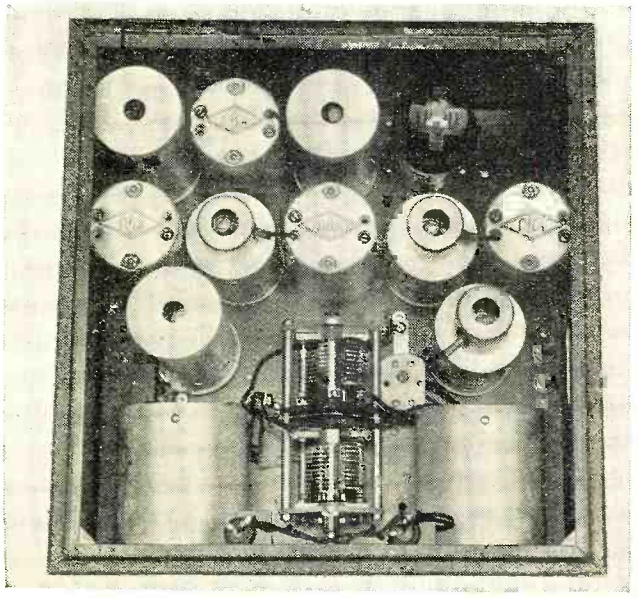
COIL FREQUENCIES

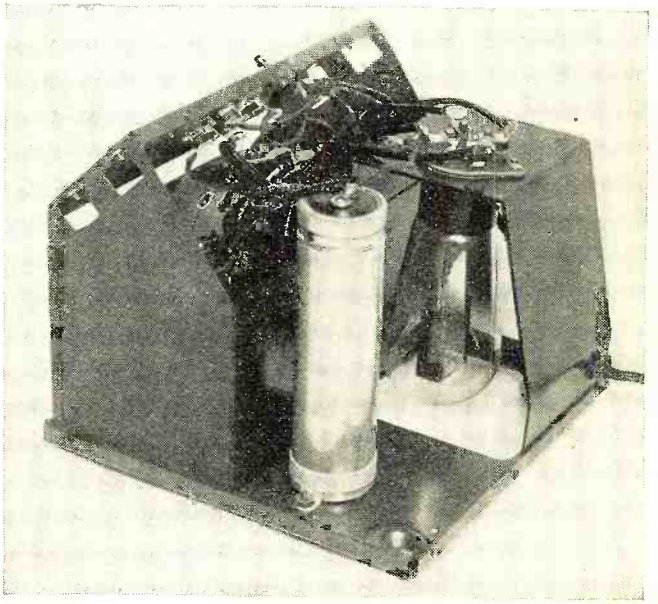
At left are shown frequency ranges of the plug-in coils A to E, inclusive

hearing so many amateur signals, both c.w. and 'phone, into sitting up all night for amateur reception results, and during a period of about twelve hours, concluded that the receiver was about as easy a thing to handle for amateur reception as has ever been used by him. The next night he was so enthusiastic that he brought it over to an amateur's station nearby, to be able to "work" some of the amateurs he had been hearing. This amateur, after another evening's test, begged to have the receiver (*Cont'd on page 251*)

INSIDE VIEW OF RECEIVER AND POWER PACK

The illustration at the left shows the arrangement of the parts. In the back row are, from left to right, the type -56 second detector tube and shield, the beat-oscillator coil, the type -24 beat-oscillator tube and shield and the type -59 output pentode tube. In the second row, starting from left to right, is the last intermediate-frequency transformer, the second i.f. type -58 tube and shield, the second i.f. transformer, the first i.f. type -58 tube and shield and the first i.f. transformer. In the bottom row are two tubes, at left the type -24 high-frequency oscillator tube and shield and at right the type -57 first detector tube and shield. The ganged condenser is centrally located between the oscillator and the detector plug-in coils. The right-hand illustration shows the "insides" of the power pack with the type -80 rectifier tube, the filter condenser and the power transformer and choke assembly in the rear

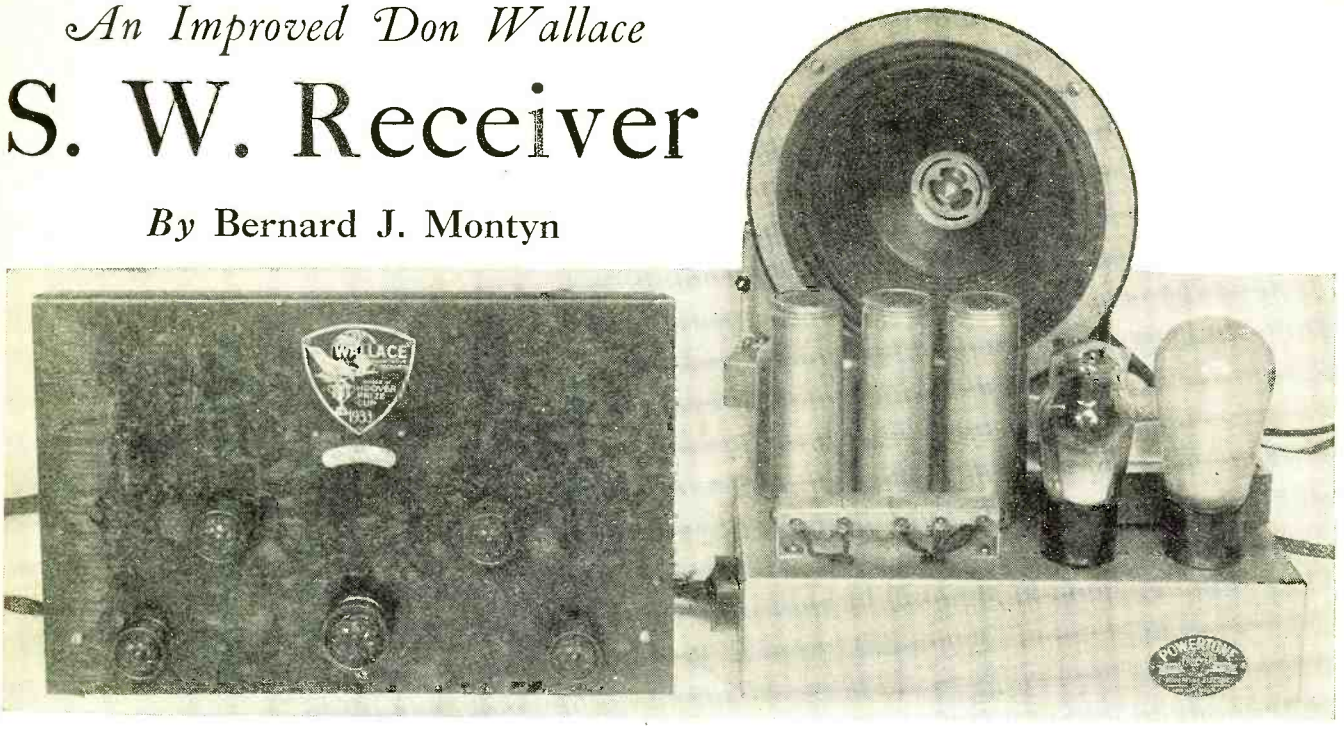




An Improved Don Wallace

S. W. Receiver

By Bernard J. Montyn



SHORT-WAVE enthusiasts who have constructed Don Wallace's two-tube, battery-operated receiver, as described in the August issue, and have found out for themselves the short-wave reception results that this circuit is capable of providing, will read with interest the present article on the Wallace four-tube a.c.-operated receiver and the instructions and circuit diagram for converting their battery receivers for a.c. operation.

For those who have not read the article in the August number, it gave complete constructional details on the Wallace two-tube, battery-operated short-wave set, using two type −30, 2-volt type tubes and featuring a tuned antenna system for dipole aerial and the employment of special coils and tuning condensers. Don C. Wallace, the designer of this circuit, is the popular amateur and owner of W6AM at Long Beach, California.

The receiver should find many new friends with both broadcast and short-wave constructors, as they will note the simplicity of the job herein described, showing that there is nothing complicated in its assembly and construction. The power supply, with automatic voltage regulation, is a separate unit that simplifies the conversion of the two-tube battery receiver for a.c. operation. Another advantage of a separate power unit is that it reduces the possibility of hum. This power pack, although designed for the Wallace receiver, will, of course, provide equally good results when used with any type of short-wave or standard receiving set requiring the voltages it provides.

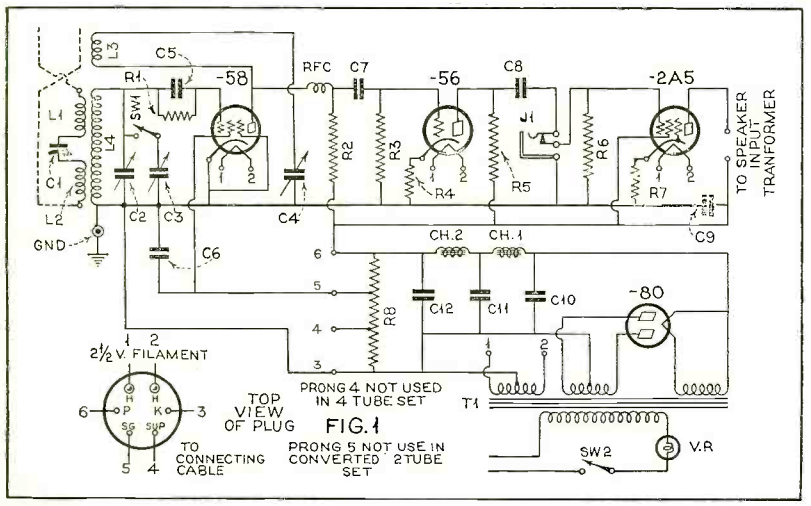
It is the main purpose of this article to deal with a discussion of the four-tube a.c. short-wave receiver, but, as mentioned above, for those who desire to convert their battery jobs it only will be necessary to refer to the circuit diagram in Figure 2 to note the small changes involved. The type −30 tubes are replaced by the −56 type and a bias resistor is placed in the cathode lead of the audio-frequency tube to supply the bias voltage. This converted d.c. receiver and the four-tube set use a six-conductor connecting cable terminating into a 6-prong type socket on the power chassis for carrying over the necessary operating voltages. Transformer-coupled audio amplification is used for the converted receiver.

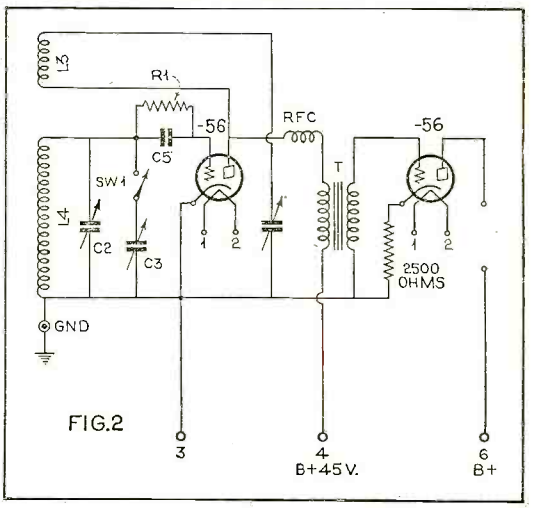
The Wallace four-tube a.c. set, as illustrated and as shown in Figure 1, employs the type −58 super-control r.f. amplifier tube for the tuning circuit, one type −56 type tube for the first audio-frequency stage and the new type −2A5 power tube for the output stage. This −2A5 tube is capable of providing 3 watts of power output. The tuner is the same as described for the battery set in the August issue, using the tuned antenna system for transposed feeder lines. This has proven to be a very effective aerial system, especially for short-wave reception.

(*Continued on page 250*)

THE CIRCUIT DIAGRAMS

The illustration above shows a redesigned Don Wallace s.w. receiver for a.c. operation employing the newest type tubes. Below, at the left, is the wiring diagram of this set. To the right is shown the converted two-tube set





A DESCRIPTION AND GENERAL EXPLANATION

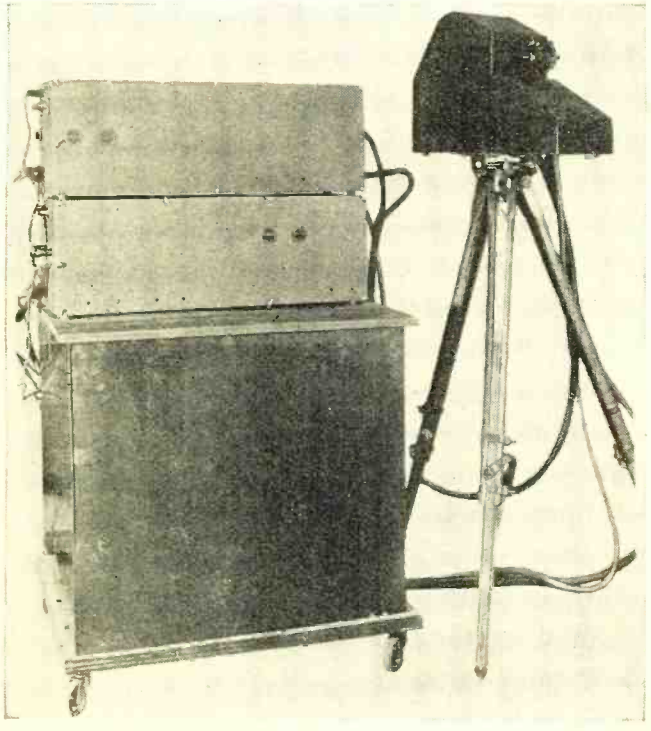
TELEVISION

THE FUTURE OF RADIO ADVERTISING

"Seeing is Believing" and television may be a strong future help in getting sales. The photo shows models displaying merchandise over Sanabria's transmitter

ZWORYKIN'S LATEST INVENTION

The Iconoscope mounted in a camera case on a tripod. The amplifiers are in the cabinets at the left. This device "sees" scenes to be transmitted



IMPORTANT laboratory developments in the television art recently revived widespread public interest in the progress of sight broadcasting. Television for mass consumer use is being brought nearer perfection through constant research and experimental developments in various American laboratories. Although many radio experts' predictions during the past few years regarding television's "early" arrival were not fulfilled, public interest in the art has never diminished and each newly announced development has brought out expressions of a tremendous fan following in the field of visual transmission and reception.

Dr. Vladimir K. Zworykin, research engineer of the RCA-Victor Company, attracted the attention of radio experts throughout the world when he recently announced his invention of the television pick-up device known as the iconoscope. In disclosing some details of his device before the annual convention of the Institute of Radio Engineers in Chicago last summer, Dr. Zworykin explained that the iconoscope duplicated the action of the human eye.

[*By* Merle S.

Designed along the lines of an artificial eye, the iconoscope includes parts that correspond with the human retina and nerves. It required ten years of research on the part of Dr. Zworykin and his staff of associates to bring his original ideas of the iconoscope to its present state of perfection.

Dr. Zworykin describes the iconoscope as a vacuum device with a photo-sensitive surface of a unique type. This photo-sensitive surface is scanned by a cathode-ray beam which serves as a type of inertialess commutator. He says that a new principle of operation permits very high output from the device. The sensitivity of the iconoscope is approximately equal to that of photographic film operating at the speed of a motion-picture camera.

In its application to television, Dr. Zworykin states, the iconoscope replaces mechanical scanning equipment and several stages of amplification. The whole system is entirely electrical, without a single moving part. The reception of the image picked up by the iconoscope is achieved by the cathode-ray receiving tube known as the kinescope which Dr. Zworykin developed several seasons ago.

The inventor pointed out that the iconoscope opens up wide possibilities for applications in many fields as an "electric eye," which is sensitive not only to the visible spectrum but also to the infra-red and ultra-violet region.

An integral part of the iconoscope consists of 3,000,000 tiny photo-cells, held in a mica sheet measuring 4 by 5 inches. The cells are so small that they only can be seen under a powerful microscope. Full details of these cells have not been divulged. The sheet containing the cells is enclosed in a vacuum tube, sixteen inches long, with a bulb eight inches in diameter.

The light impulses of the television subject or scene are

THE KINESCOPE RECEIVER

Zworykin's new cathode ray receiver. The picture appears on the ground-glass screen at the end of the tube

OF THE PRINCIPLES INVOLVED IN TWO NEW

ADVANCES!

taken for the iconoscope through a common cinema lens. The light is then transformed, in the cathode-ray tube, by means of the electron beam playing on the 3,000,000 cells into electrical energy. In turn, this energy is picked up by the cathode-ray tube of the kinescope and transformed back into light energy, thus yielding a reproduction of the televised image.

Dr. Zworykin explains that in the iconoscope the picture acts on a photoelectric cell all the time, and there is provision in the structure which collects the energy of the light, or figuratively "memorizes" it, and then transmits it, point by point, twenty-four times per second. This method, he says, involves a new principle for storing electrical energy which might be called "electrical memory."

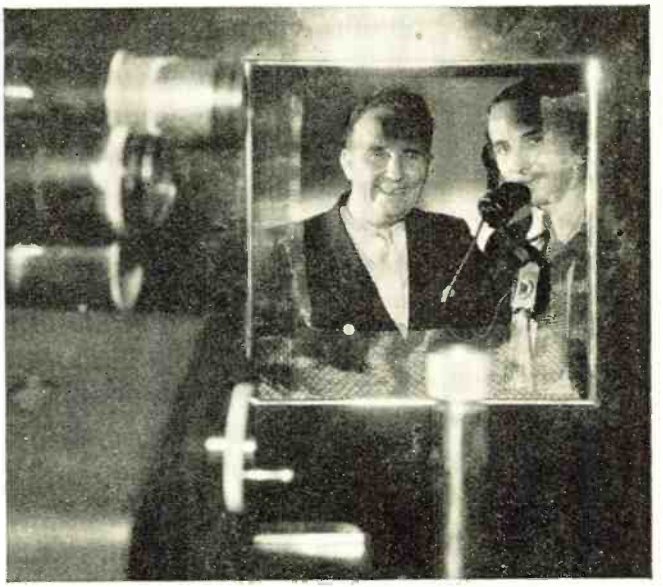
The inventor points out that, in ordinary television systems, every point of the picture acts on a photoelectric cell for a very short duration of time. This time, he said, was the order of one 1,500,000th part of a second. This duration, he added, is only obtained in the case of very good pictures. During this period a photo-cell of the highest sensitivity will deliver only sixty electrons to the amplifiers, an amount so small that good amplification is impossible.

Cummings

Thus, he explains, it can be seen that the amount of energy stored in the new photo-cell is, as compared with the old system, in the ratio of one divided by twenty-four as against one divided by 1,500,000, a "memory" some 70,000 times greater. At present he is able to obtain only ten percent efficiency, or 7000 times increase of output from the picture possible with the disk scanner under identical conditions.

The means which makes this possible is the utilization of a cathode-ray beam, which acts as a sort of electrical switch, connecting the 3,000,000 individual photoelectric cells in the iconoscope with the radio transmitter. The development is at such a point that it can perform substantially in the same manner as a motion-picture camera, which also projects twenty-four images per second. The iconoscope is so arranged that the mica sheet with the 3,000,000 photoelectric cells receives both the light from the image and the beam of electrons from the cathode. The entire apparatus consists of the cathode-ray camera mounted on a tripod and separate amplifier cabinets.

Another recent development that is attracting considerable attention is the designing of a carbon-dioxide arc lamp used by Ulysses A. Sanabria, the young Chicago television experimenter who has been in the limelight frequently during the past three years, for his efforts to perfect big-screen television receivers. Sanabria has developed this new lamp in conjunction with W. G. Taylor and L. P. Garner. He claims that the lamp yields the brightest source of modulated light known. Sanabria recently used his new lamp for a nine-day television show presented by R. H. Macy & Co., Inc., the prominent New York department store. Used (*Continued on page* 245)

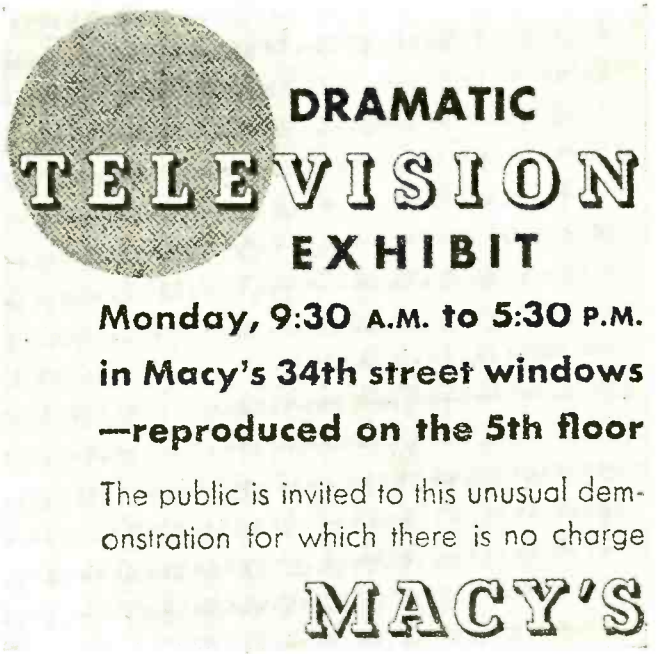


HOW IT FEELS TO BE TELEVISED

"Uncle Don" of WOR and an announcer looking in at the television window on the whirling mechanisms while their "images" and voices are being received elsewhere

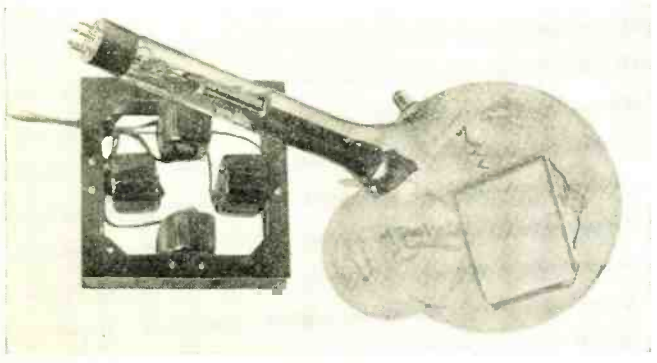
A RECENT DEMONSTRATION

Below is Macy's newspaper Ad of a television exhibit and the crowd that it attracted to view the demonstration. The large television screen may be clearly seen in the background



A MECHANICAL "EYE"

This is the close-up view of the complicated tube that functions as an "eye" and that really "sees" objects



Electric Filter Design

The fifth of a series of articles on filters. These articles should be of particular interest to engineers and advanced experimenters because of the ever-extending use of various types of filters in the radio field

By C. A. Johnson*

Part Five

THIS article discusses the design of high-pass filters, and describes the design of a useful high-pass filter, shown in Figure 2, with an effective cut-off at approximately 110 cycles per second. The insertion loss characteristic of this filter, when used in the 500-ohm resistive transmission line, is shown in Figure 3. It may be used in any circuit where 60-cycle hum and other low-frequency disturbances must be filtered out of the circuit without cutting down the volume of essential voice frequencies.

The high-pass filter described in this article, if used in tandem with the low-pass filter previously described in Part IV, will form a band-pass filter as shown in Figure 4. The attenuation loss of this band-pass filter is given in Figure 5. This filter may be used in any 500-ohm circuit to cut out both the low-frequency and the high-frequency disturbances.

In studying the design of high-pass electrical wave filters, the reader should notice that, over the transmission band, the high-pass filter must consist of a negative reactance in the series arm (Z1) and a positive reactance in the shunt arm (Z2). This fact must hold even though the series or shunt arms are composed of complicated impedance networks. The simplest type of high-pass filter is the constant "k" type, which, by definition, is one having the series arm (Z1) in inverse impedance relationship to the shunt arm (Z2); that is, Z1 Z2 = constant. In this type of section the series arm Z1 is simply a condenser of capacity C. Impedance of this arm is given by the following equation:

$$Z_1 = \frac{1}{j\omega C} \qquad (1)$$

and the shunt arm Z2 is an inductance, L, where

$$Z_2 = j\omega L \qquad (2)$$

The ratio of L to C is a constant, which may be designated as R_o^2; that is,

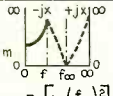
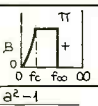
$$\frac{L}{C} = R_o^2 \qquad (3)$$

where R_o is actually the image resistance which the filter reaches at infinite frequency. This may be seen by studying the mid-series or the mid-shunt image impedance of high-pass filters shown in the design chart. If the filter is terminated mid-series, it will have a negative reactance for all frequencies from 0 to the cut-off frequency, where it will become resistive and increase its resistance up to a final value R_o at infinite frequency. If the filter is terminated mid-shunt, then it will look like a positive impedance for all frequencies from 0 up to the cut-off, where it will have a very high image resistance. This image resistance will then decrease until it reaches the final value R_o at the infinite frequency. The value of the image resistance of any high-pass (or low-pass) filter may be quickly determined from the chart (Figure 4) given in Part IV of this series. As an example, let us find the image resistance, at 1000 cycles, of the high-pass filter whose design is worked out in this article. The filter is terminated with a one-half constant "k" section. The value of R_o, chosen for its design, was 600 ohms, and the cut-off frequency f_c was 100 cycles, so that at

$$\frac{f_c}{f} = \frac{100}{1000} = .1 \qquad (4)$$

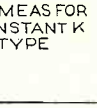
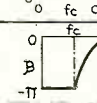
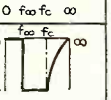
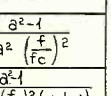
*New York University.

FIGURE 1. DESIGN CHART FOR LOW-PASS FILTERS

CONFIGURATION	CONSTANT K TYPE	SERIES DERIVED M-TYPE	SHUNT DERIVED M-TYPE
			
FORMULAE FOR ELEMENT VALUES	$L=\frac{R}{\pi f_c}$ $C=\frac{1}{\pi f_c R}$	$L_1=mL$ $L_2=\frac{1-m^2}{4m}L$ $C_2=mC$	$L_1=mL$ $C_1=\frac{1-m^2}{4m}C$ $C_2=mC$
MID-SERIES IMAGE IMPEDANCE, Z_I, FORMULAE AND GENERAL CHARACTERISTICS.	 $Z_I=R\sqrt{1-\left(\frac{f}{f_c}\right)^2}$	SAME AS FOR CONSTANT K TYPE	 $=I_m=\frac{R\sqrt{1-\left(\frac{f}{f_c}\right)^2}}{1-\left(\frac{f}{f_\infty}\right)^2}$
MID-SHUNT IMAGE IMPEDANCE, Z_I', FORMULAE AND GENERAL CHARACTERISTICS	 $Z_I'=\frac{R}{\sqrt{1-\left(\frac{f}{f_c}\right)^2}}$	 $Z'_{Im}=\frac{R\left[1-\left(\frac{f}{f_\infty}\right)^2\right]}{\sqrt{1-\left(\frac{f}{f_c}\right)^2}}$	SAME AS FOR CONSTANT K TYPE
ATTENUATION CHARACTERISTICS (SYMBOLIC-NON-DISSIPATIVE)			SAME AS FOR SERIES DERIVED M-TYPE
PHASE-SHIFT CHARACTERISTICS (SYMBOLIC-NON-DISSIPATIVE)			
$\frac{Z_1}{4Z_2}=U+jV$ NON-DISSIPATIVE	$-\left(\frac{f}{f_c}\right)^2$	$\frac{a^2-1}{1-a^2\left(\frac{f_c}{f}\right)^2}$	
$\frac{Z_1}{4Z_2}=U+jV$ DISSIPATIVE	$-\left(\frac{f}{f_c}\right)^2+jd\left(\frac{f}{f_c}\right)^2$	$\frac{(d+j1)(a^2-1)}{d+j\left[1-a^2\left(\frac{f_c}{f}\right)^2\right]}$	
CUT OFF FREQUENCY fc	$\frac{1}{\pi\sqrt{LC}}$	$\frac{1}{\pi\sqrt{(L_1+4L_2)C_2}}$	$\frac{1}{\pi\sqrt{L_1(C_2+4C_1)}}$
ATTENUATION PEAK FREQUENCY f_∞	∞	$\frac{1}{2\pi\sqrt{L_2C_2}}$	$\frac{1}{2\pi\sqrt{L_1C_1}}$

REMARKS:- ① $a=\frac{1}{\sqrt{1-m^2}}=\frac{f_\infty}{f_c}$ ② $m=\frac{\sqrt{a^2-1}}{a}=\sqrt{1-\left(\frac{f_c}{f_\infty}\right)^2}$ ③ $\frac{1-m^2}{4m}=\frac{1}{4a\sqrt{a^2-1}}$

FIGURE 6. DESIGN CHART FOR HIGH-PASS FILTERS

CONFIGURATION	CONSTANT K TYPE	SERIES-DERIVED M-TYPE	SHUNT-DERIVED M-TYPE
			
FORMULAE FOR ELEMENT VALUES	$C=\frac{1}{4\pi f_c R}$ $L=\frac{R}{4\pi f_c}$	$C_1=\frac{C}{m}$ $C_2=\frac{4mc}{1-m^2}$ $L_2=\frac{L}{m}$	$L_1=\frac{4mL}{1-m^2}$ $L_2=\frac{L}{m}$ $C_1=\frac{C}{m}$
MID-SERIES IMAGE IMPEDANCE, Z_I, FORMULAE AND GENERAL CHARACTERISTICS	 $Z_I=R\sqrt{1-\left(\frac{f_c}{f}\right)^2}$	SAME AS FOR CONSTANT K TYPE	 $Z_{Im}=\frac{R\sqrt{1-\left(\frac{f_c}{f}\right)^2}}{1-\left(\frac{f_\infty}{f}\right)^2}$
MID-SHUNT IMAGE IMPEDANCE, Z_I', FORMULAE AND GENERAL CHARACTERISTICS	 $Z_I'=\frac{R}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}}$	 $Z'_{Im}=\frac{R\left[1-\left(\frac{f_\infty}{f}\right)^2\right]}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}}$	SAME AS FOR CONSTANT K TYPE
ATTENUATION CHARACTERISTICS (SYMBOLIC-NON-DISSIPATIVE)			SAME AS FOR SERIES DERIVED M-TYPE
PHASE-SHIFT CHARACTERISTICS (SYMBOLIC-NON-DISSIPATIVE)			
$\frac{Z_1}{4Z_2}=U+jV$ NON-DISSIPATIVE	$-\left(\frac{f_c}{f}\right)^2$	$\frac{a^2-1}{1-a^2\left(\frac{f}{f_c}\right)^2}$	
$\frac{Z_1}{4Z_2}=U+jV$ DISSIPATIVE	$\frac{1}{-\left(\frac{f}{f_c}\right)^2+jd\left(\frac{f}{f_c}\right)^2}$	$\frac{a^2-1}{1+a^2\left(\frac{f}{f_c}\right)^2\left(jd-1\right)}$	
CUT OFF FREQUENCY fc	$\frac{1}{4\pi\sqrt{LC}}$	$\frac{1}{4\pi}\sqrt{\frac{1}{L_2C_1}+\frac{4}{L_2C_2}}$	$\frac{1}{4\pi}\sqrt{\frac{1}{L_2C_1}+\frac{4}{L_1C_1}}$
ATTENUATION PEAK FREQUENCY f_∞	0	$\frac{1}{2\pi\sqrt{L_2C_2}}$	$\frac{1}{2\pi\sqrt{L_1C_1}}$

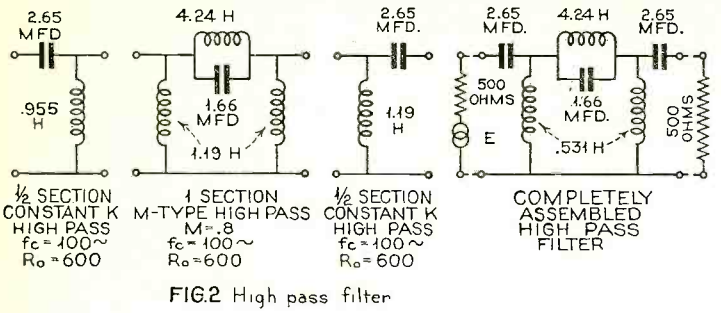


FIG.2 High pass filter

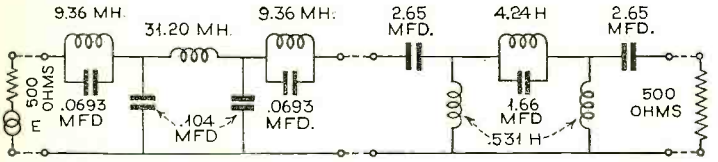


FIG.4 Band pass filter formed by joining a low pass and high pass filter in tandem.

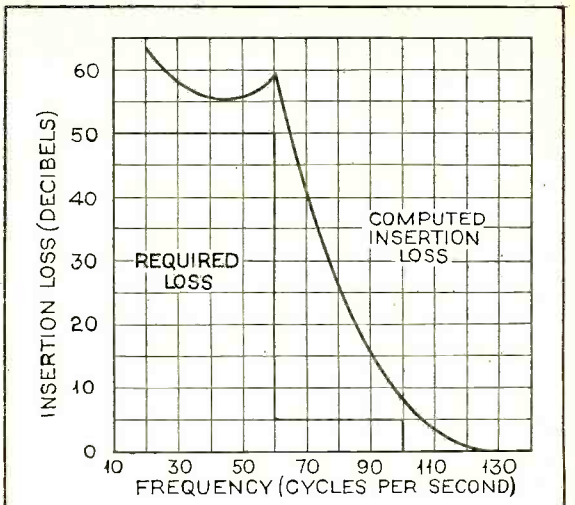


FIG.3 Insertion loss of the high pass filter shown in FIG.2

The chart gives a value of

$$\frac{ZI_m}{R_o} = .98 \text{ or } ZI_m = 590 \text{ ohms (approximately)} \qquad (5)$$

This result may be computed from the formula:

$$R = Z_1 = R_o \sqrt{1 - \left(\frac{f_c}{f}\right)^2}$$

$$= 600\omega \sqrt{1 - .01} = 588 \text{ ohms} \qquad (7)$$

This shows that the image resistance of the filter very nearly matches the transmission line above 1000 cycles. According to the formula (Equation 6), the resistance would fall off to 0 at the cut-off, but in any actual filter the effective resistance present in the coil and condensers will prevent the image resistance falling to 0. However, from the cut-off frequency at 100 cycles to somewhat above 1000 cycles, the image resistance will not match the resistance of the line and therefore reflection and interaction losses will occur. This accounts for the fact that we do not attain a perfecly sharp cut-off in our attenuation characteristic. Also, in actual filters, built up of elements having effective resistance instead of pure inductance and capacitance, there will always be present a reactive component in the transmission band which will also contribute to the reflection and interaction losses. These losses, however, are usually very small compared to the loss which the filter gives in the attenuation region so that it is practicable to build a filter which attenuates the frequencies below the cut-off much more than those in the transmission region, and that is, after all, the chief purpose of putting a filter in the transmission line. If we are forced to use inferior elements in building our filter, we can make up for the attenuation of the desired frequencies by increasing the amplification in the circuit.

The phase shift of the constant "k" high-pass filter is such that all of the attenuated frequencies are shifted negatively by π radians. This phase shift then increases to 0 at infinite frequency. Just as the attenuation characteristic is rounded off near the cut-off frequency owing to effective resistance in the coils and condensers, so the phase shift characteristic is also rounded off near the cut-off; that is, frequencies near the cut-off frequency are shifted a phase less than π radians and frequencies above the cut-off are shifted somewhat more than they would be in a non-dissipative filter structure.

The ratio $\frac{Z_1}{4Z_2}$, which determines the transfer loss of the filter is given in its non-dissipative and also dissipative forms in the design chart. The "d" in the dissipative formula for $\frac{Z_1}{4Z_2}$ is equal to $\frac{R_{eff}}{\omega L}$ where R_{eff} is the effective resistance of the coil. This value of d will vary over the frequency range, but for high-pass filters should be a maximum, if possible, at the cut-off frequency.

The cut-off frequency of the constant "k" filter is given as

$$f_c = \frac{1}{4\pi\sqrt{LC}} \qquad (8)$$

where L and C are the full section values of the filter. The series condenser and shunt coil of a half constant "k" section resonate at the cut-off frequency. The reader can easily show this by substituting in the formula for the cut-off frequency the values of L and C given in the (*Continued on page 247*)

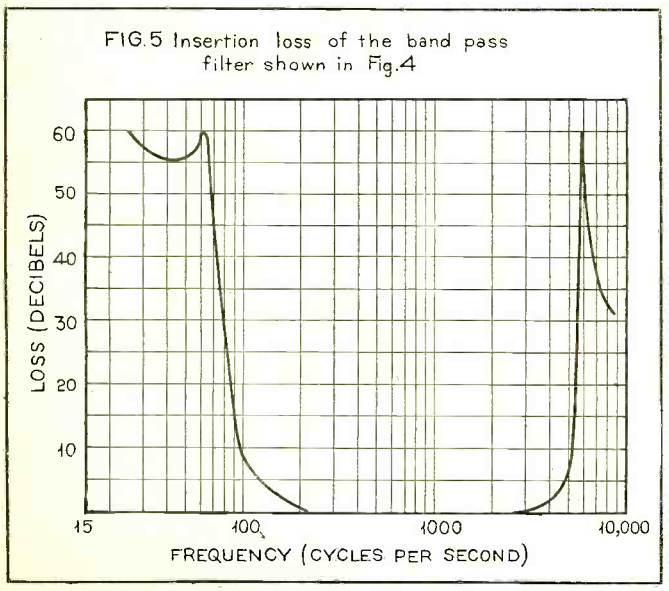


FIG.5 Insertion loss of the band pass filter shown in Fig.4

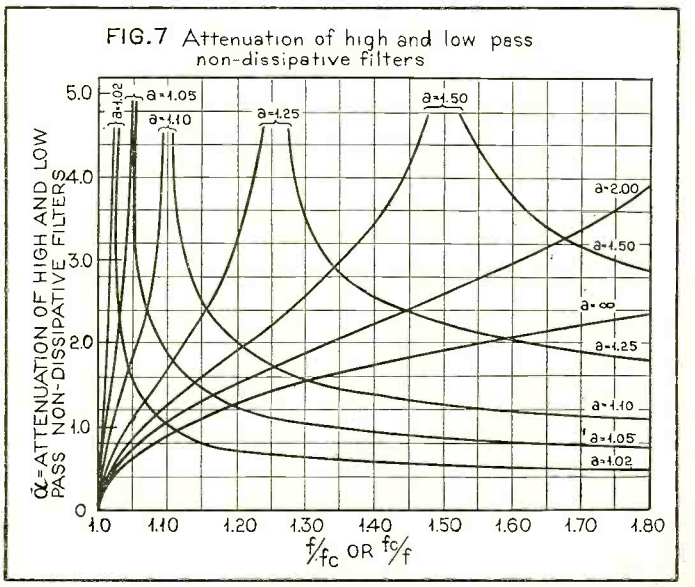


FIG.7 Attenuation of high and low pass non-dissipative filters

DEALERS and SERVICEMEN!

JOIN THIS CAMPAIGN OF PROGRESS

THE radio industry has organized to lift itself out of the depression this Fall with a smashing September radio prosperity campaign. This will be an intensive national sales and publicity drive through the month of September with a local committee in every city working together with dealers and servicemen to increase the sale of new sets, tubes, parts and accessories. It will reach a climax in Radio Progress Week, October 2nd to 7th, inclusive, 1933. During this week special broadcasting programs will be aimed to develop popular appreciation of modern radio broadcasting and receiving equipment and to enlarge the radio audience.

There follows a list of suggestions for the radio dealer, serviceman and the local campaign committee, showing just how to tie into this reconstruction campaign. Anyone can follow this plan and cash in. I shall be glad to send copies of the campaign announcement booklet for the manufacturer, distributor, dealer, serviceman and local committeeman.

By Earl Whitehorne*

Learn Your Part in the Program

1. Study the Campaign Plan in the Campaign Announcement booklet and figure out how you can take advantage of it to increase your sales this fall.
2. Get in touch with the distributors you buy from and find out what they are going to do in this campaign and how your manufacturers are tying into it. See what dealer co-operation they are planning and how you can benefit.
3. Find out if a local committee has been set up in your town to organize a local campaign to rebuild radio prosperity. Go see the chairman. See what local plans are brewing and how you can cash in on them. If there is to be no local committee in your town, tie in with the local committee at the nearest radio distributing point. They will serve your town also.
4. Hold a meeting of your salesmen, servicemen, bookkeeper—all your people—and tell them about this coming campaign to bring back prosperity to everybody in the radio business. Get them enthusiastic about Radio Progress Week and ready to work together to go over the top in the September sales drive. Offer a commission to non-selling employees on sales from leads they bring in. Offer some prizes for the best selling idea, the best display in your window, the best advertisement, the biggest sale, etc. Get them working for quick deliveries, lower costs and better service to boost your profits and their pay.

Get Yourself Ready for Selling

5. Put on your hat and walk up the street. Then stroll past your store and look it over. Is it working for you or against you? Ask yourself:
   a. Is the store front dingy? Will a new coat of paint help?
   b. does your sign reach out for attention?
   c. Are your window displays interesting? Are the backgrounds good?
   d. Does your store interior appear inviting as you look in?
   e. Study your store arrangement, equipment and decoration—is it creating a good impression or a bad one?
   f. Ask a few good friends—men and women—to visit your store and telephone for information—and give you their frank impressions.

   Make a list of the ideas that come out of this check-up, talk them over with your staff and take action before the sales drive begins.
6. Get your prospect lists in shape early so you will know just where you want to direct your selling effort.
   a. Make an up-to-date list of worthwhile customers on your books. Those who purchased good sets from you more than four years ago and those who bought cheap models are your best prospects for modern receivers. The rest are prospects for new tubes and reconditioning.
   b. Revise your list of unsold prospects by asking your old customers for names of friends who might be interested. Offer them a small commission for new set sales made with the use of their names.
   c. Go to the leading automobile dealers and get from them lists of those to whom they have made sales within two years. Offer them a commission on sales of auto sets to these prospects.
   d. Make up lists of good prospects for battery sets among the farmers in the surrounding rural territory and hamlets not served by power lines. Send them advertising matter on home and auto models and cash in on the national promotion of the campaign to the farm market.

   Make sure that you are ready with good names to whom you can mail advertising matter and send salesmen with the minimum waste of postage and time.
7. Secure a set of the campaign display and advertising material—plan book, window display, posters, decalcomania window sign, model markers, direct mail folders, poster stamps—and be ready to feature Radio Progress Week in your store and windows during the sales drive. Study the Dealer Plan Book and take advantage of every benefit the campaign offers you. Get these from your distributor or the local committee.
8. Attend the meeting of local dealers that the local campaign committee holds in your town or at the nearest radio distributing point. Make notes of the selling ideas that are suggested there and be ready to use them when the selling comes.
9. Study the details of the Radio Progress broadcasting program as they come to you and discuss them with your salesmen. Be sure they understand how to make the most of the popular appeal of this special broadcasting and use it as the urgent reason why the prospect should buy now. See that you receive the Radio Progress Week program broadside which will be ready early in September and display it prominently.

Schedule Your Activities in Advance

10. Put down on paper a sensible schedule of things to do during the sales drive that will give you a well-balanced program of selling. Make an effective combination of window and store display, newspaper advertising, direct-mail advertising and active canvassing by salesmen sent to carefully selected prospects. Set up a calendar, with your whole program set down—just when you want to start each activity. Make somebody responsible for each part of the program so that each feature will be carried out.
11. Carry through the mechanical preparation of your sales drive. Have envelopes ready to mail out the folders, advertising copy selected and cuts ready, salesmen equipped, instructed and ready to go and a schedule of window displays and store features for September and Radio Progress Week. Have plenty of manufacturers' advertising matter on hand to combine with the campaign display material.
12. Make up a list of novel ideas that may be used with dramatic effect to help you capture popular attention, create interest and attract people to your store. Select a set of selling stunts that will go well together and give you a full program of strong appeals—such as:
    a. Feature a "history" window, using traded-in models, showing the advance in radio design since early days. Give demonstrations of these sets, in your store, one after another, winding up with the latest receiver.
    b. Stage a comparative demonstration some evening between modern receivers and trade-in sets three or more years old, on the sidewalk in front of your store.
    c. Service and repair sets in the front window during the campaign.
    d. Run a door-to-door free tube testing campaign with the serviceman carrying impressive testing equipment.
    e. Demonstrate the methods used in broadcast stations to make "prop" noises during plays, right in the store window, using a public-address system.
    f. Rig up the store with photoelectric

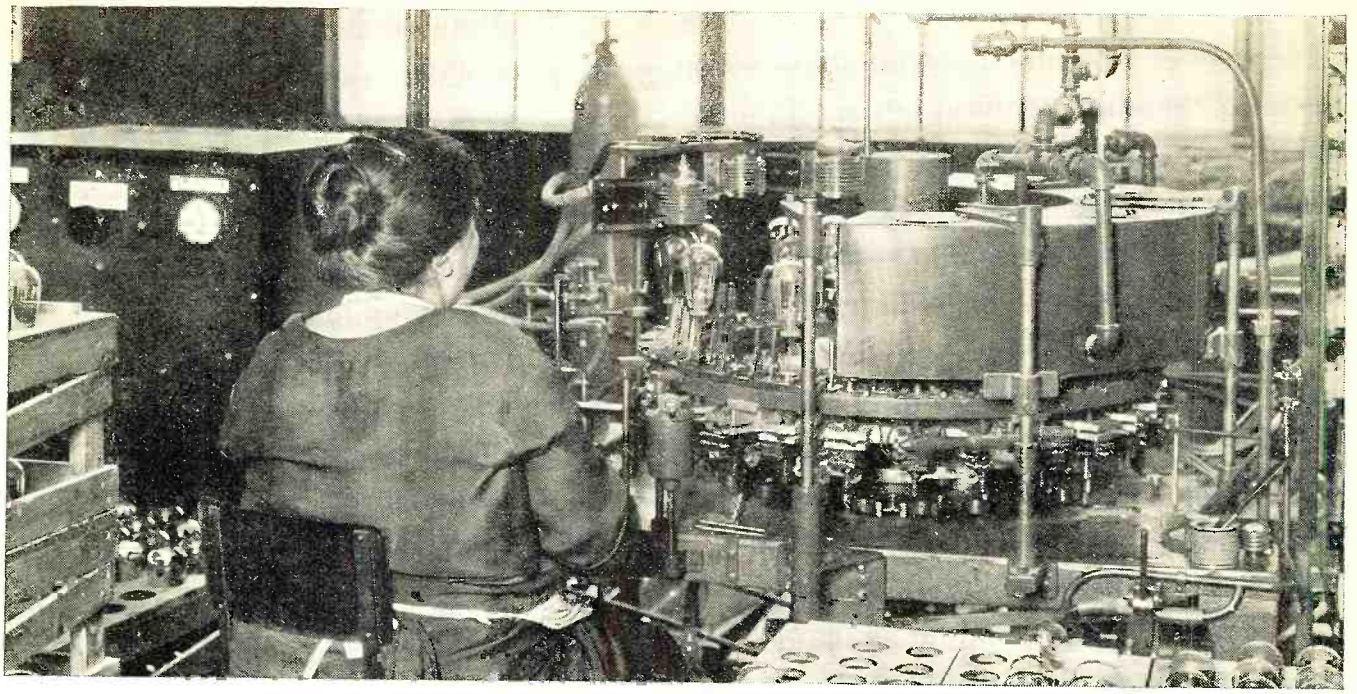
(*Continued on page* 248)

* Director of Radio Industry Campaign to Rebuild Prosperity

You Will Need These Posters, Folders, Stickers

DRESS UP YOUR STORE WINDOW AND GET READY FOR BIG BUSINESS

This is a reproduction of some of the posters for window displays, for dealers and servicemen, as well as price tags, folders, stamps and decalcomania signs that will help you in increasing your fall business through the aid of the Radio Industry Campaign to Rebuild Prosperity. Be sure that you read the accompanying article and get in touch with your local campaign headquarters for more material and facts in helping to make the campaign a success for yourself and for your community



PUTTING "EMPTY SPACE" IN VACUUM TUBES

Many readers have written in asking for information on the methods of making the vacuum inside of the radio tubes considered the heart of radio transmitting and receiving apparatus. The author, in this article, tells how it is done and explains just what is meant by the general term "vacuum"

By Irving J. Saxl, Ph.D.

THE conquest of "empty space," otherwise called a "vacuum," is perhaps the characteristic that defines best the trend of the present physical sciences and their most interesting part—the radio tube and the electronic sciences.

In the last sublimation, Einstein's relativistic universe is a cosmos, defined through its co-ordinates of space and time. As a practical working hypothesis, we find that wherever we try to go down to the fundamental principles of physical phenomena, we have to deal, according to our present theories, with a few "points" in space that act as though matter would be concentrated in them. Such points are many times their own diameters apart from each other, as postulated by the wave theory of matter. Still more primitive, mechanistically speaking, we have to deal with molecules which are separated from each other by a space several times the diameter of the molecules.

The immediate importance of the physics of space is particularly clear in the latest wonder tool of the scientific magician: in the radio and electronic sciences. The very nature of radio broadcasting necessitates a space capable of transmitting electromagnetic oscillations.

On the other hand, it is the radio tube—a *vacuum* device—which makes possible the amplification of impulses which, as such, could not be directly perceived by human beings.

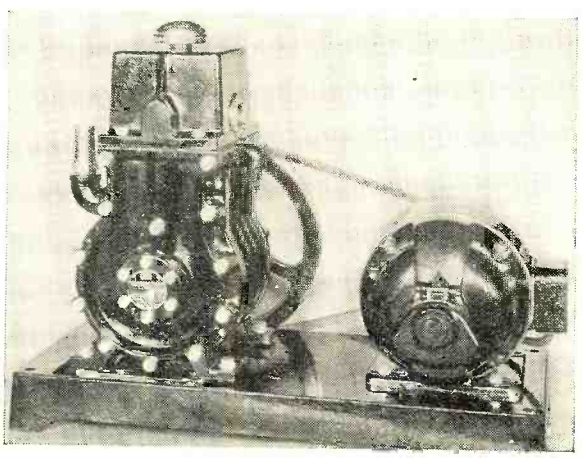
What is a vacuum? Vacuum—absolute emptiness—has as yet never been produced by man. Even with our most refined evacuating devices there still remains a vast number of molecules in each cubic inch of air. On the night of April 9, when KPO, the new 50-kilowatt broadcasting station of NBC at Belmont, was christened with a "bottle of nothing," this vacuum still contained 25 sextillion molecules of air. Though considered 99.999999 percent complete, there still remained in this pear-shaped lamp bulb of approximately 5 inches in diameter *250 trillion molecules of air.* If these were converted into drops of water, sufficient water would be produced to raise the level of the Great Salt Lake about one-sixteenth of an inch.

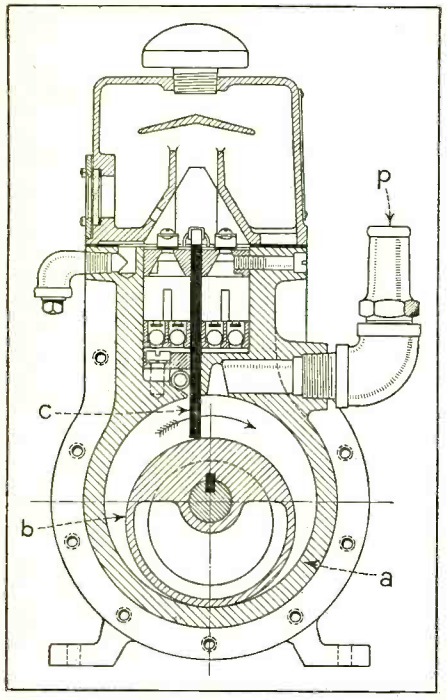
This bulb, evacuated by the best present means by Dr. Irving Langmuir, who was recently awarded the Nobel prize in chemistry and who is a specialist in high-vacuum research, still contained 250 trillion molecules of gas. This will give an idea of how far away we still are from a perfect vacuum.

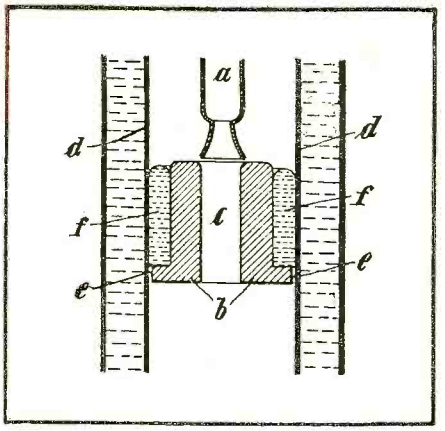
However, it is an assured fact that this incomplete vacuum we

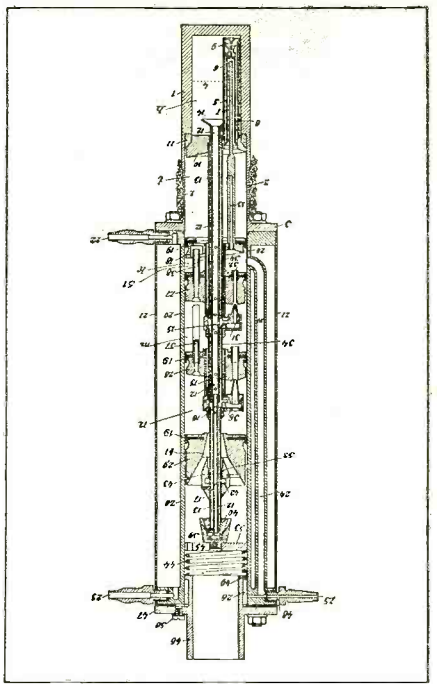
A FAMILIAR VACUUM PUMP

Figure 1. The Hypervac electrically driven pump more or less well known to people in the art









TYPES OF PUMPS

Figure 2, left, shows a cross-section view of the Hypervac pumy. Figure 3, above, shows diagrammatically another type of high vacuum pump, while Figure 4, right, is a patent diagram of a multi-stage high vacuum pump

are able to produce is, nevertheless, quite sufficient for exhausting radio receiving and transmitter tubes, X-ray tubes and other forms of vacuum equipment and for bringing about the miracles of modern electronic techniques which are so close to the borderline of the unbelievable.

How is a vacuum produced? While we have just seen that a perfect vacuum has not as yet been attained, we must make a distinction, even in this limited realm of vacua, that *is* within the reach of our instruments, between the regular vacuum, the high vacuum and the extreme vacuum.

In considering vacua, the best comparison is with the air pressure at sea level. This pressure averages about 760 millimeters of mercury. If we wish to go down somewhat, for producing pressure that is sufficient for ordinary chemical work, water jet pumps of the aspirator type are sufficient for work to about 14 millimeters pressure. However, as these pumps do not approach the region of vacuum necessary for electronic work, no particular details will be given about them here. Forms of reciprocating and other old constructions of vacuum pumps will also not be discussed here, as they, too, do not enter present-day production methods.

If we wish to go to pressures of a small fraction of one millimeter, which is the type most frequently used in vacuum work, rotating pumps of the Gaede type are used in modern vacuum techniques.

Figure 1 shows a rotating pump of this type, driven by a small electric motor. From the cross-section at the right side of Figure 2, the operation of this pump becomes clear. Within the outer cylinder (a) moves a smaller cylinder (b) which is attached eccentrically and touches, with its widest elongation, the wall of the outer cylinder chamber. As shown by the arrow, this inner cylinder rotates clockwise. A valve (c) is pressed down upon the inner cylinder by an arrangement of springs in such a way that it is moved up and down if the inner cylinder rotates.

It will be readily understood from this picture that the volume of air which has entered through the big pipe (p) at the upper right side of the diagram will be moved around clockwise before the rotating inner cylinder, and finally is pushed out through another valve (v) immediately behind valve c. The valve, of course, must close tightly, and similarly the connection between the eccentric inner cylinder and the wall must be vacuum tight.

Pumps of this type, if operated properly, give vacua which are probably better than 1 micron (1 micron is one-thousandth of 1 millimeter mercury pressure). This is within the dimension which is necessary for the production of regular radio amplifier tubes. The usual procedure is that they are exhausted in several states with rotating oil pumps, similar in their general physical construction to the one discussed above. After the last amounts of gases have been properly driven out, a small amount of material consisting mostly of magnesium, calcium and some alkaline earths is placed within and evaporated in the bulb. This material, known as a getter, covering the walls of the bulb with a mirror-like deposit, absorbs the remaining gas in the tube and brings the vacuum within the bulb down to a point where electrons can move freely and the tube operates efficiently as an amplifier for weak impulses.

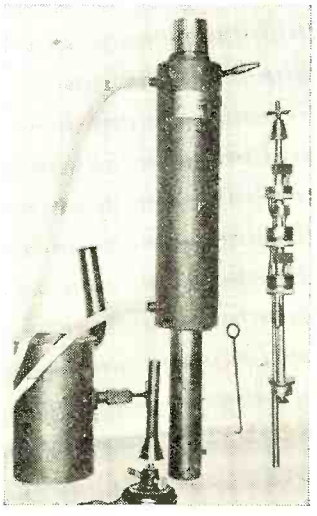
While this method of using rotating oil pumps is satisfactory for most receiving tubes which do not run under too heavy a load, difficulties arise in the production of vacuum in transmitter tubes, X-ray tubes and other high-powered electronic devices.

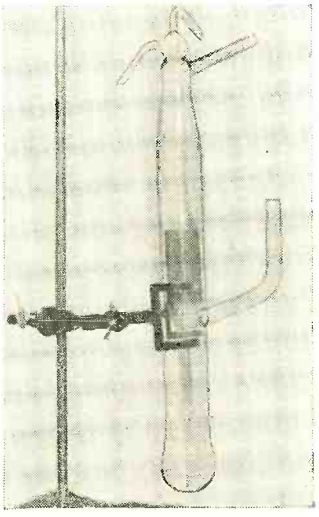
Gas may suddenly break out under the severe strain of energy transformation taking place in the tubes which carry many kilowatts of power. A higher degree of vacuum and better degassifying methods are necessary in such tubes and use must be made of other pumps, capable of producing pressures below 10^{-6} millimeters.

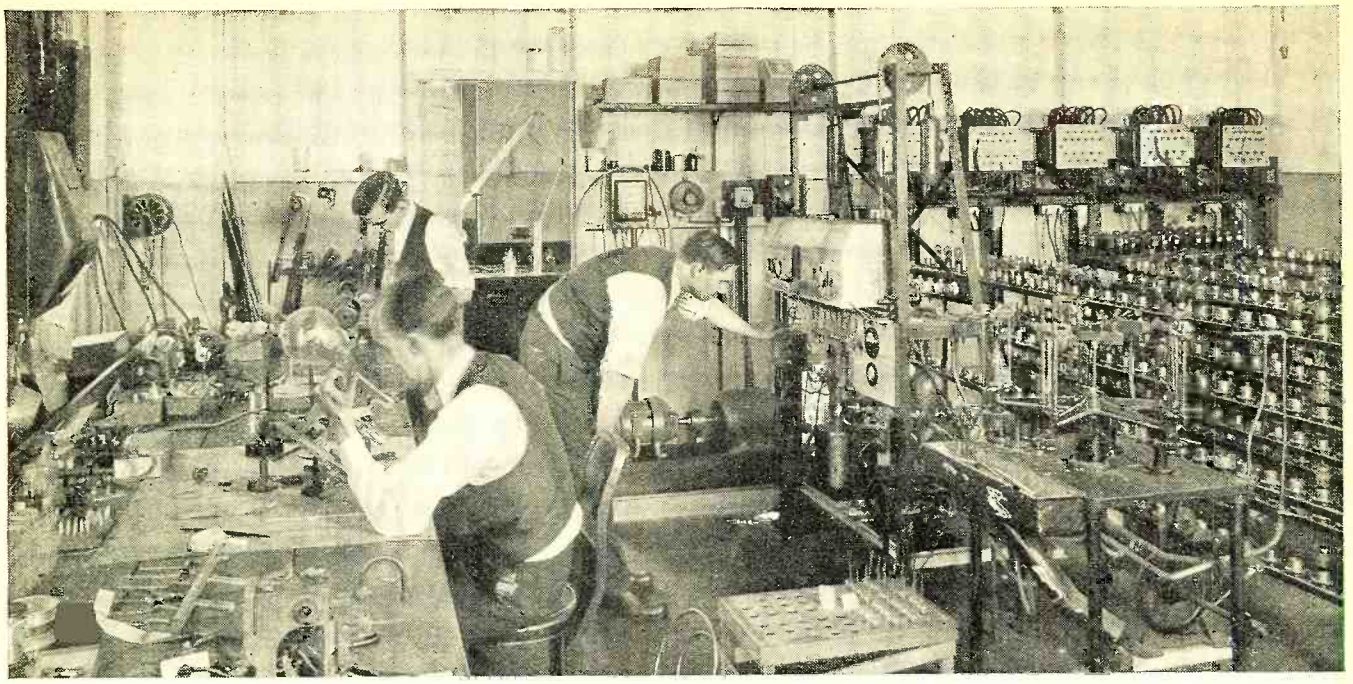
For bringing about a lower vacuum than can be obtained commercially with present-day rotating pumps,

WHAT THEY LOOK LIKE

Figure 5, extreme left, shows the outside view of a multi-stage metal pump (combined ejector and diffusion). In this same photograph, Figure 6, on the right-hand side, is a close-up of the inside assembly of this same pump. Figure 7, photograph at the right, shows the extreme vacuum type of pump of Schirman, with which it is claimed pressure as low as 10^{-12} mm. Hg. can be reached at a velocity between 20 and 30 liters per second







molecular pumps of the condensation and vapor-jet types are used.

The first one of this type is the diffusion pump. It goes back to an old principle worked out by Dr. Wolfgang Gaede as early as 1913. His invention concerns itself with an apparatus for production of a high vacuum with the aid of diffusion. The vessel which is to be evacuated is connected with a pump through a porous wall. The openings in this wall must be so fine that their diameter is not bigger than the dimension of the average free mean path of the gaseous molecules. While one side of this porous diaphragm is in contact with the space which is to be evacuated, the other side of the diaphragm is filled with mercury vapor which is as free as possible of air. Such a vapor may be either mercury vapor or certain oils of low vapor pressure. Gas of the vessel to be evacuated thereafter diffuses through the vessel and is carried away by the vapor. If the vapor which is diffusing in the opposite direction is condensed by a radiator, or if it is absorbed by chemical materials, a vacuum is produced in the vessel.

High-Vacuum Pumps

As the average free mean path of the molecule decreases with increasing pressure, the openings of the diaphragm must be finer the higher the vapor pressure. On the other hand, the openings may be so large that wire mesh may be used if the diffusion is aided by a relatively high "fore" vacuum. The bringing about of condensation and diffusion has also been used in the construction of Dr. Langmuir's condensation pump.[1]

While diffusion pumps are able to go down to small fractions of a micron, their speed is not quite what is necessary for actual production work. For bringing about quicker action, mercury vapor pumps have been constructed which, working in several stages, bring about a successive acceleration of molecules which are to be carried out from a vacuum container.

Figures 3 and 4 show a design of a multi-stage high vacuum pump as constructed by E. Leybold Co. Referring to the view shown in Figure 3, the suction member consists of a nozzle (a) from which a jet of mercury vapor may be impelled directly downward, a metallic member (b), having an axle bore (c) in alignment with the nozzle (a), spaced at an interval from the nozzle (a) and constituting, with the nozzle, a vapor ejector. The member (b) is fitted within a water-jacketed cylinder (d) so as to be in thorough cooling contact therewith.

The jet of mercury vapor rushing from the nozzle (a) passes into the bore (c) of the cooling member, where it is immediately cooled.

As long as the air passing through the chamber above the member (b) exceeds that of the jet of vapor passing into the bore (c), and the air is drawn by suction through the narrow space between the rim of the nozzle and is carried along by the jet, the pump acts as an ordinary ejector.

If the air pressure has gone down considerably, the tube works thereafter as a diffusion pump, the molecules of the gas diffusing into the space filled with mercury vapor, which is condensed thereafter.

Figure 5 shows a photograph of a complete pump of this type, while Figure 6 gives a close-up of the multi-stage jets within the pump.

While pumps operating along this physical principle are very effective in their operation, there may be mentioned one simpler pump which, though little known to industry, brings about a high-speed production of extreme vacua. In the vacuum pump of Dr. M. A. Schirmann, shown in Figure 7, gas coming from the vessel which is to be evacuated is brought into contact with a stream of mercury vapor along a large surface. This is done in three different ways:

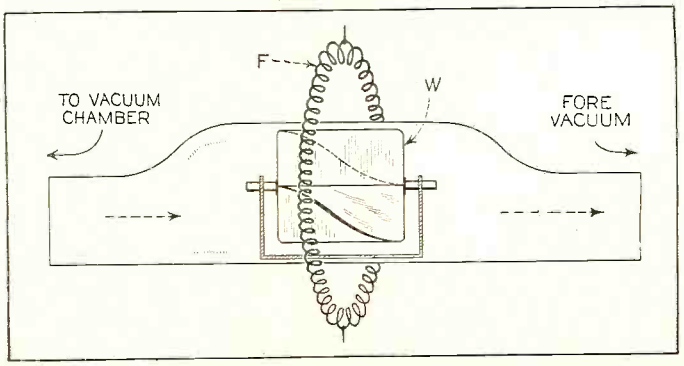
1. The vapor is ejected from a nozzle of considerable diameter, thus having a great circumference and a large active surface.
2. The speed with which the vapor is propelled is considerable; therefore the mercury vapor is projected for several inches into the space within the pump.
3. For still further straightening out of this vapor over distances as large as possible, a metal mesh is inserted, which acts somewhat similar to the guides in a vapor turbine.

Along this pre-exhausted metal net the transportation of molecules from the vacuum towards the "fore" vacuum takes place with such speed that a vacuum of 10^{-7} can be reached in 10 minutes, while it takes over an hour to get the same result with most of the condensation pumps.

(*Continued on page* 243)

JUST AN IDEA!

The author suggests that high vacua might be produced by having attached to the chamber being exhausted a glass tube with a high-speed fan run electrically with an outside armature in which would flow a rotating electric field. The purpose of the fan would be to push gas molecules in the direction of the fore vacuum



Radio Call Book Section

World Short-Wave Station List

(All time given is Eastern Standard Time)

By Wavelength, Frequency, Call, Location and Time

Meters	*Kc.*	*Call*	*Location*	*Schedule and service*
38.00	7,890	VPD	Suva, Fiji Islands	Phone
38.07	7,880	J1AA	Tokio, Japan	Tests with KEL
38.11	7,870	RXC	Panama City	Phone to HJP, afternoons
38.29	7,830	PDV	Kootwijk, Holland	Phone
38.49	7,790	HBP	Geneva, Switzerland	Phone; Sun. 5—5.45 P.M.
38.60	7,770	FTF	Ste. Assise, France	Phone
38.59	7,758	PCK	Kootwijk, Holland	Phone 9 A.M.—7 P.M.
38.86	7,715	KEE	Bolinas, Calif.	Exp.
39.01	7,685	TIR	Cartago, Costa Rica	Phone
39.16	7,660	FTL	Ste. Assise, France	Phone
39.34	7,630	RIM	.... U. S. S. R.	Phone to RKI; 6 A.M.—8.15 A.M.
39.42	7,610	KWX	Dixon, Calif.	Phone to Hawaii, nights
39.65	7,560	KWY	Dixon, Calif.	Phone to Hawaii
39.82	7,530	.....	"El Prado", Riobamba, Ecuador	Broadcast; Thu. 9—11 P.M.
39.89	7,520	KDK KKH	Kauhuku, Hawaii	Phone to KWO 9 P.M.—2 A.M.
39.97	7,500	RKI	Moscow, U. S. S. R.	Phone to RIM; 6 A.M.—8.15 A.M.
40.16	7,470	HJB	Bogota, Colombia	Phone; Irr.
40.30	7,444	HBQ	Geneva, Switzerland	Phone
40.46	7,410	WEG	Rocky Point, N. Y.	Phone
40.50	7,402	HJ3ABD	Bogota, Colombia	Broadcast 9—11 P.M. daily
40.54	7,400	WEM-W2XBJ	Rocky Point, N. Y.	Exp.
40.60	7,390	ZLT	Wellington, N. Z.	Phone to Sydney; mornings
40.71	7,370	KEQ	Kauhuku, Hawaii	Phone to California; nights
40.90	7,320	ZTJ	Johannesburg, S. Africa	Phone
41.00	7,300	HSP2	Bangkok, Siam	Broadcast
41.60	7,207	EAR58	Teneriffe, Canary Islands	Broadcast; daily 5—6.30 P.M. Sundays 7.30—9 A.M.
41.67	7,195	VK6AG	Perth, Australia	Exp.
41.67	7,195	VS1AB	Singapore, British Malaya	Broadcast; Mo., Wed., Fri. 9.30—11 A.M.
41.93	7,150	HJ1ABB	Manizales, Colombia	Broadcast; Sat. 11 P.M.—midn.
42.10	7,120	HKK	Cali, Colombia	Broadcast
42.20	7,105	HKN	Medellin, Colombia	Broadcast
42.30	7,090	HKE	Bogota, Colombia	Broadcast: Mo. 6—7 P.M. Tue., Fri. 8—9 P.M.
43.71	7,020	EAR125	Madrid, Spain	Broadcast
43.00	6,976	EAR110	Madrid, Spain	Broadcast
43.23	6,940	WEB	Rocky Point, N. Y.	Exp.; tests with Europe, irr.
43.45	6,900	GDS	Rugby, England	Phone to New York, nights
43.54	6,890	KEQ	Kauhuku, Hawaii	Phone to Calif., nights
43.73	6,860	KEL	Bolinas, California	Phone
43.70	6,860	.....	"Radio Vitus" Paris, France	Broadcast
43.82	6,840	CFA	Drummondville, Que.	Phone
44.15	6,790	GDB	Rugby, England	Phone
44.41	6,755	WOA	Lawrenceville, N. J.	Phone to England, nights
44.41	6,755	WOB	Lawrenceville, N. J.	Phone to Bermuda, nights
44.54	6,732	WEJ-W2XBJ	Rocky Point, N. Y.	Exp.
44.61	6,720	WQO	Rocky Point, N. Y.	Phone
44.71	6,705	WER	Rocky Point, N. Y.	Phone
44.91	6,675	DGK	Nauen, Germany	Tests with WEJ, near 9 P.M.
44.98	6,667	XFD	Mexico City	Phone
45.02	6,660	HKM	Bogota, Colombia	Broadcast 9—11 P.M.
45.02	6,660	TGW	Guatemala City	Broadcast
45.09	6,650	IAC	Coltana, Italy	Exp.
45.29	6,620	.....	"El Prado", Riobamba, Ecuador	Broadcast; Thu. 9—11 P.M.
45.36	6,610	REN	Moscow, U. S. S. R.	Broadcast; 1—6 P.M.
46.05	6,510	WOO	Deal, N. J.	Phone
46.27	6,480	TGW	Guatemala City	Broadcast
46.63	6,430	PCM	The Hague, Holland	Broadcast
46.67	6,425	W3XL	Bound Brook, N. J.	Exp.
46.70	6,420	RV62	Minsk, U. S. S. R.	Broadcast
47.00	6,380	HJ5ABD	Cali, Colombia	Broadcast
47.00	6,380	HC1DR	Quito, Ecuador	Broadcast
47.33	6,335	VE9AP	Drummondville, Que.	Broadcast
47.97	6,250	HJ3ABF	Bogota, Colombia	Broadcast; 7—11 P.M. daily
47.97	6,250	CN8MC	Casablanca, Morocco	Broadcast; relays Rabat
48.20	6,220	I2RO	Rome, Italy	Broadcast
48.51	6,180	TGW	Guatemala City	Broadcast; 1.30—2.30 P.M., 5 P.M.—midn. irr.
48.75	6,150	VE9CL	Winnipeg, Man.	Broadcast
48.86	6,140	W8XK	Saxonburg, Penna.	Broadcast; relays KDKA, 4.15 P.M.—1 A.M.
48.91	6,130	YV3BC	Caracas, Venezuela	Broadcast; 8—10 P.M.
48.91	6,130	VE9BA	Montreal, Que.	Broadcast
48.95	6,125	YV11BM	Maracaibo, Venezuela	Broadcast; 8—11 P.M.
48.99	6,120	ZTJ	Johannesburg, So. Africa	Broadcast
48.99	6,120	W2XE	Wayne, N. J.	Broadcast; relays WABC
49.07	6,112	YV1BC	Caracas, Venezuela	Broadcast; 5.15—10 P.M.
49.10	6,110	VE9HX	Halifax, N. S.	Broadcast; 8.30—11.15 A.M.; 5 P.M.—10 P.M.
49.10	6,110	VE9CG	Calgary, Alta.	Broadcast
49.10	6,110	VUC	Calcutta, India	Broadcast; mornings
49.15	6,100	W3XAL	Bound Brook, N. J.	Broadcast; relays WJZ, Sat. 4.30 P.M.—midnight
49.15	6,100	W9XF	Chicago, Ill.	Broadcast; relays WENR, 3.30 P.M.—1 A.M. daily except Sat.
49.19	6,095	VE9GW	Bowmanville, Ontario	Broadcast; Mo., Tu. 7 A.M.—11 A.M., Thu., Fri. 3—7 P.M., Sat. 3 P.M.—11 P.M Sun. 10 A.M.—8 P.M.
49.23	6,090	VE9BJ	St. John, N. B.	Broadcast
49.31	6,080	VE9EH	Charlottetown, P. E. I.	Broadcast
49.31	6,080	W9XAA	Chicago, Ill.	Broadcast
49.40	6,070	OXY	Skamlebaek, Denmark	Broadcast; 2—6.30 P.M.
49.40	6,070	ZTJ	Johannesburg, So. Africa	Broadcast
49.40	6,070	UOR2	Vienna, Austria	Broadcast
49.40	6,070	VE9CS	Vancouver, B. C.	Broadcast; Fri., 12.30—1.45 A.M. Sun.; noon—midn.
49.44	60,65	SAJ	Motala, Sweden	Broadcast
49.48	6,060	VQ7LO	Nairobi, Kenya, Africa	Broadcast; 11 A.M.—2 P.M. daily
49.48	6,060	W3XAU	Byberry., Penna.	Broadcast; relays WCAU Thur. Fri. 6.15 A.M.—midn.; other days 6.15 A.M.—3 P.M.
49.48	6,060	W8XAL	Cincinnati, Ohio	Broadcast; relays WLW
49.48	6,060	ZL2ZX	Wellington, N. Z.	Broadcast
49.56	6,050	GSA	Daventry, England	Broadcast
49.64	6,040	W1XAL	Boston, Mass.	Broadcast; Sundays
49.64	6,040	PK3AN	Soerabaja, Java	Broadcast
49.64	6,040	W4XB	Miami Beach, Fla.	Broadcast
49.72	6,030	VE9CA	Calgary, Alta	Broadcast
49.80	6,020	XEW	Mexico, D. F., Mexico	Broadcast
49.80	6,020	DJC	Zeesen, Germany	Broadcast; 7—9 P.M.
49.84	6,015	VE9CX	Wolfville, N. S.	Broadcast
49.93	6,005	VE9DR	Montreal, Quebec	Broadcast, relays CTCF
49.93	6,005	VE9DN	Montreal, Que.	Broadcast
49.97	6,000	RV59	Moscow, U. S. S. R.	Broadcast; daily 2—5 P.M.
49.97	6,000	ZL3ZC	Christchurch, N. Z.	Broadcast
49.97	6,000	HJ1ABB	Barranquilla, Colombia	Broadcast; 7.45—10.30 P.M. daily; 8—10.30 P.M. Mo., Wed.; 7:45—8.30 P.M. Sunday
50.22	5,970	HVJ	Vatican City, Italy	Broadcast; 2—2.15 P.M. daily; 5—5.30 P.M. Sunday
50.47	5,940	TGX	Guatemala City	Broadcast; 1.30—2.30 P.M. 5 P.M.—midn.
50.60	5,925	HJ4ABE	Medellin, Colombia	Broadcast; Mo. 7—11 P.M.; Wed., Fri. 7.30—10.30 P.M.; Tue., Thu., Sat. 6.15—8 P.M.
50.99	5,880	XDA	Mexico, D. F., Mexico	Tests with XAM; 10 A.M.—8 P.M. irr.
50.99	5,880	H2ABA	Tunja, Colombia	Broadcast; 1—2 P.M.; 7.30—10 P.M.
51.09	5,868	WOB	Lawrenceville, N. J.	Phone to Bermuda
51.69	5,800	HJ1ABB	Barranquilla, Colombia	Broadcast; daily 8—10 P.M.; Thu. 8—10.30 P.M.
51.96	5,770	XAM	Merida, Yucatan	Tests with XDA 10 A.M.—8 P.M. irr.
52.60	5,700	HCK	Quito, Ecuador	Broadcast 8—11 P.M.
52.69	5,690	TIUI	Tananarive, Madagascar	Broadcast
52.79	5,680	VK3LR	Melbourne, Australia	Exp.; 5—7.30 A.M.
57.00	5,260	WQN	Rocky Point, N. Y.	Tests irreg.
57.99	5,170	OK1MPT	Prague, Chechoslovakia	Broadcast
57.99	5,170	PMB	Soerabaja, Java	Broadcast
58.22	5,150	PMY	Bandoeng, Java	Phone to Australia; 11 A.M.
59.13	5,070	WCN	Lawrenceville, N. J.	Phone to England, nights
59.37	5,050	VRT-ZFA	Hamilton, Bermuda	Phone to WNB and GMBJ, nights
60.20	4,980	GBC	Rugby, England	Phone to ships
60.33	4,970	G6RX	Rugby England	Exp, evenings 9 P.M.
61.95	4,840	GDW	Rugby, England	Phone to U. S. evenings
62.46	4,800	W2XV	Long Island City, N. Y.	Exp.
62.65	4,785	CGA	Drummondville, Que.	Phone to ships
62.70	4,782	W9XAM	Elgin, Ill.	Time sigs.
62.86	4,770	ZL2XX	Wellington, N. Z.	Phone
63.12	4,750	WOO	Ocean Gate, N. J.	Phone to ships
63.12	4,750	WKF	Lawrence, N. J.	Phone to England; evenings
66.48	4,510	VPN	Nassau, Bahama Is.	Phone to WND; 2—10 P.M.
67.07	4,470	YID	Bagdad, Iraq	Phone
69.44	4,320	G6RX	Rugby, England	Exp.; 9 P.M. irr.
69.56	4,310	WTDV-WTDW	Virgin Is.	Exp.;Weather reports 2-3 P.M.
70.00	4,283	IBEJ	S. S. Conte Rosso	Phone
		ICEJ	S. S. Rex	Phone
		IDLI	S. S. Conte di Savoia	Phone
70.20	4,270	RV15	Khabarovsk, Siberia	Broadcast
70.20	4,270	WIR	Rocky Point, N. Y.	Phone
71.73	4,180	GFWV	S. S. Majestic	Phone
		GLSQ	S. S. Olympic	Phone
		GMJQ	S. S. Belgenland	Phone
		GDLJ	S. S. Homeric	Phone
		GTSD	S. S. Monarch of Bermuda	Phone
		GFKY	S. S. Minnetonka	Phone
		GMBJ	S. S. Empress of Great Britain	Phone
		DDAC	S. S. Europa	Phone
		DDAS	S. S. Bremen	Phone
		DDCB	S. S. Columbus	Phone
		DDCG	S. S. Resolute	Phone
		DDCP	S. S. Cap Polonio	Phone
		DDDT	S. S. Deutschland	Phone
		DDDX	S. S. Hamburg	Phone
		DDDE	S. S. Cap Arcona	Phone
		DDED	S. S. New York	Phone
		DDFF	S. S. Reliance	Phone
		DDFT	S. S. Oceana	Phone
		DDNY	S. S. Albert Ballin	Phone
72.87	4,116	WOO	Deal, N. J.	Phone
73.00	4,107	HCJB	Quito, Ecuador	Broadcast; daily except Mo.
73.21	4,100	WND	Hialeah, Florida	Phone to VPN; irr.
79.95	3,750	13RO	Rome, Italy	Broadcast
79.95	3,750	F8KR	Constantine, Tunis	Broadcast

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 percent of the worth-while programs for this reason. RADIO NEWS is therefore presenting this fifth 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 September 10th-October 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 in bold face and is easily picked out. The list is correct up to the day of going to press. Programs are sustaining, unless otherwise noted.

SPECIAL NOTE: Listings are Eastern Daylight Saving Time up to and including September 23. From September 10 to 23, 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. On and after September 24, the same listings are in Eastern Standard Time. Therefore, beginning September 24, deduct *one* hour for Central Standard Time, *two* hours for Mountain Standard Time and *three* hours for Pacific Standard Time. 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, CRCT, KDKA.

6:45—THE KING'S HENCHMEN. Jane Froman and Charles Carlisle, vocalists. Fred Berrens Orchestra. Sponsor: Kings Brewing, Inc. CBS. WABC.

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

6:45—GEORGE SCHERBAN'S RUSSIAN GYPSY ORCHESTRA. CBS. WOKO, WCAO, WAAB, CKLW, WDRC, KMBC, WCAU, WFBL, WSPD, WQAM, WGST, WBRC, WDSU, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, KTRH, WFEA, WREC, WISN, WODX, WSFA, WLAC, WMBG, WDBJ, KSL, KTSA, WMT, WWVA, KFH, WSJS, WORC, KOMA, WDAE, WKBN.

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

7:30—LUM AND ABNER. Sketch. Sponsor: Ford Dealers. NBC. WEAF, WFBR, WBEN, WGY, WTAM. (WLW on 7:45 to 8:00), WTAG, WEEI, WJAR, WCSH, WRC. **Also, 11:15—**WENR, KSD, WOC, WHO, WDAF, WTMJ, WKBF.

7:30—DOLPH MARTIN'S ORCHESTRA AND TRAVELERS' QUARTET. Sponsor: Tide Water Oil Co. CBS. WABC, WOKO, WCAO, WNAC, WGR, WDRC, WCAU, WJAS, WEAN, WFBL, WJSV, WLBZ, WHP, WFEA, WHEC, WORC, WICC.

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, WCAU, WJAS, WBT, WJSV, CKLW.

8:00—HAPPY BAKERS. Vocal trio. Piano accompanist. Sponsor Continental Baking Corp. CBS. WABC, WAAB, WKBW, WDRC, WHEC, WORC, WMAS.

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

8:15—SINGIN' SAM. Sponsor: The Barbasol Company. CBS. WABC, WOKO, WCAO, WNAC, WGR, WGN, WKRC, WHK, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WCKY, WCCO, WADC.

8:30—THE SIZZLERS. Male trio. NBC. WEAF, WCSH, WBEN, WTAM, WSAI, WMAQ, KSD, WOC, WHO, WOW, WTAG, WJAR, WFBR, KFYR, WDAF, WIS, WCAE, WSB, WIBA, KPO, WEBC, WJDX, WSMB, WKY, KTBS, WRC, WOAI, CFCF, WWNC, WIOD, WSM, KOA, KVOO.

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

8:30—POTASH AND PERLMUTTER. Drama. Sponsor: Health Products Co. NBC. WJZ, WBAL, WMAL, WGAR, WCKY, WLS, WJR, WHAM, KDKA, WSYR.

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, WCCO, CKLW.

8:45—FERDE GROFE'S ORCHESTRA WITH CONRAD THIBAULT. Sponsor: Philip Morris & Co. NBC. WEAF, WTIC, WCAE, WJAR, WCSH, WLIT, WGY, WBEN, WWJ, WMAQ, WTAM, WEEI, WFBR, WTMJ.

9:00—A. & P. GYPSIES. Sponsor: Great Atlantic & Pacific Tea Co. NBC. WEAF, WTIC, WTAG, WEEI, WJAR, WHO, WCSH, WLIT, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, WMAQ, KSD, WOC, 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, WSM, WFLA, WSMB, WJDX, WFAA, WLW, KPRC, WOAI, KTBS, WKY, KOIL, KWCR, KSO, WIBA, WAPI, WPTF, KOA.

9:30—AN EVENING IN PARIS. Sponsor: Bourjois, Inc. CBS. WABC, WCAO, WGN, WHK, CKLW, KMBC, WCAU, WJAS, KMOX, WJSV, 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.

9:45—THE WITCH'S TALE. Drama and music. WOR.

10:00—CONTENTED PROGRAM. Male quartet and orchestra. Sponsor: Carnation Milk Co. NBC. WEAF, WBEN, WCAE, WTAM, WENR, WOC, WHO, WDAF, WGY, WTMJ, WWJ, KSD, WLW.

10:00—THE HOUR GLASS. Chorus and soloists. Orchestra directed by Harold Sanford. NBC. WJZ.

10:00—ANDRE KOSTELANETZ PRESENTS. Orchestra and vocal soloists. CBS. WABC, WADC, WOKO, WCAO, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WQAM, WDBO, WDAE, WGST, WBRC, WBT, WDOD, KVOR, KRLD, KLZ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WISN, WCCO, WODX, WLAC, WTAR, KOMA, WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, CFRB, WACO, KFH, WSJS, WORC.

10:30—LITTLE JACK LITTLE. Vocalist and pianist. CBS. WABC, WADC, WOKO, WCAO, WAAB, KMOX, WHK, CKLW, WDRC, WFBM, WHAS, WJAS, WFBL, WSPD, WQAM, WGST, WPG, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WDAE, WCCO, WODX, WLAC, WTAR, WMBD, WDBJ, WHEC, KSL, KTSA, WIBW, CFRB, WDSU, KOMA, WACO, KFH, WORC.

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC, WADC, WOKO, WCAO, WAAB, CKLW, WDRC, WFBM, WHAS, WJAS, WFBL, WSPD, WQAM, WGST, WPG, WLBZ, WBRC, WBT, WDOD, KVOR, KRLD, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WCCO, WODX, WLAC, WMBD, WDBJ, WHEC, KSL, KTSA, WSBT, WIBW, KOMA, WACO, WMT, KFH, WSJS, WORC, WDSU, WDAE, KMOX.

TUESDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, CRCT, CFCF.

6:30—MID-WEEK HYMN SING. Vocal soloists and organist. NBC. WEAF, WGY, WMAQ, WIS, KVOO, WOAI, WWNC, WIBA, KTBS, WSAI, KGIR, WJDX, KPO, KFYR, WDAY, KPRC, KDYL, KTHS, WFI, WTAG, WRC, WOC, WHO, WJAX, WFAA.

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

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

7:00—GYPSY NINA. Songs. CBS. WABC, WADC, WOKO, CKLW, WDRC, WCAU, WJAS, WFBL, WSPD, WQAM, WGST, WLBZ, WBRC, WDAE, KOMA, WACO, WKBN, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WHP, KTRH, WFEA, WREC, WDSU, WBBM, WISN, WCCO, WODX, WSFA, WLAC, WTAR, WMBG, WDBJ, WHEC, KTSA, WMT, WWVA, WSJS, WORC, WBBM, WDSU.

7:30—LUM AND ABNER. Sketch. Sponsor: Ford Dealers. NBC. WEAF, WFBR, WGY, WBEN, WTAM, WTAG, WRC, WEEI, WJAR, WCSH. **Also, 11:15—**WENR, KSD, WOC, WHO, WDAF, WTMJ, WKBF.

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

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

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

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

8:45—POET'S GOLD. Poetic Readings by David Ross. Emery Deutsch's Orchestra. CBS. WABC, WADC, WOKO, WCAO, WHK, CKLW, WDRC, WFBM, KMBC, WCAU, WJAS, WFBL, WSPD, WQAM, WGST, WPG, WLBZ, WBRC, WBT, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WCCO, WODX, WSFA, WLAC, WTAR, WMBG, WDBJ, KTSA, WSBT, WMT, KFH, WSJS, WORC, WDSU, WDAE, KMOX, KOMA, WACO.

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

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

8:30 — HORLICK'S ADVENTURES IN HEALTH. Talk by Dr. Herman Bundesen. Sponsor: Horlick's Malted Milk Co. NBC. WJZ, WBAL, WBZ, WBZA, WHAM, KDKA, WLS, KOIL, WREN, CRCT, WLW, KSO, WGAR. **Also, 11:45**—KGO, KGW, KOMO, KHQ, KOA, KDYL, KFI.

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

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

9:30—NINO MARTINI. Songs. Music by Howard Barlow's Symphony Orchestra. CBS. WABC, WADC, WOKO, WCAO, KMOX, WKBN, WHK, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WGST, WPG, WLBZ, WBRC, WDAE, WBT, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WACO, KOMA, WFEA, WISN, WCCO, WODX, WSFA, WLAC, WIBW, WMT, KFH, WSJS, WORC, WDSU, KOMA, WACO, WDAE, WKBN, KMOX.

10:00—HOUSEHOLD MUSICAL MEMORIES. Edgar A. Guest, poet. Vocalists and orchestra. Sponsor: Household Finance Corp. NBC. WJZ, WBZ, WBZA, WBAL, WHAM, KDKA, WMAQ, WJR, WREN, KSO, WSYR, KWK.

10:00—LIVES AT STAKE. Dramatic Sketch and Orchestra. Sponsor: General Tire & Rubber Co. NBC. WEAF, WTAG, WJAR, WCSH, WFI, KHQ, WRVA, WFBR, WRC, WGY, WBEN, WTAM, WLW, WENR, WCAE, WWJ, KSD, WOC, WHO, WDAF, WSB, WMC, WJDX, WKY, KOMO, WSMB, WBAP, KPRC, KTBS, KOA, KTHS, WOAI, KDYL, KGO, KFI, KGW, KVOO, WOW, WSM, WEEI.

10:45—LIGHT OPERA GEMS. Channon Collinge, conductor. CBS. WABC, WADC, WOKO, WCAO, WAAB, CKLW, WDRC, WFBM, KMBC, WHAS, WJAS, WFBL, WSPD, WQAM, WGST, WUG, WLBZ, WBRC, WBT, WDOD, KVOR, KLZ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WCCO, WODX, WLAC, WMBG, WDBJ, WHEC, KSL, KTSA, WIBW, WMT, KFH, WSJS, WORC, WIP, WDSU, WKBN, WDAE, KMOX, KOMA, WACO.

WEDNESDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, KDKA, CRCT, CFCF.

6:00—MEET THE ARTIST. Interview by Bob Taplinger. CBS. WABC, WADC, WOKO, WCAO, WAAB, WGR, WHK, CKLW, WDRC, KMBC, WHAS, WJAS, WFBL, WSPD, WQAM, WDBO, WGST, KOMA, WBRC, WICC, WBT, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WISN, WODX, WSFA, WJSV, WLAC, WTAR, WMBG, WDBJ, KSL, KTSA, WTOC, WIBW, WMT, WWVA, KFH, WSJS, WORC, WIP, WBBA, WDAE, WDSU.

6:30—BACK OF THE NEWS IN WASHINGTON. Political News Comment. NBC. WEAF, WJAR, WFBR, WRC, WWJ, WTAM, WOC, WHO, KDYL, KFYR, WSM, WDAF, WIS, WWNC, WIBA, WDAY, WSB, WJDX, KVOO, KPO, WMAQ, KTHS, KPRC, KTBS, KOA, WOAI, WGIR, KGHL, WSMB.

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

6:45—TED HUSING'S SPORTRAITS—Sports talk. CBS. WABC, WOKO, WCAO, WAAB, WKBW, CKLW, WDRC, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, KOMA, WBRC, WBT, WDOD, KVOR, WTAQ, WLBW, WBIG, KTRH, WFEA, WREC, WISN, WDSU, WODX, WSFA, WLAC, WMBG, WDBJ, KSL, KTSA, WTOC, WMT, KFH, WSJS, WORC, WDAE, WKBN.

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

7:30—LUM AND ABNER. Sketch. Sponsor: Ford Dealers. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WFBR, WRC, WGY, WBEN, WTAM. **Also, 11:15**—WENR, KSD, WOC, WHO, WDAF, WTMJ, WKBF.

7:30—DOLPH MARTIN'S ORCHESTRA AND TRAVELERS QUARTET. Sponsor: Tide Water Oil Sales Co. CBS. WABC, WOKO, WCAO, WNAC, WGR, WDRC, WCAU, WJAS, WEAN, WFBL, WJSV, WLBZ, WHP, WFEA, WHEC, WORC, WICC.

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

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

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

8:00—HAPPY BAKERS. Sponsors: Continental Baking Co. CBS. WABC, WAAB, WKBW, WDRC, WHEC, WORC, WMAS.

8:15—CURTAIN CALLS. Mark Warnow's Orchestra and vocalists. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, WHK, CKLW, WDRC, KMBC, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WICC, WBT, WDOD, KVOR, WTAQ, WLBW, WBIG, KTRH, KFAB, WJSV, WFEA, WREC, WODX, WSFA, WLAC, WTAR, WMBG, WDBJ, WHEC, KTSA, WSBT, CFRB, WWVA, KFH, WSJS, WORC, KOMA, WACO, WDSU.

8:30—POTASH AND PERLMUTTER. Drama. Sponsor: Health Products Co. NBC. WJZ, WBAL, WMAL, WHAM, KDKA, WGAR, WCKY, WLS, WJR, WSYR.

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

8:30—UNITED STATES NAVY BAND. CBS. WQAM, WDBO, WGST, WBRC, WBT, WDOD, WBIG, WREC, WODX, WSFA, WLAC, WMBG, WDBJ, WSJS, WDAE, WDSU.

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

9:00—FERDE GROFE'S ORCHESTRA AND CONRAD THIBAULT, BARITONE. Sponsor: Philip Morris & Co. NBC. WEAF, WTIC, WEEI, WJAR, WCSH, WLIT, WRC, WGY, WBEN, WCAE, WTAM, WMAQ, KSD, WDAF, WWJ, KSTP, WTMJ.

9:30—WHITE OWL PROGRAM. Barns and Allen; Guy Lombardo's Orchestra. Sponsor: General Cigar Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGN, WKRC, WHK, CKLW, WOWO, WDRC, WFBM, KMBC, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WBT, KRLD, KLZ, WBIG, KTRH, WCCO, KOMA, KSL, KTSA, WORC.

10:00—CORN COB PIPE CLUB, Sponsor: Larus & Bros. 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. Fred Waring's Pennsylvanians with "Maudy Lou." Sponsor: P. Lorillard Co. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGN, WKRC, WHK, CKLW, WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WQAM, WDBO, WDAE, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, WPG, WLBZ, WBRC, WICC, WBT, WDOD, KVOR, WCAH, KRLD, KLZ, WLBW, WBIG, WHP, KTRH, KLRA, WFEA, WREC, WISN, WCCO, WODX, WSAC, WDSU, WTAR, KOMA, WMBD, KOH, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, WMT, KFH, WORC, WHAS, WNOX, KSCJ, WKBH.

10:30—HOWARD MARSH AND THE SNOW QUEENS. Sponsor: Frigidaire Corp. CBS. WABC, WADC, WOKO, WCAO, WNAC, WKBW, WBBM, WKRC, WHK, CKLW, WOWO, WDRC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WQAM, WDBO, WDAE, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, WDOD, KLZ, KTRH, WREC, WHAD, WCCO, CKAC, WDSU, WTAR, KOMA, WMBD, WDBJ, KSL, KTSA, CFRB, KFH, KSCJ, WICC, WLAC, KMBC, WFBM, KRLD, WHEC, WCAH.

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC, WADC, WOKO, WCAO, WNAC, WGR, CKLW, WDRC, WFBM, KMBC, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WLBW, WBIG, WHP, KTRH, KFAB, WJSV, WFEA, WREC, WCCO, WLAC, WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, CFRB, WMT, KFH, WSJS, WORC, WIP, WDAE, WDSU, KOMA, WACO.

THURSDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. NBC. WJZ, WBAL, WBZ, WBZA, CFCF, KDKA, CRCT.

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

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

7:00—MORTON DOWNEY. Songs. CBS. WABC, WADC, WOKO, WNAC, CKLW, WKBN, WDRC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, KOMA, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WTAQ, WBIG, KTRH, KFAB, WFEA, WREC, WACO, WISN, WCCO, DODX, WSFA, WLAC, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, CFRB, WMT, WWVA, KFH, WSJS, WBBM.

7:15—COUNTESS OLGA ALBANI. Songs. NBC. WEAF, WJAR, WMAQ, WDAF, WOC, WHO, WSAI, KSD, WCSH, WBEN, WFI, WTAG.

7:30—LUM AND ABNER. Sketch. Sponsor: Ford Dealers. NBC. WEAF, WTAG, WEEI, WJAR, WCSH, WFBR, WRC, WGY, WBEN, WTAM. **Also, 11:15**—WENR, KSD, WOC, WHO, WTMJ, WKBF.

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.

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

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, KSD, WOC, KDYL, WDAF, WHO, WOW, CRCT, CFCF, KSTP, WEBC, WDAY, WSM, WIOD, WJAX, WFLA, WMC, WAPI, WJDX, WJAR, WRVA, WSMB, WOAI, WKY, KOA, KFI, KGO, KGW, KOMO, WBAP (WTMJ on 8:30) (KTHS off 8:30) WPTF, KVOO, WLW, WSB, KTAR, KFYR, KPRC, KHQ.

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. **Also 1 A. M., Friday—**KOA, KDYL, KGO, KFI, KGW, KOMO, KHQ, KFSD, KTAR.

9:00—PRESENTING MARK WARNOW. Vocalists and Mark Warnow's Orchestra. **CBS.** WABC, WADC, WOKO, WCAO, WNAC, WJSV, CKLW, WDRC, KMBC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WDAE, WKBN, WBRC, WICC, WBT, WDOD, KLZ, KVOR, KRLD, WTAQ, WLBW, WBIG, WHP, KFAB, WFEA, WISN, KMOX, WSFA, WLAC, WTAR, WMBG, WDBJ, KSL, KTSA, WTOC, WSBT, WIBW, WMT, WWVA, KFH, WSJS, KOMA, WACO, WDSU.

9:00—DEATH VALLEY DAYS. Drama. Sponsor: Pacific Coast Borax Co. **NBC.** WJZ, WBZ, WBZA, WJR, WLW, WLS, KOIL, WREN, KDKA, WBAL, WHAM, WGAR, KWK.

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—UNITED STATES MARINE BAND. CBS. WABC, WADC, WOKO, WCAO, WNAC, WJSV, CKLW, WDRC, KMBC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WDAE, WKBN, WBRC, WICC, WBT, WDOD, KLZ, KVOR, KRLD, WTAQ, WLBW, WBIG, WHP, KFAB, WFEA, WISN, KMOX, WSFA, WLAC, WTAR, WMBG, WDBJ, KSL, KTSA, WTOC, WSBT, WIBW, WMT, WWVA, KFH, WSJS, KOMA, WACO, WDSU.

10:00—AL JOLSON. Songs and comedy. Paul Whiteman's Orchestra, vocal specialties. Sponsor: Kraft-Phenix Cheese Corp. **NBC.** WEAF, WTAG, WEEI, WJAR, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WLW, KSD, WMAQ, WOC, WHO, WOW (WDAF on 10:00-10:45), WTMJ, WIBA, KSTP, WEBC, WDAY, KFYR, WRVA, WPTF, WWNC, WIS, WJAX, WIOD, WFLA, WMC, WSB, WAPI, WJDX, WSMB, WKY (KTHS on 10:30-11:00), WBAP, KTBS, KPRC, WOAI, KOA, KDYL, KGO, KFI, KGW, KHQ, KOMO.

10:00—DEEP RIVER. Willard Robison—"Evangelist of Rhythm." **CBS.** WABC, WADC, WOKO, WCAO, WHK, WJSV, CKLW, WDRC, WFBM, KMBC, WHAS, WJAS, WFBL, WSPD, WQAM, WDBO, WGST, KMOX, WBRC, WDOD, KVOR, KRLD, KLZ, WTAQ, WLBW, WBIG, WHP, KFAB, WFEA, WDSU, WREC, WISN, WCCO, WSFA, WLAC, WMBG, WDBJ, KTSA, WTOC, WSBT, WIBW, KFH, WSJS, WORC, WDAE, KOMA, WACO.

10:30—OLDSMOBILE PROGRAM. Sponsor: General Motors Co. **CBS.** WABC, WADC, WOKO, WCAO, WAAB, WKBW, WBBM, WKRC, WHK, WOWO, WDRC, KMBC, WCAU, WJAS, WEAN, WJSV, WGST, WBRC, WBT, WCAH, KLZ, WCCO, WLAC, KOMA, KTSA, WIBW, WMT, KFH, KSCJ.

FRIDAYS

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. **NBC.** WJZ, WBAL, WBZ, WBZA, KDKA, CRCT, CFCF.

6:45—LOWELL THOMAS. News. Sponsor: Sun Oil Co. **NBC.** WJZ, WLW, WHAM, CRCT, WSYR, WGAR, WBZ, WBZA, KDKA, WJR, WJAX, WIOD, WFLA.

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

7:00—LUM AND ABNER'S OLD-TIME FRIDAY NIGHT SOCIABLE. Sponsor: Ford Dealers. **NBC.** WTIC, WEEI, WJAR, WCSH, WTAG. **Also, 10:30—**WEAF, WLIT, WRC, WFBR, WGY, WBEN, WTAM, WWJ, WENR, KSD, WOC, WHO, WTMJ, WKBF, WLW.

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

7:45—BOAKE CARTER. News. Sponsor: Philco Radio & Television. **CBS.** WABC, WCAO, WNAC, WGR, WBBM, WHK, WCAU, WJAS, WJSV, WBT, CKLW.

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

8:15—KING ARTHUR AND ARABIAN KNIGHTS. Don Voorhees Orchestra and soloists. Sponsor: Pioneer Ice Cream. WOR.

9:00—BEST FOODS MUSICAL GROCERY STORE. Fred Allen and his dramatic company. Ferde Grofe's Orchestra. Sponsor: Best Foods, Inc. **NBC.** WEAF, WTIC, WTAG, WEEI, WJAR, WCSH, WGY, WBEN, KSD, WTAM, WWJ, WRC, WFBR, WLIT, WMAQ, WLW. **Also, 11:30—**KOA, KGO, KGW, KHQ, KOMO, KDYL, KFI, KFSD, KTAR, WDAF.

9:00—LET'S LISTEN TO HARRIS. Phil Harris and his orchestra. Leah Ray, blues singer. Sponsor: Northam Warren Corp. **NBC.** WJZ, WBAL, WMAL, WBZ, WBZA, WSYR, KDKA, WGAR, WCKY, WLS, KWCR, KSO, KWK, WREN, KOIL, KGO, KFI, KGW, KOMO, KHQ, KOA, KDYL, KGIR, KGHL, WSM, WAPI, WSB, WSMB, WKY, WFAA, WOAI.

9:00—IRVIN S. COBB. Humorist. Sponsor: Gulf Refining Co. **CBS.** WABC, WADC, WOKO, WCAO, WNAC, WORC, WKRC, WHK, CKLW, WOWO, WDRC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, WGST, WMAS, WBRC, WBT, WDOD, WCAH, KRLD, WBIG, KTRH, WFEA, WREC, WSFA, WLAC, WTOC, WDSU, WTAR, WMBG, WDBJ, KTSA.

9:30—POND'S PROGRAM. Comedy and Songs. 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, KDYL, KSO, 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.

9:30—RICHFIELD COUNTRY CLUB. With Grantland Rice, Betty Barthell, Mary McCoy, Double Quartet and Jack Golden's Orchestra. Sponsor: Richfield Oil Co. of N. Y. **CBS.** WABC, WOKO, WCAO, WNAC, WGR, WDRC, WCAU, WJAS, WEAN, WFBL, WJSV, WPG, WICC, WLBW, WHP, WHEC, WMAS.

10:00—UNITED STATES NAVY BAND. NBC. WEAF, WLIT, WFBR, WRC, WGY, WBEN, WWJ, WCAE, WTAM, WENR, KSD, WOC, WHO, WOW, WDAF, WIS, WRVA, WWNC, WIOD, WFLA, WJAX, WCSH, WEEI, WJAR, WTIC, WTAG, CRCT, CFCF.

10:00—THE FIRST NIGHTER. Drama. Sponsor: Campana Corp. **NBC.** WJZ, WBAL, WBZ, KDKA, WTMJ, WOAI, WGAR, WCKY, KWK, WREN, KOIL, KSTP, KOA, WEBC, KDYL, WSB, KGO, KFI, KGW, KOMO, KHQ, WKY, WFAA, WENR, WSM, WAPI, WSMB, WJR, WBZA, KPRC.

10:00 — CHESTERFIELD PROGRAM. Lou Holtz, Grace Moore, Leonard Hayton's Orchestra. **CBS.** WABC, WADC, WOKO, WCAO, WNAC, WKBW, WGN, WKRC, WHK, WOWO, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KOL, KFPY, KWG, KVI, WGST, WPG, WLBZ, WBRC, WBT, KRLD, KLZ, KTRH, KLRA, WREC, WISN, WCCO, WLAC, WDSU, WTAR, KOMA, KOH, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WMT, KFH, WNYZ.

10:30—JANE FROMAN AND THE SNOW QUEENS. Sponsor: Frigidaire Corp. **CBS.** WABC, WADC, WOKO, WCAO, WNAC, WKBW, WBBM, WKRC, WHK, CKLW, WOWO, WDRC, WHAS, WCAU, WJAS, WEAN, KMOX, WFBL, WSPD, WJSV, WQAM, WDBO, WDAE, KERN, KMJ, KHJ, KOIN, KFBK, KGB, KFRC, KDB, KOL, KFPY, KWG, KVI, WGST, WDOD, KRLD, KLZ, KTRH, WREC, WHAD, WCCO, CKAC, WDSU, WTAR, KOMA, WMBD, WDBJ, KSL, KTSA, CFRB, KFH, KSCJ, WFBM, KMBC, WICC, WCAH, WLAC, WHEC, WMT.

10:45—HOWARD BARLOW'S SYMPHONY ORCHESTRA. CBS. WABC, WADC, WOKO, WCAO, CKLW, WJSV, WDRC, WFBM, KMBC, WHAS, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WLBW, WHP, WBIG, KTRH, KFAB, WFEA, WREC, WACO, WCCO, WODX, WLAC, WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, WMT, WWVA, KFH, WSJS, WORC, WIP, WDAE, KOMA, KMOX.

SATURDAYS

2:30—SAVITT STRING QUARTETTE. CBS. WABC, WADC, WOKO, WCAO, WNAC, WJSV, WHK, CKLW, WDRC, WFBM, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, KFAB, WFEA, WISN, WWVA, WCCO, WODX, WSFA, WLAC, WTAR, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WSBT, KFH, WSJS, WORC, WDAE, KOMA.

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

5:45—LITTLE ORPHAN ANNIE. Drama. Sponsor: Wander Co. **NBC.** WJZ, WBAL, WBZ, WBZA, KDKA, CRCT, CFCF.

7:15—MILDRED BAILEY. Songs. **CBS.** WABC, WADC, WOKO, WCAO, WAAB, WJSV, WHK, CKLW, WDRC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WLBZ, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WISN, WCCO, WDAE, WODX, WSFA, WLAC, WTAR, WMBG, WDBJ, KTSA, WTOC, WMT, KFH, WSJS, WORC, KMOX, KOMA.

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

10:45—GERTRUDE NIESEN. Songs. Accompanied by Freddie Rich's Orchestra. **CBS.** WABC, WADC, WOKO, WCAO, WAAB, WJSV, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WEAN, WFBL, WSPD, WQAM, WDBO, WGST, WPG, WLBZ, WBRC, WICC, WBT, WDOD, KVOR, KLZ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WCCO, WODX, WLAC, WDAE, WMBD, WMBG, WDBJ, WHEC, KSL, KTSA, WTOC, WIBW, WMT, WWVA, WSJS, WORC, KMOX, KOMA.

SUNDAYS

11:00 A. M.—HORN & HARDART HOUR. Juvenile entertainers. Sponsor: Horn & Hardart Co. **CBS.** WABC.

11:15 A. M.—MAJOR BOWES' CAPITOL FAMILY. Variety. **NBC.** WEAF, WVAR, WFBR, WRC, WTAM, WDAF, WFLA, KFYR (WAPI, WHO, WOC off 11:45), WSMB, WTAG, KDYL, WEBC, WJAX, WFAA, WGY, WDAY, WSAI, KSTP, WMC, WIOD, WKY, KTBS, WOAI, WMAQ, WWNC, KPRC, KOA, WCAE, KVOO.

11:45 A. M.—SALT LAKE TABERNACLE CHOIR AND ORGAN. CBS. WABC, WADC, WOKO, WCAO, WDAE, KOMA, WHK, CKLW, WDRC, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WQAM, WDSU, WGST, WPG, WKBN, WBRC, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WREC, WCCO, WODX, WORC, WACO, WLAC, WMBD, KSL, WSBT, WIBW, CFRB, WMT, KFH.

12:15—RADIO CITY CONCERT. S. L. Rothafel (Roxy), master-of-ceremonies. Variety. **NBC.** WJZ, WBAL, WHAM, WGAR, WFLA, WLW, KDKA, KWK, WREN, KOIL, WJAX, WIOD, KFSD, WBZ, WBZA, CFCF, WDAY, KFYR, WSMB, KPRC, KOA, KDYL, WMAQ, WAPI, KTAR, KGO, KFI, KOMO, KHQ, WMAL, WEBC, WSYR, CRCT, WDJX, KVOO, WIS, WSM, WSB, WCKY, KSO, WBAP, WOAI.

3:00—WAYNE KING'S ORCHESTRA. Sponsor: Lady Esther. **NBC.** WEAF, WTAG, WEEI, WCSH, WJDX, WLW, WRC, WGY, WBEN, WCAE, WTAM, WWJ, KSD, WOC, WHO, WOW, WRVA, WJAR, WTMJ, KSTP, KGW, KHQ, KVOO, KDYL, WKY, WOAI, KPRC, WFAA, KOA, KGO, WLIT, KFI, WJAX, WFLA, WMC, WSMB, KOMO, WWNC, WIOD, WSM, WSB, WLS.

3:00—SYMPHONIC HOUR. Howard Barlow's Symphony Orchestra. **CBS.** WABC, WADC, WOKO, WCAO, KOMA, WKBN, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WQAM, WDSU, WGST, KMOX, WBT, WDOD, KVOR, WACO, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC,

WISN, WCCO, WODX, WDAE, WLAC, WTAR, WMBD, WMBG, WDBJ, KTSA, WSBT, WIBW, WMT, KFH, WSJS, WORC.

4:00—CATHEDRAL HOUR. Channon Collinge, conductor. Choir, orchestra and soloists. CBS. WABC, WADC, WOKO, WCAO, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WQAM, WGST, KMOX, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WISN, WCCO, WODX, WLAC, WTAR, WMBD, WMBG, WDBJ, KTSA, WSBT, WIBW, WMT, KFH, WSJS, WORC, WHK, WBRC, KRLD, KSL, WDAE, WDSU, KOMA, WKBN.

5:00—WILLARD ROBISON'S SYNCOPATED SERMONS. CBS. WABC, WADC, WOKO, WCAO, WDAE, KMOX, WHK, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WDSU, WQAM, WGST, KOMA, WBRC, WBT, KLZ, WDOD, KVOR, KRLD, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WKBN, WISN, WCCO, WODX, WSFA, WLAC, WTAR, WMBD, WMBG, WDBJ, KTSA, WSBT, WMT, WORC, WIBW, KFH, WSJS.

5:30—FRANK CRUMIT AND JULIA SANDERSON. Songs. Sponsor, General Baking Co. CBS. WABC, WADC, WOKO, WCAO, WAAB, WGR, WHK, CKOK, WDRC, WFBM, KMBC, WHAS, WCAU, WEAN, KMOX, WFBL, WSPD, WJSV, WICC, WCAH, KFAB, WDSU, WTAR, KOMA, WHEC, WWVA, KFH, WORC, WMAS.

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, WKY, KOA, KGHL, WJDX, WBAP, KPRC, WWNC, KSTP, KGIR, KPO, WAPI, WJAX, KECA, KGW, WIS, WSB, KTBS, KDYL, KOMO, WENR, KTAR, KVOO.

7:30—JOHN HENRY—BLACK RIVER GIANT. Drama. CBS. (First Part.) WABC, WADC, WOKO, WCAO, WDSU, WDAE, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WQAM, WBBM, WGST, WPG, WKBN, WBRC, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WFEA, WREC, WISN, WCCO, KOMA, WODX, WSFA, WLAC, WTAR, WDBJ, WHEC, KSL, KTSA, WSBT, WIBW, WWVA, KFH, WSJS, WORC, WIP, KMOX, WACO.

8:00—CHASE & SANBORN HOUR. Eddie Cantor, songs and humor. Dave Rubinoff's Orchestra. 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, CRCT, WTMJ, KSTP, WEBC, WDAY, KVOO, WFAA, WOAI, KOA, KGO, KFI, WFBR, WRC, WGY, KGW, KOMO, KHQ, WPTF, WSM, WOW, WJAR, WCSH, WMAQ, WRVA, WAPI, KTHS, WSMB, WJAX.

8:15—JOHN HENRY—BLACK RIVER GIANT. Drama. CBS. (Second part.) WABC, WADC, WOKO, WCAO, WKBN, KMOX, CKLW, WDRC, WFBM, KMBC, WHAS, WCAU, WJAS, WFBL, WSPD, WQAM, WACO, WGST, WBRC, WBT, WDOD, KVOR, KLZ, WTAQ, WLBW, WBIG, WHP, KTRH, WDAE, KOMA, WFEA, WREC, WISN, WCCO, WODX, WSFA, WLAC, WTAR, WDBJ, WHEC, KSL, KTSA, WIBW, WDSU, WORC, WMJ, WWVA, KFH, WSJS.

8:30—CHOIR INVISIBLE. Orchestra directed by George Shackley; vocal soloists and poet. WOR.

9:00—MANHATTAN MERRY-GO-ROUND. Orchestra and vocalists. Sponsor: R. L. Watkins Co. NBC. WEAF, WTIC, WJAR, WFBR, WRC, WGY, WWJ, WSAI, WENR, KSD, WOC, WHO, WOW, WDAF, KHQ, KOA, KDYL, KGO, KFI, KGW, KOMO, WFI, WTAM.

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

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

10:00—COL. LOUIS McHENRY HOWE. Interview by Walter Trumbull. Sponsor: RCA-Victor Company, RCA-Radiotron Company and Cunningham Radio Tube Company. NBC. WEAF, WTIC, WTAG, WJAR, WCSH, WFI, WFBR, WRC, WGY, WBEN, WCAE, WTAM, WWJ, WSAI, KSD, WMAQ, WOC, WHO, WOW, WDAF, WTMJ, WIBA, KSTP, WEBC, WDAY, KFYR, WMC, WSB, WSMB, WKY, KPRC, WFAA, WOAI, KOA, KDYL, KGIR, KGHL, KGW, KFI, KOMO, KHQ, KGO, KVOO.

Our "Uncle Sam" Says

ETHEL WATERS, noted for her rendition of "Stormy Weather," is the latest of Negro singers to get a featured network berth. . . . Jack Pearl is said to be considering a brand-new comedy idea for his return to the air in the Fall; he's in Hollywood now making a talkie. Jessica Dragonette, charming star of the NBC Cities Service Hour, was born in Calcutta, India. . . . Julia Sanderson collects autographs. . . . Numerology is the reason Ireene Wicker, NBC dramatic actress, uses so many "e's" in her name. . . . John S. Young, prominent NBC announcer, is the proud possessor of an honorary LL.D. degree bestowed by St. Benedict's College. . . WPG, the CBS Atlantic City outlet, has a unique studio a half-mile out on the Steel Pier. . . . WLW, Cincinnati, is using a new 831-foot vertical radiator antenna tower. . . . NBC put much ballyhoo energy behind the Piccard stratosphere flight at the Century of Progress Exposition. . . . The Chicago World's Fair drew many artists to the Windy City to make personal appearances before the throngs at the Fair grounds. . . . Jane Froman, pretty Chicago songstress, has returned to New York and the CBS; she is co-featured Friday nights with Jacques Renard. . . . The success of "The Voice of Experience" caused many stations throughout the country to feature the "question and answer" type of philosophy program. . . . Canada launched an effective campaign to rid its air channels of quack medicine advertisements and it might be a good idea for American stations to do the same. . . . NBC is expected to feature the 1933-34 Metropolitan Opera programs on the air. . . . With Al Jolson rejoining Paul Whiteman on the weekly Kraft Phenix Cheese Hour on NBC, the program has been switched from a Monday to a Thursday schedule; the broadcast now lasts only one hour on the entire hook-up, the second WEAF hour being dropped. . . . M. H. Aylesworth, president of NBC and R-K-O, is an occasional visitor to the Radio City Music Hall studio when Roxy's Gang broadcasts. . . . Willard Robison has switched from NBC to CBS. . . . The networks have been giving considerable attention to dramatic programs, but there has been very little improvement noted. . . . For some reason or other, sponsors are still wary of Saturday programs; it is the hardest day of the week for networks to sell. . . . Dick Leibert, popular NBC organist, smokes while at the studio console; he is one of the few network stars to rate a special studio ash tray. . . . Eddie Cantor is due back on the Sunday Chase & Sanborn Hour on September 10, but the sponsors will still use Bert Lahr on another program.

NORRIS GOFF AND CHESTER LAUCK

RAMONA

Backstage in

Personal interviews with broadcast artists and executives

By Samuel

A NEW series of rural skits which shows promise of becoming a radio sensation is the "Lum and Abner, Ford Dealers of the Air," sketch which is heard over NBC each night, excepting Saturdays and Sundays. The series had already built up an unusual following in the Cleveland, Ohio, area, where it was broadcast locally. The new series is sponsored by Ford dealers in the various cities in which the program is heard. Chester Lauck and Norris Goff, who portray Lum and Abner respectively, are both natives of Arkansas. They claim to bring to their broadcasts the authentic color of the rural community in which they grew up together. They created the Lum and Abner characters during the Red Cross relief drive of 1930-31 and later were heard on NBC sustaining programs. Lum and Abner write their own scripts and each broadcast originates in the studios of Station WTAM, Cleveland. On Mondays, Tuesdays, Wednesdays and Thursdays, the program takes the form of a fifteen-minute skit, while on Fridays the team presents an old-time Friday night sociable during which guest artists are heard. The program lasts thirty minutes on Fridays.

WHEN Will Rogers' contract with the Gulf Refining Company terminated, the sponsors of the Sunday night Gulf Headliners NBC program scored a new radio scoop in securing Arthur Brisbane, one of the best-known American editorial writers, to present a weekly radio talk. His broadcast, entitled "This Week," contains news comment of much the same type as his widely syndicated newspaper column, "Today." He has been a prominent figure in American journalism for many years, but has constantly kept away from the microphone. Walter C. Kelly, also known as "The Virginia Judge," shares time on the program with Brisbane. Al Goodman's Orchestra and the Revelers Quartet are features retained from the original Rogers series. It is reported that Rogers will return to the series sometime in the Fall.

WITH Ed Wynn deserting the microphone for the Summer months to make a talkie in Hollywood, the Fire Chief's "uncle," in the person of Taylor Holmes, has hastened to the NBC studios to carry on for his popular "nephew." It seems that Ed Wynn had constantly been joshing about his uncle and the sponsors thought it a good idea to bring the much-discussed relative before the microphone in the Fire Chief's absence. The remainder of the usual Wynn cast, including Graham McNamee, chief stooge, the Fire Chief Quartet and Don Voorhees' Orchestra, continues along with Holmes until Wynn returns from the Celluloid City. Although a newcomer to radio, Taylor Holmes has already appeared in almost every other form of entertainment. He launched his professional career with character readings at clubs and lyceums and has been on the stage almost as long as Wynn himself. Vaudeville and London music-hall appearances followed his lyceum work and then he appeared on the legitimate stage with many noted stars. A surround-

ARTHUR BRISBANE

THE FIRE CHIEF'S FAMILY

PEGGY HEALY

THE HAPPY BAKERS

Broadcasting

Chatty bits of news on what is happening before the microphone

Kaufman

ing comedy cast supports Holmes in his new radio series. Wamp Carlson, dialect comedian, has the rôle of "Keeper of the Chief's Horse." Larry Butler, nine-year-old actor, is featured as the fire mascot. Wynn is expected back on the program late in the Fall.

PAUL WHITEMAN, for many years a big name in radio—adds still more laurels to his microphone efforts through his new Thursday night NBC series, sponsored by Kraft-Phenix Cheese Corporation. The program is a full hour for the network and continues a second consecutive hour through the key outlet, WEAF. With Jolson as guest star, the series started off as a smash hit early in the summer. Deems Taylor, newspaper writer and opera composer, introduces the numbers on each broadcast. Whiteman was especially elated over his two-hour weekly assignment, because it gave him the opportunity to play some of his favorite long compositions without the need of condensing scores. Various of Whiteman's headlining soloists are heard on each week's broadcast. The soloists include Jack Fulton, tenor; Ramona, singing pianist; Peggy Healy, personality singer; Roy Bargy, pianist; Al Dary, baritone, and the Rhythm Boys, vocal quartet.

JEAN SARGENT

JEAN SARGENT, the young Philadelphia society girl now featured over NBC as a personality singer, has been attracting wide attention to her chain microphone efforts. Born in New York, Jean's family soon moved to Philadelphia, and she returned to the larger city twenty years later as a musical comedy headliner. Instead of following the routine of the usual society débutante, Jean got a job on a Philadelphia paper when she finished her schooling. While performing in an amateur show in Philadelphia, Jean's efforts caught the eye and ear of a New York producer and she became a featured member of the cast of "Face the Music." When that show closed after a successful run, she appeared in another hit, "Flying Colors." She's still single.

THE trio heard on the Happy Bakers CBS program each Monday, Wednesday and Friday consists of Frank Luther, Jack Parker and Phil Ducy, all veteran radio vocalists. The boys attribute much of their radio success to their accompanist and arranger, Will Donaldson. Frank Luther, the second tenor, grew up as a cowboy on a cattle ranch in Kansas. He didn't care much for college and joined a male chorus for a Chautauqua tour and spent three years doing evangelistic work. On the West Coast he became an ordained minister, but forsook the pulpit for music. He joined a choral group in New York and set off on a country-wide tour with Will Rogers. He later joined the Revelers and subsequently launched the Happy Bakers trio. Parker, the first tenor, hails from Hackensack, New Jersey. He entered vaudeville shortly after leaving high school. Ducy was born on a farm near Richmond, Indiana, the son of

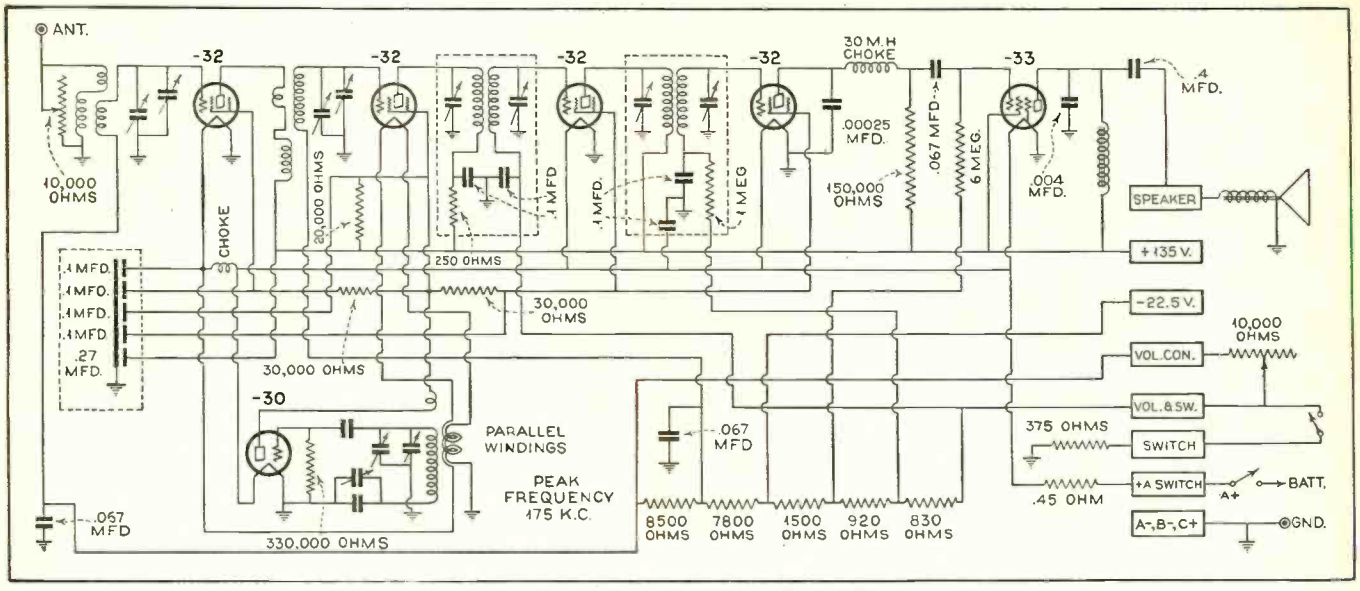
(*Continued on page* 249)

PAUL WHITEMAN

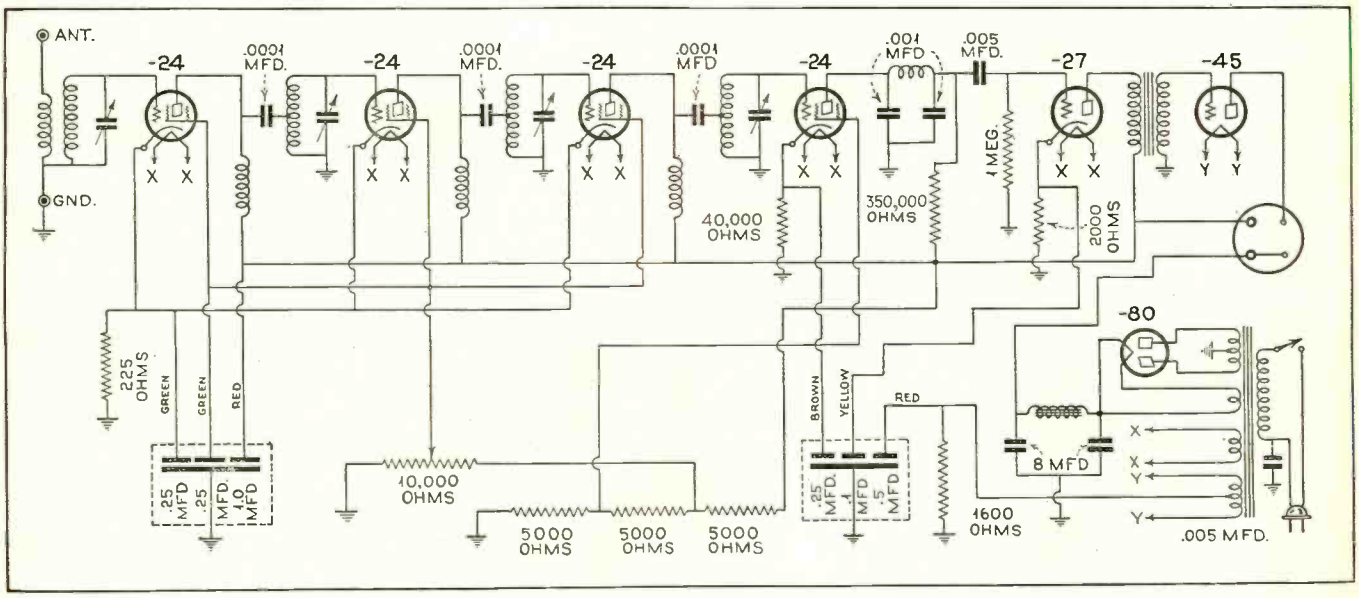
BABY ROSE MARIE

EDGAR A. GUEST

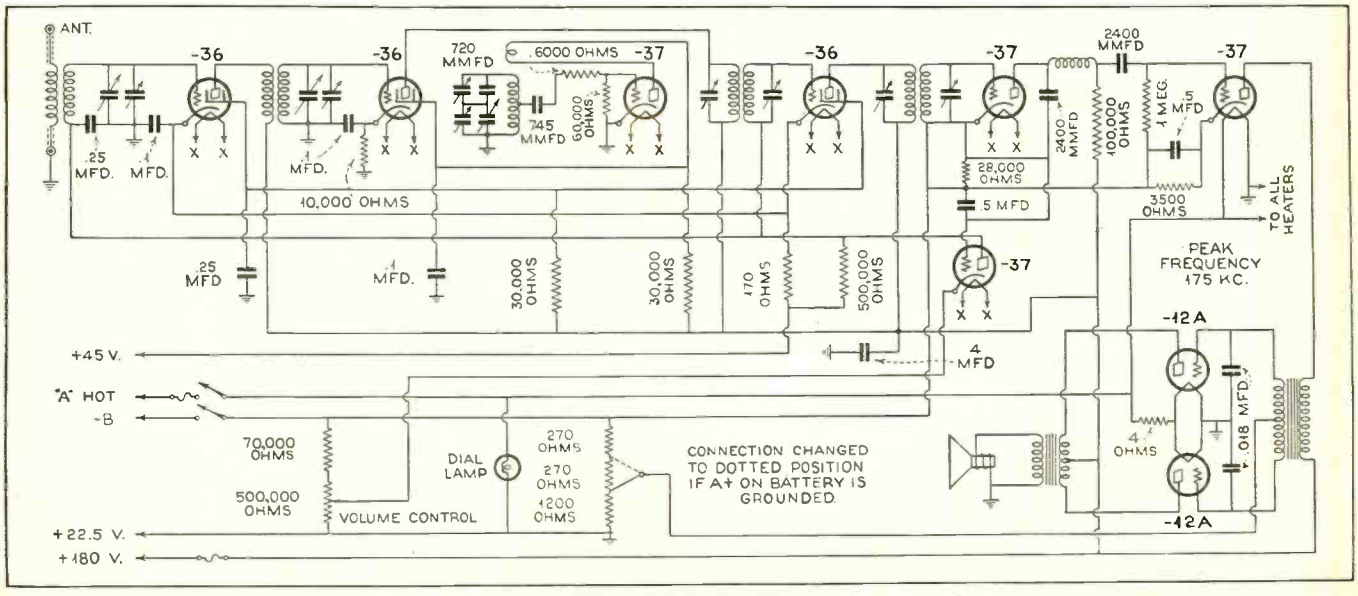
Service Data for Servicemen



MAJESTIC SCREEN-GRID SUPERHETERODYNE, MODEL 120



OZARKA, VIKING 92 A.C.



RCA-VICTOR AUTOMOBILE RADIOLA, MODEL M-30

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

Short-Wave Wireless Communication, by A. W. Ladner and C. R. Stoner. John Wiley & Sons. 1933. Communication on short waves involves problems which are entirely different from those encountered on the broadcast band. A book dealing exclusively with these problems will no doubt be welcome to the majority of amateurs, experimenters, engineers and operators. It is assumed by the authors that the reader has some understanding of long-wave radio communication, consequently, it does not go into the usual elementary principles of tuned circuits, etc., but the book fills the gap other texts have left in connection with short waves.

The beginning is concerned with a history of short waves and the most important pioneers. Then follow two chapters on the nature of waves and their propagation. The authors have succeeded in giving a concise and clear picture of this difficult subject. Actual circuits and apparatus are the subject of the later chapters. First comes modulation, followed by a chapter of the various ways of connecting push-pull amplifiers (including carrier suppression and other special uses). Short-wave transmitters of all types are next in order. The theory of radio-frequency feeders and the use of aerials and arrays come in for a detailed discussion. Final chapters deal with short-wave receivers, from the simplest to the most complicated ones used for commercial trans-oceanic work. Since the book is published in England, most of the illustrations and examples involve equipment used by the British Marconi Company.

Standard Handbook for Electrical Engineers. Sixth edition. Prepared by a staff of specialists. Frank Fowle, editor. McGraw-Hill Book Co. 1933. The latest edition of the "Handbook" comprises in one volume of some 2800 pages the essence of the best engineering practice in all branches of the industry. As many as 91 specialists have contributed to the handbook. The book has been divided into 28 subjects, to each of which a section has been devoted. So, for instance, the first section is entitled "Units and Conversion Factors," and it certainly gives more information on this subject than we have ever seen presented together. Separate sections are found, dealing with the theory of electric and magnetic circuits, measuring and measuring apparatus, properties of materials, magnets, transformers, generators, etc., etc.; we cannot enumerate them all. The "properties of material" section gives all data on copper wire, aluminum wire, resistance alloys, magnetic materials and insulating materials. Converters and rectifiers are covered in a separate section. Radio has not been forgotten. There is a section on wire telegraphy and telephony, one on radio and wired radio and a section on tubes. No doubt any engineer and experimenter will wish to keep the "Handbook" close at hand.

School Broadcasting, published by the League of Nations (available in U. S. A. from the World Peace Foundation, 40 Mt. Vernon Street, Boston, Mass.). This is one of the books in the Intellectual Coöperation series, issued by the International Institute of Intellectual Coöperation, founded by the League of Nations. The text consists of two parts. Part I deals with "The leading principles of School Broadcasting" wherein the best subjects, procedure, etc., are discussed. All attention seems to be directed towards employing radio broadcasting in the classroom, supplementing the regular courses. Very little consideration is given to employing radio broadcasting for the general public. Part II is entitled "Experiments, Results and Prospects in 25 Countries." In this section the progress in each country is sketched. A bibliography completes the volume.

Il Radio Libro (The Radio Book), by D. E. Ravalico. Ulrico Hoepli, Milan (Italy). 1933. A textbook on the principles and practice of radio receivers such as the serviceman would need—written in Italian. The beginnig chapters are devoted to the theory of electrical circuits and the tube. Then follow chapters on receivers, power packs, components, the superheterodyne, audio amplifiers and loudspeakers. Service work has not been forgotten. A chapter on trouble-shooting, aligning, etc., and one on installation will appeal to the serviceman. The final chapter contains diagrams of commercial receivers (some American, some European).

Guia Radio, published by Radio Revista, Buenos Aires, Argentina. This is primarily a list of amateur radio stations in all Latin-American countries and in Spain. The book also contains the radio laws of some countries and lists of broadcast stations in South America.

Pierre Key's Radio Annual, edited by Pierre V. R. Key, Pierre Key Publishing Co. This book will be of unusual interest to those interested in broadcasting. It contains various lists of programs on the air, advertisers, artists, a list of stations with their rates per hour, half-hour, quarter-hour, rates of networks in all combinations, lists of stations in U. S. and the rest of the world. It is the most ambitious collection ever published on the subject. Attempts have been made, apparently, to make the information as up to date as possible. Anyone realizes that a list of commercial programs on the air must of necessity become obsolete after a short time. Information on stations, advertisers, talent, etc., arranged in more than one way, is not so variable and ought to be of great value.

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

Diode Detection Analysis, by C. E. Kilgour and J. M. Glessner. The current and output relations for the linear and square-law diode detector in terms of the detection efficiency and the detector and load resistances are given in this paper. The square-law case is shown to yield results similar to the linear for large input potentials and reasonable values of load. The various factors which are involved in obtaining best operation with this form of detector are given detailed consideration.

Application of Transformer-Coupled Mod-

ulators, by J. A. Hutcheson. This paper gives a brief résumé of Heising's modulator theory together with a discussion of the Class B operation of tubes in a push-pull audio-frequency circuit. A discussion of several general problems involved in the use of Class B audio amplifiers is presented, showing the higher efficiency of this type of amplifier.

A Theory of Available Output and Optimum Operating Conditions for Triode Valves, by M. V. Callendar. In this paper, the form of triode valve curves is investigated experimentally, and the allowable limits of dynamic swing thus determined for any given percent harmonic; on this basis, a series of expressions are mathematically developed giving the required output characteristics in terms of an easily obtained valve constant. The method described is simpler than the previous static or dynamic methods generally used for determining output and operating characteristics.

A Simplified Frequency Dividing Circuit, by Victor J. Andrew. A description is given in this paper of a circuit in which a type –57 tube functions as two triodes in two separate oscillator circuits. One of the circuits is a crystal oscillator, and the other is a self-excited circuit which is controlled by the crystal so that it oscillates at a subharmonic of the crystal frequency.

An Analysis of Power Detection, by Rinaldo De Cola. This paper discusses the reasons for overloading of detectors as output devices. It is shown that in grid-circuit rectification, replacing the grid leak with a high-impedance choke extends the overload point considerably. Using a type –47 pentode, 800 milliwatts are obtained at the output circuit with seven percent maximum distortion.

Review of Contemporary Literature

The Panel Dial System. Bell Laboratories Record, July, 1933. A description of the dial telephone system which shows how a call is put through between the calling station and the called station. The description covers the telephone exhibit at the Century of Progress Exposition.

Soft Rubber Earpiece for the Audiphone, by M. B. Gardner. Bell Laboratories Record, July, 1933. This paper contains a discussion of the factors which were considered in the design of the new Western Electric audiphone soft rubber earpiece. It gives considerable information on the characteristics of different ears and their requirements for fitting comfortable and efficient earpieces for use with hearing aids.

Noise Measurement, by E. E. Free. The Review of Scientific Instruments, July, 1933. This article gives a general description of the progress which has been made in noise measurement and the results of some noise surveys. It describes the usual types of instruments used for making noise measurements and discusses their advantages and disadvantages.

The Pentagrid Converter, by C. L. Lyons. The Wireless Engineer and Experimental Wireless, July, 1933. This article contains a discussion on the operating characteristics and use of the Pentagrid Converter tube and the features which make it particularly suited for combination oscillator and detector use in superheterodyne receivers.

The Optimum Decrement of Tuned Circuits for the Reception of Telephony, by D. A. Bell. The Wireless Engineer and Experimental Wireless, July, 1933. This paper contains a discussion on the subject of the extent to which the decrement of tuned circuits may be reduced to provide greater sensitivity and selectivity, and the extent to which tone correction circuits may be employed to compensate for the cutting of sidebands in such circuits.

On the Amplitude of Loudspeaker Diaphragms at Low Frequencies, by N. W. McLachland. The Wireless Engineer and Experimental Wireless, July, 1933. This article covers many important phases which govern the ability of a loudspeaker to reproduce faithfully as sound waves the electrical variations fed to it by the amplifier. The amplitude required to radiate a given amount of power, the average amplitude necessary with average receivers, the effects of resonance in increasing response at certain frequencies and the relation between amplitude and loudness are some of the subjects covered.

Some Improvements in Cathode-Ray Oscillographs, by John D. Crawford. General Radio Experimenter, June-July, 1933. This article contains a discussion of the factors which affect the efficient operation of cathode-ray tubes and descriptions of the construction, features and operating characteristics of a number of General Radio cathode-ray oscillographs.

The Variac—A New Adjustable Transformer, by H. H. Scott. General Radio Experimenter, June-July, 1933. A description of a new variable transformer which makes it possible to obtain a continuously variable alternating current voltage source of from zero to 130 volts from a 60-cycle, 115-volt alternating current line, is described in this article.

Radio Cabinet Design, by Ruth Kock Gerth. Electronics, July, 1933. An analysis of the development and trend of radio cabinet design is given in this article which holds that radio instruments should have distinctive designs and not be camouflaged as other pieces of furniture. The need for distinctive designs in good taste is stressed as a means of increasing sales.

Jacking Up Tone Quality. Service, June, 1933. This article shows how the quality of receivers can be improved considerably and at low expense by a number of methods, among which are described automatic tone control, low-frequency compensation, detector frequency control and acoustically compensated volume control.

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.

RADIO NEWS *cannot undertake to supply copies of these articles. They are NOT included in the* RADIO NEWS *Free Technical Booklet Service.*

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

Review of Technical Booklets Available

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

6. *Line Voltage Control.* Characteristics and uses of a voltage regulator and chart showing the correct Amperite recommended by set manufacturers for their receivers. Also tells how to improve your customers' sets and make a profit besides.

7. *Rich Awards in Radio.* This 64-page book is filled with information on the growth of radio and the opportunities existing in the field of radio manufacturing, radio servicing, broadcasting, talking pictures, television, public-address systems and commercial station operation on land and sea, for men who are trained to fill the many jobs created by the radio and allied industries. 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 the RADIO NEWS readers who are over 16 years of age and who are residents of the United States or Canada.

9. *Catalog of Fixed, Metallized and Precision Resistors.* 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. *R.M.A. Standard Resistor Color Code Chart.* A handy postcard-size color code chart designed by the Lynch Mfg. Co. to simplify the job of identifying the resistance values of resistors used in most of the standard receivers. 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 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 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 especially adapted for use in connection with all-wave and amateur receivers. The shielded transmission type is especially suited for use on broadcast receivers.

34. *Serviceman's Replacement Volume-Control Guide.* A 44-page vest-pocket size booklet containing 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 and volume-control circuits for over 2000 different receiver models.

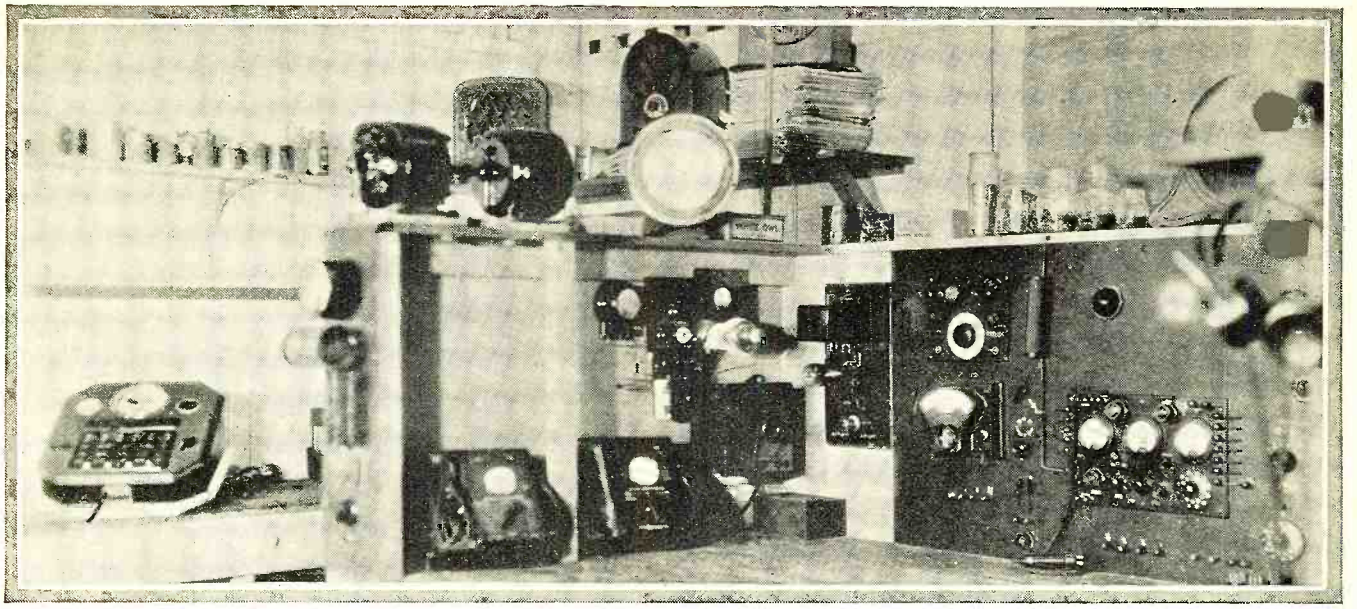
39. *Radio Servicing and Radio Physics.* A 4-page folder which gives descriptions and tables of contents of two inexpensive books on every phase of radio. The books are written by A. A. Ghirardi and Bertram M. Freed and should be in the libraries of every radio student, experimenter and serviceman. The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

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 low-priced kit. 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, showing how any meter—preferably a low-range milliammeter—can be used to measure amperes, volts and ohms over any desired range through the use of proper shunt and series resistors. The bulletin has been prepared by the Lynch Mfg. Co. and gives both the theoretical and practical data 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 folder describes the new set analyzer

(*Continued on page 237*)



The Service Bench

Until a theoretically impossible perfection is attained, the best of receivers will demand the occasional attention of the serviceman. The repairs described in The Service Bench for a specific receiver should in no way be taken as a reflection on that receiver. Also the fact that one receiver may be the subject of several service items does not indicate that it is particularly prone to trouble. On the contrary, its wide use, through deserved popularity, is often responsible for the repeated mention!

Conducted by
Zeh Bouck

THE primary job of the serviceman is to maintain radio receivers in a satisfactory operating condition. His ability to do this depends upon his experience, rather than on equipment alone, and upon the experience of others who are willing co-operatively to share their knowledge. The *Service Bench* is, therefore, a clearing house for radio service experiences.

The fact that ability and experience are more important than elaborate equipment is demonstrated by A. S. Barnes, of Rochester, N. Y., who writes:

"Test sets and analyzers are undoubtedly great things—time and money-savers. However, the serviceman who lets them do all his brain work may find himself stuck when, in some emergency, such apparatus is not available. The expert can diagnose probably a good percentage of radio troubles without the use of anything more than his head and a screwdriver, and in a number of instances temporary repairs can be effected without new or additional parts.

"One night a call followed me up where I was playing cards—by luck, close to the source of complaint. The radio had suddenly gone haywire, just a half-hour before a championship fight was scheduled to go on the air. Sorry to bother me and all that, but would I please rush over. There was no time to pick up my kit, which was in the shop at the other side of the city.

"The symptoms were distortion and low volume. A pencil tap on the detector tube brought forth no response from the speaker, so the trouble was tentatively localized in the a.f. circuit. The first audio tube was cold to the touch, and so I suspected an open bias resistor. (Had the tube been *very* hot, I should have looked for a shorted resistor—probably caused by a defective by-pass condenser.) I borrowed a screwdriver from the household tool drawer and shorted this resistor. No result. Next in line was the probability of an open plate-voltage resistor, and again using the screwdriver, I shorted this out. Volume and how! I made a temporary repair by bridging over from one of the r.f. plate-voltage resistors just as the gong rang for the second round. Result: satisfied customer, overtime fee and a glass of Scotch!

"When the detector rings through, it can safely be assumed that the trouble lies up ahead. In a tuned r.f. set, the difficulty can be often located and temporarily remedied by moving up the antenna to successive grids. This will also work on a super as far as the pre-selector is concerned. On a super, if the a.f. is okay, and no signal comes through with the antenna on the first detector grid, the i.f. circuit is next in line, and I bridge across the individual stages one at a time. If still no signal, the trouble is in the oscillator—perhaps the tube. If no spares are at hand, try shifting tubes. A tube that has just gone bad as an oscillator will usually pass some sort of a signal as an amplifier or detector.

"When the complaint is a sudden drop in signal strength, but still good quality, I first look at the antenna—equipment or no equipment. A bit of judicious shaking along the lead-in may show up more here than a whole laboratory of test sets.

"In the case of a loose connection, a good thump on the cabinet has been known to bring back a station and keep it until the emergency is over and a detailed inspection can be made.

"I have cured several cases of motorboating by the simple expedient of shifting tubes around."

Service Notes on Philcos

"I have had several complaints regarding the shadow-tuning Philco models, where there has been little or no change in the width of the shadow. This has invariably been due to an insufficient length of aerial. Where the sensitivity of the receiver is pushed close to maximum by turning up the volume control, the effectiveness of this tuning indicator is considerably lessened. A good sales argument for an efficient outdoor antenna system."—J. H. Coffin, Minneapolis, Minn.

R. H. Lang, serviceman in Des Moines, Iowa, runs into mechanical hum in the power transformer of several Philcos. "Upon taking the transformer apart, the cause was discovered in the outer core laminations, which were somewhat loose. The trouble was corrected by bending the center leg of the 'E' so as to provide sufficient tension to dampen the vibration."

"A trouble that is sometimes rather baffling in the Philco model 7 and similar receivers," writes Stewart J. Robinson, of Sacramento, Calif., "is a rattle sounding like a defective tube or a loose connection. This will often be due to a poor contact between the coil shields and their bases. The rims should be cleaned with emery cloth or sandpaper, and crimped so as to make a tight joint. It is a good idea to do this to all the shields after removing the chassis from the cabinet. It is difficult to localize the trouble, as a pencil tap on any part of the chassis

will produce the racket." (Poor shield contacts may be the cause of a variety of radio ills, such as instability, oscillation, fading, broadness of tuning and poor tracking. Trouble of this nature is almost always accompanied with noise.—The *Service Editor.*)

Charles F. McNulty, Clearfield, Pa., has run into by-pass and coupling condenser trouble on Philcos. "Intermittent reception, or loss of volume, is almost always an indication of faulty a.f. coupling condensers—providing tubes, etc., check okay." (The same holds for any receiver employing one or more resistance or impedance-coupled stages. This trouble will probably become more and more evident with the new tubes and circuits which rather consistently employ modifications of these fundamental coupling systems. Loss of all low-frequency response is a concommitant symptom.—The *Service Editor.*)

Dial Service and Adjustment

There are three principal reasons why the drive cable on the Majestic Model 70 breaks. These are, as Russell L. Woolley, of Seattle, Washington, describes them:

"First, the operator has forced the dial past the end stop. Second, the cable has cross-threaded on the sheaves. Third, the serviceman who last rewound it did not parallel the filed washer under which the

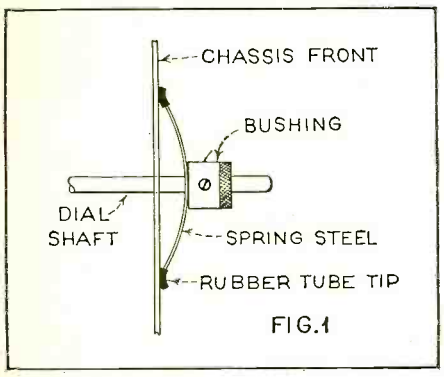


FIG.1

end of the cable is fastened. In this last case the sharp edge of the washer tears the cable to shreds.

"Replacement can be made with any standard drive cable wire. Number 12, 24-pound fish line can also be used. However, if the latter is used, an eyelet must be inserted in the center and the exact length of the cable determined by comparison with the original wire.

"With the dial set at the low-frequency end, the rear sheave is threaded full, and the front sheave has one turn on it. The process of recabling is as follows: Loop the end of the cable over the rear sheave pin and turn the control shaft clockwise until it is fully threaded. Hold the shaft steady by inserting a three-cornered file between the shaft and the chassis. Now run the cable over the rear pulley, through the chassis opening, and make a half turn around the drum dial track. Insert the tension screw through the eyelet. Complete the turn around the drum and bring the cable out through the chassis opening, over the front pulley, making one turn around the front sheave. The end of the cable is fastened under the machine screw and filed washer—making sure that the edge of the washer is parallel with the cable. The correct tension is obtained by pulling the wire tightly over the front tension spring pulley and by making the final adjustment on the dial hub tension screw."

The *Philco Serviceman* (distributed by Philco among their servicemen and dealers) considers the problem of dial slipping on their models equipped with drive cord tuning. This is usually caused by the weakening of the drive cord spring tension, allowing the cord to slip over the drum of the dial. It can often be corrected by moving the spring from the second to the third notch on the inside of the drum. If this does not correct the condition, a new and heavier spring should be installed, such as Philco part number 7776.

The problem of holding the dial mechanism steady during repairs on drum dials has stimulated the ingenity of several servicemen. Frank J. Faulkner, of Brigham City, Utah, supplies the desired third hand by slipping a tough rubber band over the dial knob and stretching it, with the desired tension, to an adjacent volume or tone-control knob.

A slightly more elaborate method is suggested by Algie Robinson, Niagara Falls, Ontario, who sends along Figure 1 and the following explanation:

"If there is a more tedious job in the entire radio business than the repair of dial cables and the installation of new ones, on some of the sets, then, in my thirty-five years' experience I do not know of it.

"So-o-o-o, as Ed Wynn says, burn out or break out the bushing from an old bakelite dial. Take a piece of clock or phonograph spring about 2½ inches long, drill a hole in center and solder the bushing to spring. Pieces of rubber tubing slipped over the two ends of spring complete the job. The natural curvature of the spring will supply sufficient tension when the tool is slipped over the the dial shaft, thereby holding shaft solid, leaving two hands with which to handle the cable, etc.

"Nearly as good results can be obtained by taking an old dial and gluing two or three pads of sponge rubber on the underside and drilling the shaft hole completely through the dial.

"Either of these devices can be used in same way, to hold a dial setting on a particular signal when testing the chassis for intermittent opens, etc."

Servicing Speaker Rattles

"I have found the following service kink to be very effective in taking the rattle out of a Crosley Dynacone and similar speakers, and provides a new use for old inner tubes.

"Upon investigating the cause of the rattle, it was found that the outer cone clamp has

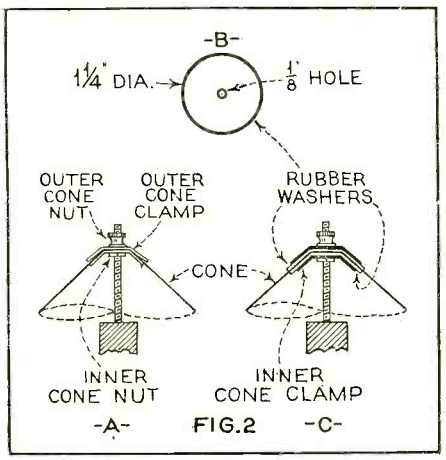
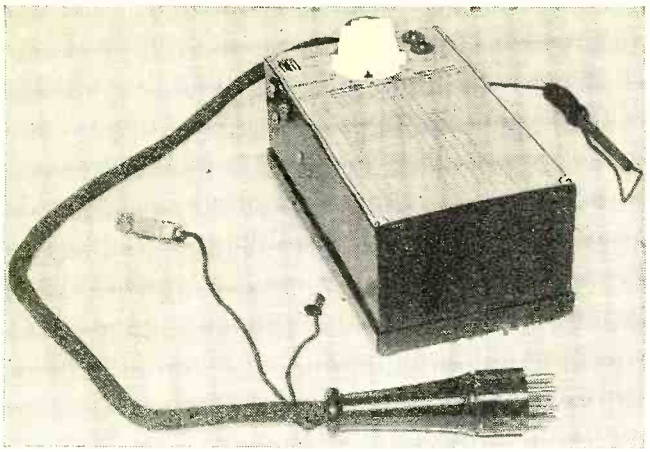


FIG.2

a tendency to flatten through the tightening of the outer clamp nut, as shown in A, Figure 2. This allows the cone to vibrate in the small space between the outer and inner cone clamps.

"Make up two rubber washers from an old inner tube (felt will serve the same purpose) as suggested in B, Figure 2. Insert the washers as shown in Figure C. To do this, remove the outer cone nut, outer cone clamp, cone, inner cone clamp, and run the inner nut down a few threads on the screw. Reassemble in the following order: Inner cone clamp, one rubber washer, cone, the other rubber washer, outer cone clamp and outer

(*Continued on page 256*)



New Service Unit Simplifies

Resistance Analysis

By Kendall Clough

RESISTANCE analysis of receiver circuits has been accepted by the servicemen as an indispensable means of locating and tracing troubles in radio circuits. Ohmmeters have been highly developed for this purpose, but it is a notable fact that little has been done previous to this date to simplify the application of the resistance analysis system in actual application.

It is well known that the circuit diagrams as presented by the manufacturer, while perfectly clear from an operation standpoint, do not show information as to the actual placement of the tube elements around the face of the socket. There are now some thirty-odd arrangements of prongs and elements which make memorizing impossible. True, charts are liberally supplied by the tube manufacturers, but their use requires that the serviceman take cognizance of which view of the tube sockets is presented in the chart—that is, whether the socket or the tube pins are being shown, and of the manner in which he is viewing the socket—whether from the top or the bottom. All of these mental gymnastics, of course, distract the serviceman's mind from the interpretation of the results shown by the ohmmeter, which is, after all, the important thing.

Analysis Simplified

A new instrument, known as the "Statichecker" and developed by the Clough-Brengle Company, which simplifies and speeds up resistance analysis, is shown in Figure 1. A nine-cord cable coming out of the metal case connects to a seven-prong plug, as well as grid cap, ground clip and test prod. The two jacks on the side of the case are for insertion of test prods from the ohmmeter, which in most cases the serviceman already possesses. Four adapters of four, five, six and large seven prongs are also supplied for use with other than small seven-prong sockets. The cord from the adapter plug leads into the twelve-position switch shown on the face of the panel.

The panel has processed into it, in addition to the numerals around the switch, a chart in which over one hundred tube types—both old and new—have been classified and coded to the switch in such manner that the location of circuits in a receiver is reduced to the simplest possible operation. This operation will be briefly described.

How It Works

With the volt-ohmmeter plugged into the Statichecker and the ground clip attached to the chassis of the receiver, a tube is removed from the socket in the circuit to be tesed. Suppose, for example, that this tube is a 2A7 and the No. 1 grid circuit is in question. The circuit diagram of the receiver shows the position of the grid as being the one closest to the cathode in the tube, but does not give any indication as to which prong of the tube socket carries this grid. The Statichecker makes it unnecessary to consult a chart for the information. The seven-prong plug is inserted in the socket and the chart on the face of the Statichecker consulted under the classification of seven-prong tubes. The 2A7 is located and, scanning across the chart, it will be seen that G1 (grid No. 1) appears in column 6. The panel switch is therefore turned to position 6 and the ohmmeter reads the resistance of this circuit. This operation is actually faster in the execution than in the telling.

In making zero adjustment of the meter it is unnecessary to remove the connections between ohmmeter and Statichecker, but simply turn the dial to the point marked Test Prod. The circuit is now open and the zero scale adjustment can be made. The knob is now turned to "Short Circuit" and the battery adjustment made for zero resistance. In the event that the receiver chassis has been opened and it is desired to test some portion of the circuit that is not accessible through a tube socket, the dial is turned to the position marked "Test Prod" and a prod from the Statichecker is available for the test without removal of the test prods of the ohmmeter.

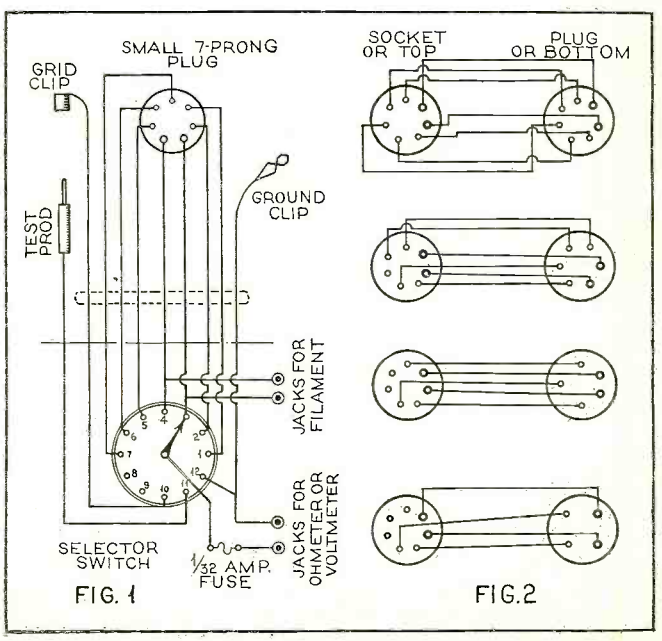
When it is desired to check for filament voltage on the tube socket in which the analyzer is plugged, the voltmeter may be applied to two jacks mounted in the panel opposite positions 3 and 4.

Particular attention has been paid to the factor of obsolescence in the design and layout of the device. Too many of the devices worked out for the serviceman in the past have been relegated to the scrap heap with the advent of new tubes and new circuits. In keeping with this aim, the Statichecker table has been developed with the co-operation of several of the most prominent tube manufacturers, with the result that it includes not only the tubes now in use, but those just emerging from the laboratory as well. Inasmuch as no tubes beyond those included in the chart are scheduled for release for the next five or six months, the applicability of the device is assured. Over and above this consideration, there have been provided in the chart blank lines, as well as two blank columns for the addition of tubes that may appear at any time in the future. The material used for the front panel permits these additions, in permanent manner, at any future date.

Resistance analysis is ordinarily applied to the receiver in an inoperative condition—that is, (*Continued on page 237*)

DIAGRAMS OF THE NEW SWITCHING DEVICE AND ADAPTER CONNECTIONS

Figure 1. Used in conjunction with an ohmmeter, this ingenious device permits resistance measurements between ground and any element in any tube in a receiver. Figure 2. The unit is supplied with a complete set of adapters permitting its use in analyzing circuits of any type of tube in any receiver



(*Continued from page 236*)

with the power turned off. Meters have been damaged, however, by inadvertent application of the ohmmeter to a live current. To avoid this, a delicate meter fuse is provided in the meter circuits of this new analyzer.

The bottom of the Statichecker box is removable for packing the adapters and cords of the instrument when not in use. In this way a compact unit, which measures only 7 inches by 4 inches by 3½ inches overall, is made for inclusion in the service kit.

Technical Review

(*Continued from page 233*)

remanufacture plan perfected by the Supreme Instruments Corp. for the conversion of obsolete set analyzers such as the Jewell Pattern 198, 199, 408 and 409 analyzers; Weston Model 537, 547, 565 and 566 set testers; and Supreme 99-A, 400-A and 400-B diagnometers into efficient, up-to-date testing equipment, at low cost. 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 RCA-Victor automatic remote-control unit used makes it possible to operate a set at a distance up to 75 feet from the tuner. Information is also given on how to add a remote-control unit to a P. A. tuner.

45. *Condenser Bulletin for 1933.* This bulletin gives descriptions, specifications and prices on the entire line of Potter paper and

(*Continued on page 251*)

October, 1933
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Student's Radio

LESSON TWENTY-TWO—ELECTRO

By Alfred A.

This series deals with the study of the physical information of particular value to physics colleges. The text material aids teachers

THE electromotive force produced by the chemical action in the cells of a battery causes free electrons to flow through the conducting circuit in one direction. The flow of electrons, and therefore the flow of current, is usually maintained at a steady rate in circuits of this kind. This is known as a *steady direct current* or *unidirectional current*. If the current flows always in one direction but the rate of flow varies, it is called a *varying* or *pulsating direct current*. A current of electricity (stream of electrons) flowing through a conductor sets up magnetic forces (a magnetic field) around the conductor. In 1831 the English physicist, Michael Faraday, discovered that an e.m.f. can also be set up in a conducting circuit by moving a magnet near it, or by moving the conductor across the field of the magnet. If the conducting circuit is arranged to form a closed loop, the induced e.m.f. will produce a flow of current through it. This great discovery forms the foundation of the entire science of induced e.m.f., and its practical application led to the discard of the use of primary batteries and chemical action for the commercial production of e.m.f. and currents on a large scale, in favor of the electric generator which generates e.m.f. by causing a relative motion between conducting circuits and an intense magnetic field. Without this simple, efficient means of producing electricity on a large scale, the development of present-day electrical devices and machinery, and the growth of the electrical industry, would never have come about. Radio and broadcasting as we know it today would never have been developed.

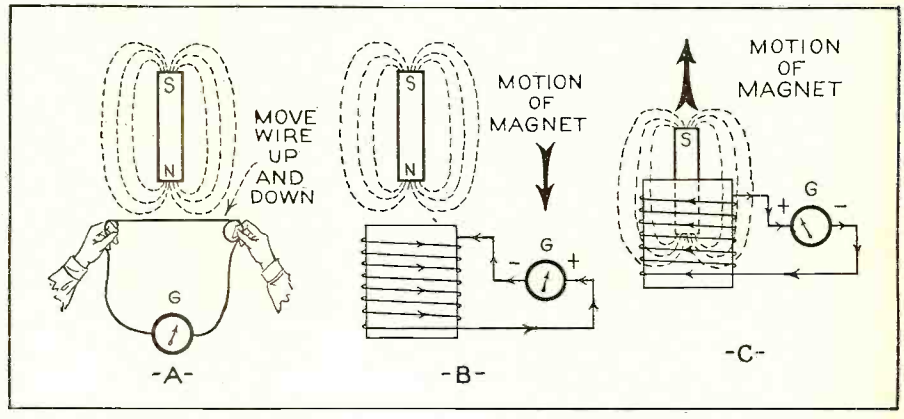


Figure 1. Inducing e. m. f. and current in a conductor by means of a magnetic field

E. M. F. Produced by a Magnetic Field and a Conductor

The experiments of Faraday may be repeated in their essentials by means of very simple apparatus consisting of one or two permanent bar magnets, a 100-foot roll of ordinary No. 18 cotton-covered copper wire (commonly called *bell wire*), one or two No. 6 dry cells and a galvanometer, low-reading milliammeter or other sensitive current or voltage-indicating instrument. The instrument used should have the + and — terminals plainly marked on it. The plus (+) terminal of such a device is that terminal which, when current is sent into it (or is connected to the positive side of a circuit), will make the pointer deflect to the right on the scale. If the terminals are known, we can quickly tell which way the current is flowing through such an instrument by simply noticing the direction of deflection of the pointer.

If the bar magnet is a very strong one and the current-indicating device is very sensitive, it will be possible to induce a voltage of sufficient strength to be indicated on the galvanometer by connecting the ends of a straight piece of the wire about two feet long to the terminals of the instrument and then quickly moving the wire up and down *across* the magnetic field of the bar magnet (close to the pole where the field is strongest), as shown in (A) of Figure 1. (If a horseshoe permanent magnet is used instead, the field will be stronger and a larger deflection will be obtained on the meter.) Since nothing but an electric voltage or current could cause the galvanometer to register, it is evident that during *motion* of the wire an e.m.f. and current was produced. It will be noticed that the induced voltage and current reverse in direction when the direction of motion of the wire is reversed (as indicated by the deflection of the meter needle in the opposite direction.) If the wire is held stationary in the field, no e.m.f. or current is produced. If the wire is moved from left to right in a direction across this page, no e.m.f. will be generated because its motion is parallel to the lines of force.

Now wind about 50 feet of bell wire into the form of a soleznoid coil having a hole just large enough to admit two bar magnets together. This may be wound on a wooden spool or a cardboard tube, or may simply be taped up to hold the turns together. Connect the ends of the coil to the indicating instrument as shown at (B) of Figure 1.

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

Physics *Course*

MAGNETIC INDUCTION

Ghirardi*

aspects of radio phenomena. It contains teachers and students in high schools and in laying out current class assignments

If the N pole of the bar magnet is suddenly thrust into the solenoid, the galvanometer needle will be temporarily deflected. Notice that the deflection now is much greater than in the case when the single straight wire was used, indicating that a stronger e.m.f. is now being induced in the wire. If the galvanometer is watched carefully, it will be seen that the needle moves as soon as the pole of the magnet begins to approach the end of the solenoid. When the bar magnet comes to rest inside the solenoid, the galvanometer needle returns to the zero position.

When the magnet is rapidly pulled out of the solenoid as shown at (C) of Figure 1, the pointer deflects in the opposite direction, showing that the induced e.m.f. and current are now in the opposite direction.

If the magnet is plunged into the solenoid first quickly and then very slowly, it will be found that the quicker it is moved in and out, the stronger will be the e.m.f. and current produced. If the motion is too rapid, the needle does not have the time to take up the alternate positions due to the opposite currents traversing the instrument, and will remain at zero with only a slight vibration.

Now quickly plunge the S pole of the magnet into the coil and notice that the galvanometer needle deflects in a direction opposite to that when the N pole was plunged in. The same thing happens when the S pole is pulled out, showing that the direction of the induced e.m.f. and current depends on the direction of motion of the magnet or conductor.

Place the two-bar magnets with both N poles together so as to make a strong N pole. Plunge them into the solenoid together and notice that the e.m.f. is stronger than when a single magnet was used.

Now leave the magnet stationary and quickly slide the solenoid over it. Notice that the galvanometer deflects just as before. If more turns of wire are added to the solenoid it will be found that the more turns of wire employed, the stronger will be the e.m.f. and current produced.

It must be remembered that the linking and unlinking of the lines of force of the magnet with the turns of wire on the solenoid really induces an e.m.f. in the wire. If the two ends of the wire were left open, the e.m.f. would be present but no current would flow. If the circuit is closed, this e.m.f. causes a flow of electrons around the wire, in a direction opposite to that conventionally ascribed to the current. The phenomenon observed in the experiments described above is termed *electromagnetic induction*. Hereafter we shall designate the e.m.f. or difference in electrical potential thus produced as an *induced e.m.f.* The currents produced by these induced *e.m.f.'s* could be called *induced currents*. Each turn of the conducting circuit is called *a turn or conducting loop*.

Value of Induced E. M. F.

These experiments prove that an e.m.f. can be induced by the motion of a conductor in a magnetic field. The results may be summarized by saying that the magnitude of the induced e.m.f. depends upon the following factors:

(a) The flux or total number of lines of magnetic force sweeping across the conductors.
(b) The number of turns of wire being swept across by the field.
(c) The rate or speed of unlinking or linking of the lines of force with the turns of wire.

These statements may all be summed up and written in a simple equation of the form.

$$\text{E.M.F.} = \frac{\Phi N}{T} \times 10^{-8}$$

Φ = total number of lines of force linked or unlinked during time T seconds.
N = number of turns of wire.

Example: Ten turns of wire cut across a field of 50,000 lines of force 50 times every second. What is the value of the total induced e.m.f.?

Solution:

$$\text{E.M.F.} = \frac{\Phi N}{T} \times 10^{-8} = \frac{50{,}000 \times 50 \times 10}{1} \times 10^{-8} = 0.25 \text{ volt}$$

This example illustrates the fact that a conductor must cut across a very large number of lines of force every second (100,000,000 to be exact) in order to generate one volt of e.m.f. In commercial dynamos, high voltages are generated by rotating a large number of conductors at high rates of speed in intense magnetic fields produced by the strong field electromagnets. The field electromagnets obtain their exciting current from the generator itself in most cases, since the exciting current required is only a small fraction of the total output of the machine.

Radio Dealers Please Note Correction

The dealer's price quoted in the Universal Meter Works' advertisement on page 126 of the August issue of RADIO NEWS should be $29.45 instead of $24.95, as shown.

Subscribes to NRA Code

NEWARK, N. J.—The Arcturus Radio Tube Company has signed President Roosevelt's NRA code and begins operation under this code immediately. In accordance with the provisions of the code, the earnings of employees will increase approximately 5% irrespective of shorter working hours. The working force will be immediately increased 17%. In taking on new help, officials announce that preference will be given to former employees. A telegram which was sent to General Hugh S. Johnson today reads: "This is to inform you that the board of directors of Arcturus Radio Tube Company have voted to support the President's reemployment program and we are putting this program into effect immediately."

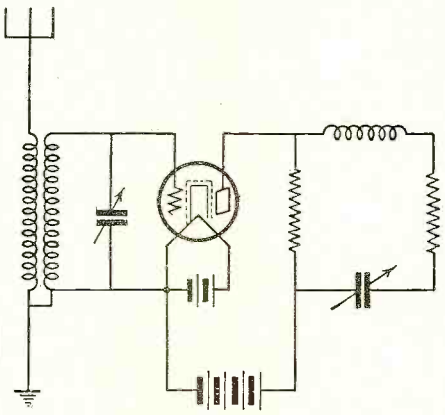
Latest Radio Patents

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*

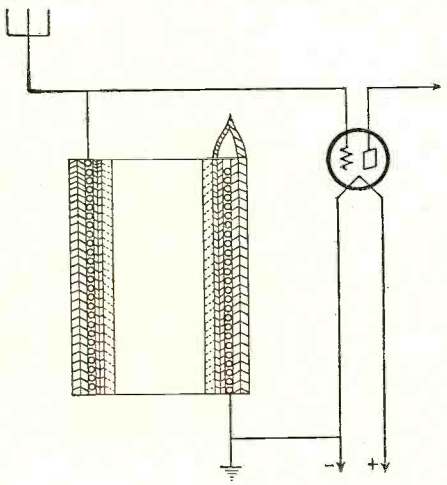
1,893,563. SELECTIVE AMPLIFIER. ALGER S. RIGGS, New York, N. Y., assignor to Willis L. Pratt, New York, N. Y., Frank W. McDonell, Rye, N. Y., and Frederick R. Rich, New York, N. Y. Filed June 8, 1929. Serial No. 369,383. 4 Claims.

1. A selective amplifier of electrical variations consisting of an electron-discharge device, a suitable source of input signal potential, power supply sources for cathode and anode circuits, and an anode output network consisting of a non-inductive resistor shunted by a condenser and an inductance forming a series circuit resonant to the frequency of the input signal potential, said non-inductive resistor having a value approximating that of the tuned circuit resistance at signal frequency.



1,897,082. BROAD BAND FREQUENCY RESPONSIVE MEANS. ERWIN R. STOECKLE, Milwaukee, Wis., assignor to Central Radio Laboratories, Milwaukee, Wis., a Corporation of Wisconsin. Filed Aug. 19, 1929. Serial No. 396,760. 9 Claims.

9. An electrical circuit having inductive means incorporated therein, means connected to a part of the circuit and coacting with the inductive means to supply distributed capacity in electrical relation to and co-extensive with the inductive means whereby the inductive and capacitive reactances are varied with changes in the frequency impressed on the circuit and control the extent of the inductive and distributed capacitive means effective in the circuit to thus automatically maintaining the circuit in resonance with the frequency impressed thereon.

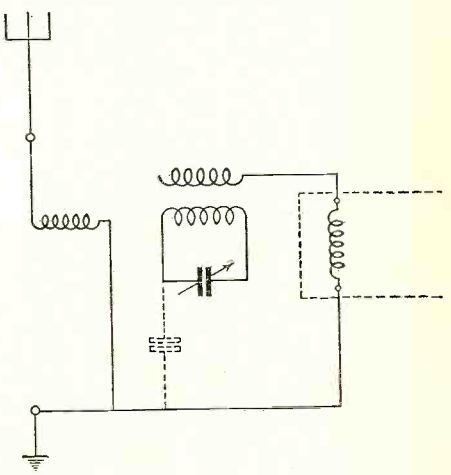


1,893,779. SUPERHETERODYNE RECEIVING SYSTEM. LUCIEN LEVY, Paris, France. Filed Oct. 3, 1927, Serial No. 223,761, and in France Oct. 13, 1926. 5 Claims.

1. In a superheterodyne receiver comprising a receiving circuit and a local oscillations generating circuit, the difference between the proper frequencies of which must always keep the same value, the combination of variable inductances in each of said circuits, means for varying said inductances so that they always remain equal to each other, straight-line frequency condensers in each of said circuits, means for simultaneously moving the rotors of said condensers, and means for varying the angular relation between the stator and the rotor of one of said condensers when varying the common value of the inductances, to always keep a constant difference between the frequencies of the receiving circuit and of the local oscillatons generating circuit.

1,897,633. BAND-PASS FILTER. HENRI FRANCOIS DALPAYRAT, New York, N. Y., assignor to Radio Patents Corporation, New York, N. Y., a Corporation of New York. Filed Nov. 19, 1929. Serial No. 408,304. 2 Claims.

1. In a band-pass filter; an input circuit having an inductance, a tuned circuit having capacity and inductance, the inductance being coupled with said first-mentioned inductance, a third inductance in close inductive relation with the inductance of the tuned

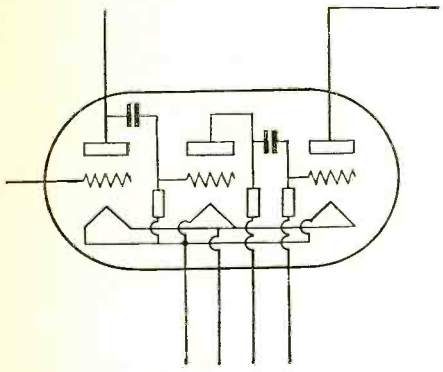


* Patent Attorney, Washington, D. C.

circuit and having distributed capacity therewith, said third coil being open at one terminal thereof and circuit connections to the opposite terminal thereof, said capacity of the tuned circuit being in capacity relation with said circuit connections.

1,895,254. MULTIPLE-UNIT TUBE. SIEGMUND LOEWE, Berlin, Friedenau, Germany, assignor to Radio Corporation of America, a Corporation of Delaware. Filed Apr. 29, 1927, Serial No. 187,680, and in Germany July 19, 1926. 4 Claims.

1. A multiple unit tube enclosing a plurality of capacity-coupled amplification stages,



each stage comprising an anode, a control electrode and a cathode, and an external lead directly connected to the anode of a stage preceding the last.

1,897,373. WAVE ANTENNA. NICHOLAS GERTEN, Douglaston, N. Y., and RALPH LINDSAY JENNER, East Orange, N. J., assignors to Blaw Knox Company, Blawnox, Pa., a Corporation of New Jersey. Filed July 29, 1930. Serial No. 471,466. 16 Claims.

13. A wave antenna comprising a metallic tower, a metallic pole, means at the top of said tower for holding said pole in a vertical position and in electrical contact with said tower, means for supporting said tower at its base and at only one other portion, means for insulating said antenna from ground, and means associated with said holding means for enabling said pole to be moved vertically with respect to said tower, whereby the effective height of said antenna may be adjusted to the height required for maximum radiation of the wave impressed thereon.

Short Waves

(*Continued from page* 203)

working with stations in Peru and Chile, and a station in Rio de Janeiro, a distance of 14,000 miles away.

We were, however, now anxious to attempt direct contact from Manila to Washington, D. C., and for some time had corresponded with Dr. Hoyt Taylor of the Naval Radio Laboratories in Bellvue, and had arranged tests. Tests had already been arranged, also, with the Signal Corps station at Camp Vail (now Fort Monmouth, N. J.). On these tests an Australian amateur was very helpful, since he could hear us both and would tell us just when the called station was answering.

Since the signals from the States fell off at about midnight in the Philippines (on 40 meters), 1HR used to close station at about that time. One night, however, due to insomnia or other reasons, operation continued into the wee small hours, and 2LZ in London, England, was worked without difficulty. We also got reports from Italy, France, Holland and Sweden. This opened up a new world for 1HR, but one which caused a loss of much needed sleep, because this world began for us after midnight.

One evening, after we had worked several "6's," in California, we heard a station call us and sign 6BJX. We had a nice contact, after which he asked us for a regular daily schedule. Little did we realize that, when this schedule was made, it was going to be kept for 26 consecutive months and that he was going to take over 200,000 words of traffic from 1HR, never missing a day, excepting a very few times due to sickness.

Samoa, Canada, Mexico, China, Spain and Norway were now added to our list of contacts, and QSL cards were being received in great numbers.

About this time came the biggest thrill of all, in the operation of 1HR, during my time there. On December 2, 1925, on a scheduled test with NKF (Navy Radio Laboratory at Washington, D. C.), our call was answered, and a message sent them, which was acknowledged for, and answered the next day. This message, the first ever to be sent from the Philippine Islands to Washington, D. C., direct, was as follows:

To NKF, "For the Chief Signal Officer of the Army, Washington, D. C.

Greetings by short-wave radio direct from the 12th Signal Company, Manila, P. I."

One of the most interesting exchanges of messages that I recall was during the winter of 1925, when I received a phone call, asking me if there was any way I could get a message immediately to a sanatarium in Glendale, California. Knowing I could easily contact Los Angeles and that Glendale was a suburb, I accepted the message. Briefly, the case was as follows: A Filipino, residing in Manila, had sent his wife to a sanatarium in Glendale. The lady had previously been under the care of her family physician in Manila, who knew her case well. The Glendale sanatarium wanted to operate immediately and cabled for authority. The family physician in Manila did not recommend the operation and wished to get word quickly to Glendale to this effect. I sent out a call for Los Angeles and was answered by a station I had heard before, and upon questioning, I learned the astonishing fact that the station was operated by a patient in this sanatarium at Glendale. A "private" radio channel was thereby set up, for the two doctors to thrash the thing out. Medical terms, which neither of the operators knew anything about, were flashed back and forth, explaining the symptoms and the past experiences with the case, and before long it was agreed that an operation was not necessary. Such service probably could not have been bought at any price, commercially, and through amateur short-wave radio a needless operation was avoided.

An attempt was made to have the Philippines considered as a division of ARRL, but evidently due to the comparatively small number, it was made a section of the Pacific Division of the ARRL. Traffic reports were sent in monthly, and soon 1HR was one of the consistent leaders of the "Brasspounders League" (those who handled the greatest amount of traffic). At this writing, seven years later, station 1HR still is one of the leaders in traffic, and has a very high average rating, if not the highest, throughout the year. The station is manned by Filipino soldiers, members of the 12th Signal Co. (Philippine Scouts, U. S. Army). Its regular periods of operation are from 4 p.m. to midnight, daily (Philippine time).

1HR is an official relay station of the ARRL, a member of the "WAC" Club (Worked All Continents Club), a member of the I. A. R. U. (International Amateur Radio Union), a member of the Philippine Radio Club and a member of the Army Amateur Radio System. This station has contacted every known country in the world where there are amateur radio stations and continues to be heard in every corner of the earth.

?QRD?

A column devoted to the commercial operator and his activities

Conducted by GY

RADIO has been used for the purpose of racketeering, booze running, etc., for some time, but a new wrinkle has been put in the old-fashioned racket by using it to drown out broadcasting stations who have an assigned frequency. Out on the West Coast a couple of "wagons" have been broadcasting on the legitimate channels of broadcasting stations and it is whispered that they asked the land stations to shell out and they would get off their frequency. There is an investigation going on by the Commission and new laws will have to be put into effect to curb this new type of nuisance. Jack S. says he is surprised that up to the present time no racketeering has begun to broadcast on the short waves, through the police systems and thereby get the cops to another section of the city while they strut their stuff in another part of it.

Not bad. . . . Not bad. . . . Scene One: Casey and the gang playing rummy in the Buzzer room. Door opens with a rush and the announcer pokes his head through. "Somebody wanted who owns a typewriter." "All right, I have one," answers Casey. Scene two: On the high bounding waves two days out of New York. The skipper greets Casey with a hearty "hello". 'Tis marnin', me hearties. "Oh, by the by, Casey, you're the Radio-op who said he had a typewriter. Now what I want you to do is to make up the bills and the other few things I have in the Log Room." "Okay, Skipper, but I haven't got the typewriter here. I left it home. All I was asked is whether I had one and not to bring it along with me." Seen somewhere on the horizon: Casey floating around holding onto his hat.

The American Radio Telegraphists Association is going through a reorganization with a few changes in the executive personnel which every one in on the know is positively sure will greatly improve the efficiency and morale of the Association. Due to the inefficient method of handling the funds, discrepancies have been made which have lowered the bank account, needlessly. These have now been hammered into shape and with the uplifting of the morale great things are expected in the formation of future policies and a united front for better conditions for radio ops. A code has been promulgated for the information and guidance of the National Industrial Board who have requested same so as to make equitable adjustments for the goodwill and morale of Radio Operators in general. If this is acted upon by them, great credit should be given to the ARTA for their persistent efforts to effect this change. We all hope that the future will "shine down" upon those ops who have found bitterness in their hearts toward the existing standards and will receive their just rewards because of a patient and faithful performance of their duties in the face of adverse conditions.

Experiments have been conducted by the Department of Commerce engineers on a new portable and compact radio receiver and transmitter. Sing Sing prison, in N. Y. State, has requested a wavelength so that the guards patrolling the walls and the outside of the prison will be able to keep in constant communication, with the aid of this apparatus. Tests have proven the feasibility of this apparatus and it is believed that within a short time, most of the prisons will become so equipped. They weigh only about 18 lbs. and can easily be strapped to the shoulders. Their band will probably be around the 5 meter wavelength. Soon it will become an easy matter to keep in touch with the home fires by use of this.

Just sittin' back and wonderin' what became of that boy wonder who invented the Tubeless Radio. He startled the radio world when his announcement came through and from all of his reports the tube manufacturing plants were just about ready to shut down and go out of business. But no further reports have come through so far. His claim for the invention was lower initial cost and upkeep, less static and smoother and more vibrant tone. Well, it "might" be done as the tube is nothing more or less than an oscillator, but the prospects of it being able to get into the market with all the fortunes invested in equipment and manufacturing facilities is almost nil.

Well, some more good news comes over the atmospheric waves 'cause, according to Mr. Pannill of the RMCA, more orders are coming in for more radio marine equipment. This is an indication of an upswing of business in American shipping. He also pointed out that a substantial number of vessels are being recommissioned at this time while others are placing contracts for apparatus and radiotelegraph service. Another order from the Pan American Airways is for furnishing Radiotelegraph and a radio direction finder to the S.S. Jelling which has been chartered by the Airways Co. for survey work in connection with the proposed Trans-Atlantic air route. He says in closing, "It is particularly encouraging to learn that five tankers of the Standard Shipping Company which are equipped with RCA apparatus and radio direction finders will shortly be coming out of lay-up. To our radio business, that is as good as a new order. To marine business generally, I think it is further proof that the beginning of better times is difinitely with us." And this column also adds that in the past few weeks more than twenty-four Ops have been assigned duties. Which all goes to prove that the corner has been reached, if not turned; what ho!

The Candler System Company have inaugurated a system whereby a student can receive the actual experience of copying stuff shot through the air by means of a complete time schedule which is sent to the students so that they may listen in if they wish to gain practice. The schedule with time, station and frequency they will send to students who so request them. It is not a bad idea, as there is a difference in getting code over a buzzer and through the atmospherics with lots of QRM interference.

Dick Hoyt, who has more association buttons on his lapel than any other op, sends in an epistle to enquire as to the health and whereabouts of his old crony, NC. He is now up at WSF and is expecting to be quite busy with the Italian Armada. Sez that before this assignment he was nursing a pick and shovel on the highways and byways of Mt. Vernon, N. Y. His ham station is still hamming and he wants to hear from some of the old gang on his W2FFL on the 3.5 MC band. Also wants to hear from some of the old standbys who were with him on the old Rochester in the banana fleet way back when. . . . To LC, DM and CF, please ship a letter to the U. S. Dept. of Commerce and ask for Aeronautics Trade Direc-

tory. This is sent free and will give all the dope which you require. . . . New applications have been mailed out by the airways service and it would be advisable to get hold of one of 'em. . . . Spud Henderson, erstwhile Oriental sideswing artist, lets it be known to all and sundry that he is now basking in the warm sunlight of California, having done his bit in helping to lower the supply of Singapore Gin-slings out in them thar yellow waters, and craves knowledge as to whether a meteorologist is just a confirmed weather liar. . . .

RMCA take notice! It was only about a year ago that the tugboat MARS was tied up alongside the S. S. Susan Moran waiting to get a report from the radio Op on board the Susan. "Yes, sir," sez the skipper of the MARS to Captain McNeily of the Susan, "Try and catch me paying a thousand bucks a year for a few measely words written on a scrap of paper by a radio operator. That radio service ain't worth nothing." Captain McNeily said nothing. A few months later the MARS shoved off with a tow for Jamestown and they are still looking for her. Nothing has been heard from her since then. . . . And the tug was worth about thirty thousand dollars. What is the moral of the story, my little children. . . ?

If the whereabouts of an Op named Milkiewitz, Joseph B., is known, kindly tell him to communicate with his Dad at 230 Cotes Lane, Bay Terrace, Staten Island, N. Y. He was formerly employed with Mackay Radio . . . Boy, oh boy, how the old bloodhounds step out on the trail . . . Now, f'rinstance, trying to find out the dope on the new licenses, but then we're modesty itself, so leaving it to your imagination and continuing to act as the ol' question and answer box, we'll be seein' yuh, with a cheerio . . . 73 . . . GY.

Empty Space

(*Continued from page 222*)

There is still one more thing to be mentioned in the pumps described above, which is that practically only mercury was used. For liberating the vacuum from mercury vapor, it is necessary, in such pumps, to condense the mercury vapor in liquid air traps. An improvement has been made recently by Dr. K. C. D. Hickman of the Research Laboratories of the Eastman Kodak Company, by introducing Butyl phthalate instead of mercury.

Butyl phthalate and certain oils of the apiezoil type have a vapor pressure below 10^{-7} millimeters of mercury at room temperature and thus are able to replace mercury under certain conditions.

Figure 8 is a schematic diagram of an idea for a new design of simplified high-vacuum pump.

According to this theory, the motion of the molecules from the high vacuum toward the fore vacuum is not effected by a stream of vapor (which always necessitates provisions for cooling, condensation and heating), but by inserting into the vacuum a small, pre-exhausted turbine wheel, (W). It would be driven by a rotating electromagnetic field (F) placed on the outside of the glass tube. As half of the turbine is encased in a container, only the upper half, which moves constantly in one direction, is protruding. Its motion would be impressed upon the remaining molecules, thus initiating a stream of gas towards the "fore" vacuum. This would eliminate the necessity of vapor traps in the high vacuum part of the apparatus.

* Irving Langmuir. Phys. Rev., 8—48-51, July, 1916.

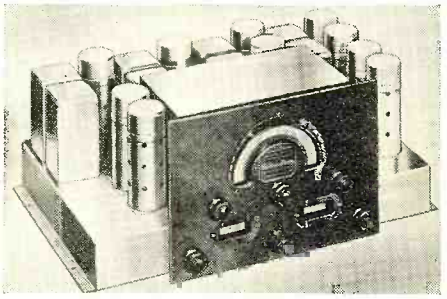
What's New in Radio

A department devoted to the description of the latest developments in radio equipment. Radio servicemen, experimenters, dealers and set builders will find these items of service in conducting their work

By The Technical Staff

New All-Wave "Laboratory-Built" Superheterodyne

Description—The new Hallicrafters all-wave superheterodyne receiver is the latest addition to the ranks of "laboratory-built" receivers. It is designed in two units, the tuner chassis being separate from the power pack, power amplifier and speaker. The receiver features more than the usual number of refinements and includes automatic vol-

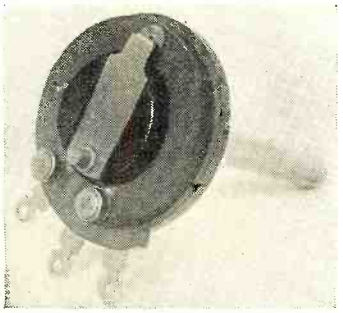


ume control, automatic tone control, the newest tubes, interstation noise suppression and, particularly, a new system of i.f. amplifier coupling which involves four tuned circuits between i.f. tubes instead of the usual one or two. Not only is unusually high i.f. selectivity thus obtained, but a "band-pass" effect is also procured which results in the reduction of side-band cutting to a negligible amount. To simplify tuning a shadowgraph band indicator and colored dial system is employed. Each frequency band is subdivided into channels and each channel is marked with the type of service for which it is allotted.

Maker—Silver-Marshall Mfg. Co., 417 North State St., Chicago, Ill.

A New Line of Controls

Description—This new line of Tilton Ex-Stat controls are made of a moulded carbon resistance element fixed on a bakelite base.

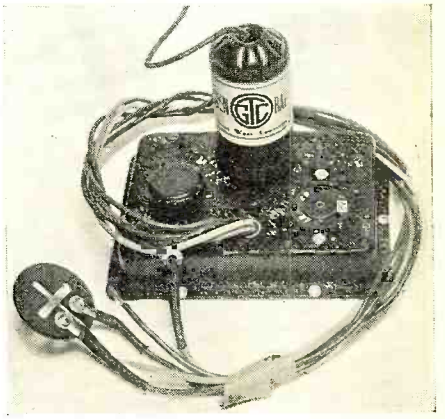


The resistance element, fired at high temperatures, acquires a hard glasslike contact surface, providing a smooth, unbroken resistance variation which means quiet operation. The control is unaffected by humidity and is designed to stand hard usage and to carry considerable current. The mounting bushing and shaft are insulated from the control resistor. These controls can be furnished either with or without integral a.c. switch and are available in uniform or taper resistance in values up to 1 megohm.

Maker—Tilton Mfg. Co. 15 E. 26th St., New York City.

Short-Wave Converter

Description—This new General short-wave converter is to be used in combinatioin with standard a.c.-operated broadcast receivers so the listener may receive amateur signals as well as the interesting aircraft and police reports on their assigned short-wave bands just below the 200-meter broadcast range. It is a simple matter to connect this unit to the receiver. The single blue wire with the round lug slips over the plate prong of the audio amplifier power tube. As an example, this tube may be one of the following types: –12, –71, –45 or the –50. The fibre disc connected to the two red wires slips over the heater prongs of any five-prong tube in the set and the tube is returned to its place. The yellow and black wires connect to the

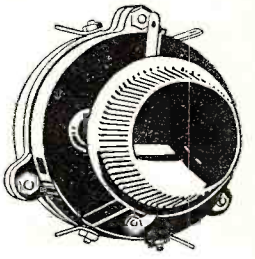


aerial and ground posts, respectively, on the receiver. It is then only necessary to insert a –27 type tube in the converter. The adapter measures 4¾ inches long by 3½ inches wide with an overall height of 3½ inches.

Maker—General Television Co., Box 81, Hamtramck, Mich.

Constant Resistance Attenuators

Description—The new Centralab constant-resistance attenuator is sturdily constructed, measures 3½ inches in diameter by 1¾ inches deep and is available as an L pad, T pad or a constant-impedance fader. These controls are available in the most widely



used values, from 15 to 10,000 ohms. The resistance network is a combination of wire-wound and composition. The wire-wound sections are the portions of the network that carry the most current in service, and where taper is not important. The resistance network is enclosed in a bakelite case, designed for single or three-hole mounting. The same

manufacturer announces 3-inch-diameter gain control plates. These dial plates provide definite attenuation reference points. They are made of heavy brass, silver finished, with etched black lines and numerals.

Maker—Central Radio Labs., 900 E. Keefe Ave., Milwaukee, Wis.

Electro-Dynamic Speaker Unit

Description—The latest Macy type GU-1 electrodynamic horn unit is designed for use with public-address and moving-picture equipment. The sound head and pot magnet

cover are fastened by 6-point suspension, assuring permanent alignment of the diaphragm, in spite of any rough handling it may receive. There is a special corrugation in the diaphragm providing a recess in which the voice coil is firmly held. The unit weighs 19 pounds and is ruggedly constructed to withstand hard usage and all manner of weather conditions. The frequency range of the unit is said to be from 50 to 8000 cycles. It is made to stand a peak load of 30 watts and is conservatively rated at 10 watts for continuous operation. The impedance of the voice coil is 16 ohms. The field winding is designed for operation at 6 volts, which can be supplied by storage battery or a suitable exciter. The unit is available on special order with a 110-volt d.c. field of 1000 ohms.

Maker—Macy Engineering Co., 1451 39th St., Brooklyn, N. Y.

Miniature Featherweight Earphone

Description—The new Trimm miniature earphone, especially designed for hearing-aid equipment, is available in any resistance

from 6 to 2000 ohms. It can also be used with a radio receiving set. This earpiece is held securely in place by means of a moulded hard-rubber adapter designed to fit comfortably into the ear, and is available with a combined volume control switch which is connected into the phone cord. The earphone is extremely small in size, measuring about ⅞ inch in diameter by ½ inch in thickness.

Maker—Trimm Radio Mfg. Co., 1528 Armitage Ave., Chicago, Ill.

Television Advances

(*Continued from page* 215)

in conjunction with a 45-line lens disk, revolving at the rate of fifteen revolutions a second, Sanabria achieved clear, sharp images five feet in height, projected on a translucent screen.

New Yorkers turned out at the rate of 20,000

each day to witness the Macy demonstrations. The transmission equipment was set up in a street window, where it attracted huge sidewalk crowds throughout each day of the demonstration's run. It was necessary to draw curtains across the window to shut out the daylight when the actual transmission of images was going on.

The impulses of the images were conveyed over wires to a "television theatre" erected

SANABRIA'S HUGE SCANNER
The inventor stands on the platform in back of his completely shielded high-speed scanning disk

on the fifth floor of the store. Thirty-two five-minute shows, each day, were presented before capacity crowds in the store. A public-address system was installed so that combination sight-and-sound programs could be conveyed to the "television theatre" from the window studio. Station WOR talent was used for many programs, and Roger Bower, an announcer of the Newark station, served as master of ceremonies for most of the programs.

A dark room behind the television screen contained massive reproducing equipment mounted on a platform level with the screen. The 48-inch-diameter disk, studded with 2⅛-inch lenses, whirled before the carbon-dioxide arc lamp and the image was projected on the screen. The images were remarkably clear over distances of twenty feet and more. The pictures were *black* and *white*. There was a sort of bluish tint over the image, but it did not hamper the clarity of the view. The image seemed very much like a motion picture, but the scanner was limited to only "heads and shoulders."

Sanabria tells the writer that, although his scanner was only of forty-five lines, he used an "electrical retouching" system which gives the same effect as a 40-line scanner. He says that his new lamp is a distinct television improvement because it gives a brighter and steadier picture than earlier television apparatus and has a life of about 300 hours. During his earlier demonstrations, including his ten-foot screen exhibit of two years ago, the lamps would last only about thirty minutes.

The window transmitter was of the familiar scanning type. Each subject faced a frame of eight photoelectric cells, the scanning beam passing through the center of the frame.

Sanabria has already conducted television demonstrations in theatres and department stores from coast to coast, but his New York demonstration at the Macy store was the nearest his demonstrations ever came to commercial television programs, he said.

The department store capitalized on the presence of the large crowds at the television exhibit by displaying various types of sale merchandise over the television hook-up. It gave the visitors an idea of what type of commercial programs they might get when sponsored television periods arrive.

Models were seen on the Macy screen showing shoes, cameras, bathing suits and various other lines. The announcer gave a word description of each product as it was displayed before the electric eye of the television transmitter. When large objects were brought before the scanner, only portions could be shown at a single time on account of the limited picture range of the equipment.

Thus, considerable progress has been made in the laboratory and radio experts believe that the day of television for popular fan use is thus brought nearer. Some thirty experimental television transmitters are now in operation in the United States. About a half dozen operate on regular schedules.

The National Broadcasting Company is continuing experiments, many of them in conjunction with RCA-Victor, from the television station atop the Empire State Building in New York. Merlin H. Aylesworth, president of NBC and Radio-Keith-Orpheum, recently declared that Hollywood would be the base for all R-K-O and NBC television activity. The experiments at the Empire State Building are still of a secret nature and no statement concerning them would be given out by NBC or Radio Corporation of America officials. A demonstration of an R. C. A. television receiver was given privately to R. C. A. licensees several months ago. At that time a program of live talent as well as motion pictures was transmitted from the Empire State Building to the RCA-Victor offices about a mile away. The receiver was said to be built along the lines of Dr. Zworykin's kinescope. No word, up to the time of this writing, has been forthcoming from RCA-Victor as to when the firm will produce television sets for mass consumer use.

The Columbia Broadcasting System closed its New York television transmitter several months ago when it was decided by executives that it did not pay to continue the schedule of combination sight-and-sound

NEW TELEVISION GLOW TUBE
This is the glow tube developed by Taylor and Sanabria and described in the text of the article

programs until better transmitting equipment was available and larger television audiences were assured. The CBS television presentations were conducted on regular daily schedules on an experimental basis. Last year, the staff engineers devised a system whereby sight-and-sound programs were presented on a single wave-band.

Dr. Lee De Forest, inventor of the three-element vacuum tube which revolutionized the radio industry, has established head-

(*Continued on page* 247)

Electric Filters

(*Continued from page 217*)

design chart, then remembering that a half section of the filter will be formed by using twice the value of the condenser in the series arm and twice the value of the coil in the shunt arm.

The series-derived, M type, high-pass filter section is derived from the constant "k" filter section by equating the open-circuit and short-circuit impedances in such a way that the mid-series image impedance for the two structures are alike.* In this way, the mid-series-derived filter section can be joined mid-series to a constant "k" filter without reflection losses in the transmission line. It has the advantages in that a steeper attenuation characteristic can be obtained and undesired frequencies can be suppressed very highly at the frequency where the shunt coil and condenser resonate. The shunt coil and condenser must always resonate below the cut-off frequency so that the shunt arm will be a positive reactance over the transmission band of the filter, otherwise we would not have a high-pass filter.

The mid-shunt derived high-pass filter is formed so that the mid-shunt image impedance is identical to the constant "k" high-pass filter, while the mid-shunt image impedance varies as shown in the design chart. This type of filter has a coil and condenser in parallel in the series arm and must always resonate below the cut-off so that the series arm will be a capacity reactance over the transmission band of the filter. It has the same attenuation characteristic as the mid-series-derived filter.

The design constant "a" for high-pass filters determines the steepness of the attenuation characteristics and is defined by

$$a = \frac{f_c}{f\infty} \qquad (9)$$

Where $f\infty$ is the frequency of infinite attenuation in non-dissipative filters. It is the frequency at which the shunt arm of the series-derived section resonates and at which the series arm of the shunt-derived section resonates. Just how the attenuation varies with different values of "a" is shown in Figure 7. The ordinates give the transfer —loss in nepers so that it is necessary to multiply by 8.68 to obtain the loss in decibels. With this chart it is very easy to determine approximately what loss a high or low-pass filter will give at any frequency, once a tentative cut-off and "a" has been selected. When a final determination of these two constants is arrived at, the values of inductances and capacities are readily computed from the design charts Figures 1 and 6.

*See page 244, "Transmission Networks and Wave Filters," by T. E. Shea. (D. Van Nostrand Co.)

Television Advances

(*Continued from page 246*)

quarters in California, where he is working on television. His object is said to be enlarge the images to theatre screen size.

It is understood that television experiments are continuing in many major radio manufacturers' laboratories. It has been hinted that many television achievements have been shelved until better economic conditions warrant television's mass introduction to the market. In all, considerable television progress has been noted and there is reason to believe that the not-distant future may see a wide exploitation of the art.

Campaign of Progress

(*Continued from page* 218)

cells to do all sorts of semi-scientific tricks. Advertising it as the "Magic Shop." Make the cells turn radios on and off. Add old radio equipment to give a "Radio Museum" effect, showing progress.

g. Put police calls on short-wave foreign broadcasts on a front-door speaker for short periods. Call attention to these unusual programs with appropriate signs and in your newspaper advertising.
h. Run a trade-in campaign, offering some special inducement.
i. Where you can't close sales to good prospects immediately, secure permission to install sets on demonstration during Radio Progress Week. Close the sales during the special broadcasts.
j. Hold an evening reception in your store to show the new models in your line. Invite artists from the local broadcasting stations to be your guests. Send out invitations. Serve light refreshments.

13. Your local committee has been provided with many suggestions for co-operative activities to create local publicity for radio in the interest of all dealers. If no committee has been organized by the radio distributors in your town, call a meeting of the local dealers and form a dealers' committee to organize co-operative publicity. Write to campaign headquarters for a list of local publicity ideas.

Organize Your Canvassing—Special for the Serviceman

14. Plan your canvassing with these two objectives clear—to sell new sets wherever possible, and when you can't, to sell new tubes and recondition the set in use. Write to all customers, telling them about Radio Progress Week, offering to inspect their sets without charge and to provide new tubes or parts at special rates during September and October.
15. Study the Dealer Plan Book and follow its suggestions on the best method of handling the sale when you reach the prospect's house, so that each call will give you a chance for either a new set or recondition sale.
16. Work up a route plan for your salesmen and servicemen, so that they will cover the residence districts in the shortest possible time. Secure a report on each call and follow up no-sale calls on the telephone in the evening, talking to the husband.
17. Give your servicemen a typed sheet listing the things to do in checking a customer's old set for reconditioning, including:
    a. Test and match tubes. Substitute new, modern tubes giving better volume or better tone, or both, for older types, and make necessary circuit changes.
    b. Renovate the existing antenna system—solder connections, inspect insulation, check lightning arrester and move wire to another position if better results seem possible. Inspect and solder the ground. "Pretty up" the wiring inside the house. Or—install new, modern "noiseless antenna" system.
    c. Locate and clear sources of electrical interference in the home.
    d. Install modern accessories such as tone control, automatic volume control, intersection noise suppression, visual tuning.
    e. Clean and "balance" the receiver so that it again performs as it did when it left the factory.
    f. Install extra speakers for remote use, or twin-speaker tone.
    g. Refinish cabinets, remove scratches and nicks and repolish.
    h. Electrify old auto receivers by installing modern B eliminators.

    Make the most of this canvass to recondition sets in preparation for Radio Progress Week. It will bring many opportunities to sell new receivers. It will show many homes the value of a periodic inspection to keep the radio tone quality and control as good as it should be. The serviceman is a vital part of this campaign.
18. Don't quit selling when Radio Progress Week is over. Keep on. Public interest is keen. Many prospects are half sold. In October you can talk about what happened in Radio Progress Week better than you could describe it in September. Keep on cashing in!

Don't hesitate to write or telegraph immediately to the R. M. A. Headquarters of the Radio Industry Campaign to Rebuild Prosperity at 1317 F Street, N. W., Washington, D. C., for more information.

Crystal Super

(*Continued from page* 205)

harmonics of 1971 kc. will do the trick.

At this point it might be well to call attention to the fact that the harmonics of an oscillator have the same order of stability as the fundamental crystal oscillator and are just as useful in a superheterodyne, provided they are strong enough, and in our case we have made them stronger than necessary so we can cut them down to just that potential that will give us best results. Table 1 shows some of the harmonics of a fundamental frequency of 1971 kc.

Of course, with all these harmonics running round loose, it is absolutely essential to have very complete shielding of the entire oscillator and harmonic amplifier, and this should be made up as a unit in one well-shielded box. Now, as we are only going to make use of the fourth and seventh harmonics, we will have to tune the tank circuit of the harmonic amplifier so as to pick out either of these frequencies.

This means that for certain waves we will turn the switch that gives us, say, the 13,797 kc. local oscillation. Also, so that we don't get mixed up, we have two miniature neon tube absorption wave meters, pretuned and coupled to the output of the harmonic amplifier. Each neon tube is marked, and whichever frequency is coming from the local oscillator, its corresponding neon signal will stay lighted.

Table 2 indicates the heterodyning problem when using one or two fixed oscillatory waves and the corresponding requirements of tuning the variable i.r.f. amplifier.

We can tune one harmonic amplifier coil with a big enough condenser so it will cover the range from the fourth harmonic to the seventh harmonic or 7884 kc. or 13,797 kc., or we can make two coils. However, one coil will do, and if we want to, we can tune the amplifier to the second and third harmonics, but here we need a larger coil which you can make up if you want to, but I didn't need it for my requirements.

This is because today there are really no high-class broadcasters on regular schedules outside the range from about 16 meters to 50 meters.

Also, practically speaking, no waves over 35 meters are very useful for rebroadcasting here in the tropics, as the natural static noise level is about the same on 40 or 50 meters here as on the longer waves of the regular broadcast band of 200 to 550 meters in more temperate climates. Also, here in Cuba, where most of my radio work has been done, I have found that the 49-50 meter waves are ordinarily troubled with extreme fading most of the time in the early evening, and up to about 10 p.m. Furthermore, these waves are not useful in daylight at 1200 miles.

The automatic carrier wave level control (commonly called automatic volume control) which regulates the grid biases on the t.r.f. tubes, makes this set deliver a good steady signal to the rebroadcasting station or for pleasure listening purposes. The output of the second detector alone is sufficient to fully excite the input amplifier of the transmitter after passing through two kilometers of lead-covered compensated telephone cable. The audio output stage employing a type -50 tube may be used if desired and will operate a 14-inch dynamic speaker at full power.

Due to the fact that short-wave fading is mostly an interference phenomenon, an a.v.c. circuit alone is not an unmixed blessing, as I have pointed out in previous papers in this magazine. However, the big commercial stations get around this by the use of what they call "diversity receivers." This means about three antennas located at points separated roughly from each other of from 1000 to 3000 feet, each feeding its own receiver. the common a.v.c. circuit automatically picking out the receiver at any instant in which there is a good signal quality. All of this is beyond the means of the individual both as regards cost, space and complication. A near approach to the results may be obtained, however, by my method, to be outlined next month, in the second of this series of articles. The receiver, of course, will operate beautifully on an ordinary antenna on good quality signals, but where it shines is in the results it produces when conditions are not of the best and a diversity effect receiver is desirable. The article next month will also start the description of the receiver.

Backstage

(*Continued from page 229*)

the town bandmaster. He won a scholarship at the Juilliard School of Music and appeared in the musical comedy "Good News" before joining the trio. Donaldson was in vaudeville for eight years. He served as Nora Bayes' accompanist in England and once worked in a Brooklyn café with George Gershwin.

POETRY seems to be gaining more and more favor on the air. Among the more prominent microphone poets is Edgar A. Guest, who has been an established radio feature on the NBC Tuesday Household Musical Memories programs for some time. Eddie Guest was born in England, but was brought to this country when ten years old, and he became a naturalized citizen as soon as he became of age. As a lad, he worked in a Detroit drug store near the office of the Detroit *Free Press*. He became the newspaper's office boy and his first job was to mark the baseball scores on a street bulletin board. He became police reporter, exchange editor and columnist. He has been on the *Free Press* staff ever since, but his poetry, epigrams and anecdotes are widely syndicated to many other cities. He has written several books of verse.

BABY ROSE MARIE, the best-known child radio star, has been signed to star

in a new NBC series for Tastyeast on Monday nights over an extensive hook-up. Baby Rose Marie's songs, stories and impersonations over the air have won her a unique spot in radio. She is also well known to vaudeville and talking picture fans. During her few, but crowded, professional years, the child prodigy has appeared with Vincent Lopez, Rudy Vallee, Leo Reisman and other well-known conductors. Six years ago—at the age of two—Baby Rose Marie won an amateur stage contest. Shortly afterwards she launched her professional career in Atlantic City. She made her first motion picture short when she was four. By the time she was five she was a radio and stage celebrity. She is the daughter of Frank Curley, an actor. When "out of character," Baby Rose Marie is very much like other children. She likes to play with dolls, draw pictures and go to the movies.

TED HUSING, stellar CBS sports announcer, recently launched a new series of Monday night sport talks under the title of "Sportraits." Husing chats informally on affairs of the sports world during which he scans recent events and forecasts those to come. The series is similar to his "Sportslants" programs heard over the network from 1929 to 1932. From time to time, he intends supplementing his own comment by interviewing prominent figures in the world of sport during his broadcast. Husing has

TED HUSING

been with CBS since shortly after the network's inception. He ranks with the best-known sports and "spot news" announcers of the day. In recent seasons, Husing has made a number of motion picture shorts on sport topics.

S.W. Receiver

(*Continued from page 213*)

The special tuning coils have four prongs at the bottom for the connecting leads to the grid and plate circuit and on top of these forms there is a 4-prong socket into which a plug fits to carry over two pair of twisted leads. One twisted pair connects to the aerial posts and the other pair to the antenna tuning condenser C1. The secondary windings of these plug-in short-wave coils are wound with flat silver ribbon wire on a moulded-ribbed bakelite form.

The tuning condensers comprise two sections on a single shaft; one section is of nine plates, C3, and one is of two plates, C2. With the switch SW1, it is possible to connect both condensers in parallel or to have only the smaller section connected. In this arrangement, where only the two-plate condenser is in the circuit, a band-spread effect is obtainable. Isolantite sockets are utilized to advantage in the receiver chassis.

The audio-frequency end of the set employs resistance-coupled amplification with a type –56 tube in the first stage followed by the type –2A5 power tube. For headphone reception the jack J1 is connected in the grid circuit of the second tube.

The Power Supply

The power supply is equipped with the Amperite 5-A-5 voltage-regulator tube, employs the type –80 rectifier and is designed with a two-section filter system, using two 30-henry choke coils and three electrolytic type condensers, each of 8-microfarad capacity. By referring to the illustration, it will be noticed that the filter condensers are mounted between the bleeder resistor and the choke coils. The power transformer, T1, can be seen in the back of the rectifier and the voltage regulator tubes. The dynamic speaker shown in the photograph contains its own power supply, operating off the a.c. line. However, there is no trick in using a standard d.c. speaker having a 1600-ohm field winding and obtaining its operating current from the receiver power pack.

The assembly and construction of both the receiver and the power supply is simple, as is obvious by referring to the illustration and diagrams.

Operation

In operating the set, the regeneration control is to be advanced till a hiss is heard in the phones or the speaker. Then slowly rotate the main tuning dial until you hear a whistle when a station is passed. The regeneration control should now be retarded and the program should come in with clearness and volume. The antenna condenser C1 should be set approximately at the right place before looking for stations with the main tuning condenser. With a little practice the operator can locate the best point.

The following parts comprise a kit for the Don Wallace 4-Tube A.C. Short-Wave Receiver, that is made available to set builders by Try-mo Radio Company, Inc.:

Parts List

C1—43-plate midget condenser, 325 mmfd.
C2, C3—Special "Wallace" band-spread condenser, 75 mmfd., total
C4—34-plate midget condenser, 250 mmfd.
C5—Fixed condenser, .0001 mfd.
C6—.1 mfd. 200-volt tubular condenser
C7, C8—.01 mfd. 200-volt tubular condensers
C9—8 mfd., 250-volt electrolytic condenser
C10, C11, C12—8 mfd., each, electrolytic condensers
Ch1, Ch2—30-henry, 300-ohm chokes
J1—Phone jack
L1, L2, L3, L4—Special "Wallace" short-wave coils
RFC—Radio-frequency choke
R1—5-megohm grid leak
R2, R3, R6—250,000-ohm resistor
R5—50,000-ohm resistor
R4—2500-ohm resistor
R7—500-ohm resistor
R8—20,000-ohm resistor, 50 watts
SW1, SW2—s.p.s.t. toggle switch
T1—Power transformer
2 Isolantite sockets, 6-prong
1 Isolantite socket, 5-prong
1 Isolantite socket, 4-prong
2 wafer sockets, 4-prong
1 wafer socket, 6-prong
VR—Voltage-regulator tube, type 5-A-5
Panel and base for receiver
Base for power pack
1 vernier dial
1 triple binding-post strip
1 double binding-post strip
1 connecting cable with plug

Testing a Super

(*Continued from page 212*)

left there for a little longer and it was two or three days more before we could get it back. What with the easy tuning accomplished, with real single control, and with real band spread on the long horizontal dials and with excellent selectivity, this amateur said "she sure does perform."

Selectivity Test

One interesting point, showing its excellent selectivity, is shown by the log of the 48-meter broadcast band, where it was possible to separate the following stations, individually, without interference within a wavelength band of only one meter: W8XK on 48.8; W2XE on 49; VE9HX, listed as 49 but fractionally above it; YV1BC, 49.1; W3XAL, fractionally above 49.1; VE9GW on 49.2; W9XAA on 49.3 plus; W8XAL on 49.4; W3XAU on 49.5; DJC on 49.8; VE9DR on 49.9. The log also showed no trouble in separating individual stations on the very congested 31-meter band, including W3XAU, CT1AA, XETE, HBL, W1XAZ, DJA, YV3BC, GSB, W2XAF, VK2ME, VK3ME, etc. And while we list the two Australian stations, VK2ME and VK3ME, we might mention that this receiver brought in these two stations every morning they were on the air for a consecutive fourteen-day period, which satisfied us as to the receiver's sensitivity.

The tests were made on a series of four antennas, one a doublet (without a ground) and the others single-wire antennas with interference-eliminating leads-in. In each case we disconnected the ground binding post from the chassis, keeping it in circuit with the primary coil of the antenna tuner only and using a separate ground on the chassis. The antennas used were directional for the various locations from which it was desired to receive. The doublet antenna was directed for Australasia.

The middle knob on the set is the tuning control, and the frequency, unlike most other receivers, increases with dial reading. The toggle switch at the left opens the B circuit, leaving the heaters of the tube still hot. This was originally designed for turning "off" the receiver during transmission periods, by amateur users. We think it is a good plan to turn this switch off when changing coils. The switch on the right-hand side of the panel turns "on and off" the beat-oscillator which is used primarily for reception of c.w. although it is extremely helpful in locating weak broadcast and 'phone stations. When the whistle is tuned in "zero beat," the oscillator may be turned "off" and *there will be the station!* The type of circuit employed on the beat-frequency oscillator admits of practically no drifting.

Calibrating Loudness

Another useful feature is the knurled disk protruding from the panel just below the main knob. It is a volume control, calibrated in steps of approximately 8 decibels each and marked one to nine. Any signal which is just audible with the control full on—that is, set at one—will be R-1 on the audibility scale. A signal which is just audible with the control set at 8 will be R-8, etc. This we have found extremely useful in checking up the day-by-day log of short-wave broadcast stations received, showing their variation in signal strength. A curve can be made on this approximate variation in decibels. It gives a good indication of what bands are best for receiving conditions, day and night. For any further information on this receiver, readers may write to the technical editor, who will see that their questions are answered.

Technical Review

(*Continued from page 237*)

electrolytic condensers for by-pass, filter and replacement use in home and auto radio sets.

46. *Book of Facts on High-Speed Radio and Telegraph Code Sending and Receiving.* A 24-page book which explains the opportunities for pleasure and profit in radio and telegraph operating and the three inexpensive courses available through the Candler system for attaining high speed in sending, receiving and copying code on the "mill." Different courses are suited for different students such as beginners and experienced operators who wish to increase their speed.

47. *A Modern, Low-Cost Portable Public-Address System.* This bulletin describes and gives the specifications and price of a low-cost portable public-address system—the Type U-19—designed and manufactured by the United Sound Engineering Co. The unit employs the latest tubes and a 10-inch dynamic speaker, and is capable of amplifying normal speech and music for crowds up to 1000 people. With auxiliary equipment it can be used for crowds up to 3000 people.

48. *A Low-Cost Superheterodyne Receiver.* This folder describes a midget radio manufactured by the Fordson Radio Mfg. Corp. It is especially suited to fill the needs of the serviceman seeking a well-designed chassis for replacement purposes. The set contains many modern improvements and features not usually available in a set in its low-price class.

49. *Portable and Home Type Receivers.* This folder gives descriptions and prices of a line of receivers and chassis made by the Commonwealth Radio Mfg. Co. The list of receivers ranges from the most inexpensive midget sets to the higher cost console models.

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

53. *Practical Training for Radio Servicemen.* This 32-page book, prepared by the Radio Training Association of America, gives an outline of their course of instruction for radio servicemen—a course that is endorsed and recommended by more than thirty leading radio manufacturers and trade associations.

Some of the greatest authorities predict the next three years will show a greater growth in the radio industry than has the past twelve years, with many opportunities for thousands of ambitious, technically trained servicemen. This book shows how to qualify for a big radio future.

54. *Public-Address Systems, Transmitting and Short-Wave Receivers and Accessories.* This 24-page catalog issued by the Wholesale Radio Service covers the entire requirements of men engaged or interested in these fields for amplifiers, loudspeakers, microphones and other special and standard equipment required for such work.

PLEASE NOTE: To avoid disappointment, please make your selection of booklets from the latest issue of RADIO NEWS, since our supply of booklets not listed in the current issue is exhausted. The list and coupon contained in this (October) issue should not be used after October 31, 1933.

The DX Corner

(*Continued from page 210*)

the United States, that he hears regularly like locals, are W1XAZ and W2XAF. He encloses a card from XETE verifying his reception of that station.

Reception in Los Angeles

Mr. W. Howald, a member of the Short-Wave League, writes us saying that for short-wave information he finds RADIO NEWS the best. He is using a Silver-Marshall 10-tube model and states that he gets all of the United States stations and many stations in Mexico, Japan, Canada and Australia, but up to the present time has not been able to tune in to a European station. He sends us complete information about the new Mexican station, XETE.

An Expert's Report from Missouri

Mr. C. H. Long, the well-known DX worker of Winston, Missouri, sends in this report. He says: "W3XAL is usually very well received from about 10 to 12 a.m. W2XE is very strongly received in the morning. W8XK is very strongly received in the morning on 19.7 meters. GSF has been fairly well received a number of times, on 19.81 meters, around 8 or 9 o'clock a.m. W8XK and W2XE are strongly received in the afternoons on the 25-meter band. VE9JR on 25.6 meters is very strongly received all during the day, whenever it is on. I2RO on 25.4 meters, DJD on 25.5 meters, FYA on 25.6 meters and GSD on 25.5 meters continue to be well received in the afternoons, the best time being around 4 to 5 p.m. J1AA on 30.5 meters is being quite well received again until it signs off. EAQ on 30.4 meters is strongly received around 6 p.m. W3XAU, W1XAZ, W2XAF are very strongly received during the day and with greatly increased strength at night. The new Mexican station, XETE, is very strongly received on 31.2 meters from 6 p.m. on. There are occasional announcements in English. VK2ME and VK3ME are strongly received on their regular morning transmission, the best time usually being after sunrise. GSB

Radio News Technical Information Service

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

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

Preparation of Requests

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

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

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

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

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

OCTOBER, 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.....

NO ONE can yet say how far-reaching will be the effect of radio on modern living and business — *but every one is agreed the industry is still in its infancy . . . that its possibilities are unlimited!*

This is why the wisest counselors are advising young men to acquire the fundamentals of radio . . . to prepare themselves for the opportunities ahead. The future is exceedingly bright.

Thousands are finding exactly what they need in the International Correspondence Schools' Radio Course. So can you! Prepared by experts, and frequently revised by them, this course has the enthusiastic approval of the industry.

There is a consistent demand for radio mechanics, assemblers, testers, inspectors, draftsmen, service men, installers and salesmen; also, for operators and attendants on board ship and at commercial radio stations, government police stations and aviation stations. The field of opportunity is unlimited. Let us send you complete information — absolutely free. Just use the coupon. Mail it today—Radio beckons you.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 8284-M, Scranton, Penna.

Without cost or obligation, please tell me about the NEW RADIO COURSE

*Name*_____ *Age*_____

*Street Address*_____

*City*_____ *State*_____

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Ltd., Montreal, Canada.

on 31.5 meters is strongly and enjoyably received at 6 p.m. On the 49-meter band W8XK, W2XE, W9XF, W9XAA and W3XAU are strongly received in the late afternoon and evening. Of these W8XK is the best. VE9GW is strongly received on Sunday afternoon. Reception of other stations on this band are still being spoiled by static. Many other stations are received, but this list includes only those that are best received."

A Note from Iowa

Mr. William E. Spargrove writes in to say that he thinks the short-wave DX Corner is a real help and guide for listeners in the high-frequency bands. He mentions the new Mexican station XETE and gives us information on its transmissions. He also mentions that station GSF on 19 meters comes in every evening with twice the signal strength of GSB. Mr. Spargrove uses a Hammarlund "Pro" with a good balanced-doublet antenna, with directional characteristics for N.E. and S.W. stations, about 50 feet in the air, with a Lynch transposed lead-in. He promises to send in a complete list of stations for the DX Corner soon.

More Data on Wisconsin Reception

Mr. Frank Rosmussen of Marinette, Wisconsin, sends in the following list of Best Bets for his location: W8XK, W2XE, W3XAL, W3XL, W9XAA, W9XF, W2XAF, W1XAZ, KWU, WSBN, WOO, WLO, WEN, WND, WMA, WNC, WMI, WOF, WAE, HKC,, HKD, HKO, HK2AM, DJA, DJC, DJD, DHC, GSB, GSC, YVQ, YV1BC, YV2BC, TGA, TIR, CT1AA, I2RO, FYA, XETE, EAQ, LSY, PSH, GBW, GBP, CGA, VE9GW, GE9JR, VK2ME, CMCI. He neglected to state what type of receiver he is using.

An Illinois Report

Mr. Robert L. Weber, a member of the International DX'ers Alliance, of West McHenry, Illinois, states that stations coming in best and most consistently in his location are: GSB, EAQ, DJD, I2RO, W8XK, W1XAZ, W3XAL, W1XAL, W2XAD, VE9GW, W2XE, YV1BC and the new Mexican station, XTE. He uses a Midwest 8-tube all-wave receiver.

A Note from Virginia

Mr. D. W. Parsons of Roanoke, Virginia, encloses the following: "The Empire Broadcasting Station at Daventry, England, is now using another section of their transmitter. It is GSG ('G' for 'greetings'), on 16.9 meters or 17,770 kilocycles. I heard them this morning between 7 a.m. and 8 a.m., E.S.T., with excellent volume and quality. They signed off at 8 a.m. 'Big Ben' could have been heard a block away from the speaker, while there was very little fading during the entire program.

"I noticed that the frequency of GSG is listed the same as that of PHI, namely, 17,770 kilocycles, but the carrier of PHI was on about fifteen minutes before GSG signed off and there seems to be a difference of about 5 kilocycles between their frequencies, because I had perfect separation. PHI made his announcement about two minutes after GSG's sign-off, and he is coming in now as I am writing this, with wonderful volume."

More News from Ohio

Mr. W. O. Beck of Toledo, Ohio, a member of the American Radio Relay League, gives the following stations as Best Bets in his location: GSB, VK2ME, VK3ME, EAQ, CEC, X26A, HKN, DJA, DJB, HJ4ABE. He also gives us the correct information on station XETE in Mexico. Mr. Beck uses a National FB7 receiver, with an indoor spring aerial stretched across the room and using no ground.

A New Report from Maine

Mr. R. I. Keeler of West Scarboro, Maine, sends in a new report of Best Short-wave Bets: GSB, EAQ, VE9DR, VE9GW, GSD, GSC, DJD, DJC, HJA, VK3ME. He uses the Chesley Johnson receiver described some time ago in RADIO NEWS.

Short Waves at Richmond Hill

Mr. John Berlucci, who, by the way, is a licensed electrical contractor and makes a hobby of the short waves, sends in a list of Best Bets that he hears, using a two-tube converter on a six-tube broadcast set. They

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are: DJC, DJD, FYA, I2RO, GSG, GSF, GSD, GSC, GSB, GSA, VE9GW, W9XF, W8XK, W3XAU, W2XAD, W2XE, W8XAL, W3XAL, VE9DR.

Another Ohio Report

Mr. C. H. Skatzes, using a Scott receiver, sends in the following list that "came in like locals": XETE, EAQ, GSF, GSB, I2RO, VK3ME, PHI, DJC, FYA as well as most of the United States and Canadian stations:

EAQ on 38.5 Meters?

The operator of the United States amateur transmitter W3AMH sends in the following for our information. He says he logged EAQ on about 38.5 meters between 6 and 7 p.m., E.D.S.T., 6/29/33. Said he got them with consistent and strong loudspeaker reception and asked the question: "Did you know that this station was on this frequency before?" (We have not picked up EAQ on this wavelength and we are wondering if it were possible that this could be an upper oscillator setting on a superheterodyne receiver. We would be interested to learn if other listeners have heard EAQ above their normal apparent setting.)

Stations Heard Best at San Juan Bautista

Mr. Louis Ataix of San Juan Bautista, California, states that the Best Stations Heard in central California are the following: RV15, J1AA, FYA, VK3ME, W3XAL, W8XK, XETE, VE9JR, W1XAZ, W2XAF, in the order named. He uses a Hammarlund Comet "Pro."

Another Confirmation of XETE

Mr. Chas. G. Payne, a member of the International Brotherhood of Electrical Workers of Seattle, Washington, writes as follows: "In the current issue of RADIO NEWS there are inquiries about the new Mexican station. I am pleased to give you the dope on this station, as I have a confirmation from them. It is station XETE, Mexico City, operating daily from 5 to 11 p.m., C.S.T. I received them on 9600 kilocycles —31.25 meters. They are also on at 6130 kilocycles—48.94 meters. R. S. Bravo is the engineer in charge. This station does *not* announce at regular intervals. The company is the Empress De Telefonos Ericsson, S. A., Mexico, D. F. Generally, when they sign off, they announce in English that they will stand by on 40 meters to listen to any c.w. station that wishes to test or comment with them. I am using a Hammarlund Comet 'Pro' of the latest type with air-tuned transformers and 2A3 audio tubes."

Short Waves in Montana

Mr. Edwin E. Ash of Hamilton, Montana, using an Ozarka model 51C five-tube superheterodyne, with a Philco three-tube No. 40 converter, sends in the following Best Bets for his location: GSB, FYA, W3XAL, W2XAF, W1XAZ, VE9JR, WEA, XETE, W8XK, W3XAU.

Relaying Programs to Rio

Mr. C. T. Sheaks of Turtle Creek, Pennsylvania, writes us that he has heard WEA and WEF transmitting broadcast programs to Rio de Janeiro recently on about 32 meters.

Readers Who Helped Log Stations for This Month's Report

We are indebted to the following readers of RADIO NEWS who sent in reports of reception this month: G. Robison, Mt. Vernon, N. Y.; M. Coley, Tuscaloosa, Ala.; J. E. Brooks, Montgomery, Ala.; M. W. Kinkead, Fort Dodge, Ia.; G. Lilley, West Chester, Pa.; C. H. Canning, Los Angeles, Cal.; J. P. Watson, Hazlehurst, Miss.; W. Dixon, Plainfield, N. J.; E. A. Rogland, Herington, Kans.; J. A. Mas, New York City; L. P. Clinton, Canterbury, N. Z.; D. W. Parsons, Roanoke, Va.; H. R. Whitaker, Rockford, Ill.; L. Clarkson, Montreal, Can.; H. S. Ough, Pachuca, HGo, Mexico; F. E. Grover, San Benito, Tex.; R. J. Schulz, Wilmar, Cal.; R. Macgurn, Roanoke, Va.; A. B. Coover, Union City, Ind.; E. Peil, Jr., Hollywood, Cal.; C. H. Armstrong, Atlanta, Ga.; E. L. Bennett, Lander, Wyo.; F. C. Kientz, Fairmount, Ind.; C. Skatzes, Delaware, O.; (Miss) V. Turner, Austin, Tex.; L. L. Shilling, St. Joseph, Mo.; H. A. Matthews, Culgo, Victoria, Australia; M. H. F. Young, Lunenberg, N. S., Can.; A. E. Braley, Iowa City, Ia.; R. Woods, San Springs, Okla.; R. Zorn, Tucson, Ariz.; E. E. Ash, Hamilton, Montana; A. Hoyos, Manizales, Colombia, S. A.; C. G. Payne, Seattle, Wash.; L. Ataix, San Juan Bautista, Calif.; W3AMH, Sharon Hill, Pa.; J. Berlucci, Richmond Hill, N. Y.; C. T. Sheaks, Turtle Creek, Pa.; R. I. Keeler, West Carboro, Me.; W. O. Beck, Toledo, O.; D. W. Parsons, Roanoke, Va.; R. L. Weber, West McHenry, Ill.; F. Rasmussen, Marinette, Wis.; W. E. Spargrove, Des Moines, Ia.; C. H. Long, Winston, Mo.; W. Howald, Los Angeles, Calif.; G. W. Martin, Tooele, Utah; A. Hamilton, Somerville, Mass.; W. Hardell, Rhinelander, Wis.; R. W. Evans, Lima, O.; F. K. Boyd, Guanajuato, Gto, Mexico; J. A. Chambers, Cincinnati, O.; A. D. Jaoquin, Medellin, Colombia, S. A.; Herman Degwit, Caracas, Venezuela; C. W. Jones, Quito, Ecuador, S. A.

The Editors acknowledge with thanks the assistance of public-spirited readers who have thus co-operated to make these columns so successful and helpful. Let us urge our readers, one and all, to continue, in even a larger way, to send in these reports. We would be grateful if every reader who hears even a single station would send it in to us with just the data as to its wavelength, the time which it was heard, etc. Of course, we would

prefer to get more information, including the Best Bets in each listener's locality, as well as definite logs of stations, their wavelengths and times of transmission. Readers will also help by stating what type of receiver they use in logging these stations.

5-Meter Receiver

(*Continued from page* 207)

R3—Resistor, 3 megohms
R4—Electrad type R1-205 potentiometer
R5—Resistor, 200,000 ohms
T—Audio transformer, ratio 1-3 or higher
3 Hammarlund Isolantite sockets, 5 prongs
12-inch length ¼-inch diameter bakelite rod
2 Hammarlund flexible, insulated shaft couplings
1 grid clip
Miscellaneous bakelite pieces for shelves and bushings for mounting C7, C8 and oscillator coils L3-L4
2 type –37 tubes
1 type –38 tube
Aluminum for chassis and panel, $\frac{1}{16}$-inch stock, with 12 ½-inch right-angle brackets for assembling
1 5-wire battery cable
1 vernier dial
1 knob for C7

The Service Bench

(*Continued from page* 235)

con nut. Make the necessary adjustment on the speaker adjustment screw."—A. V. Ditty, Groce Electric Co., Columbus, Ohio.

In some instances speaker rattle may occur even when the cone is perfectly tight at the apex. Sol Leibowitz, of Akron, Ohio, has serviced such cases, and writes:

"I have been confronted several times with Crosley dynacoil speakers (from their model 71-A), the cones of which seem to have a natural resonant frequency at the higher notes, causing a very unpleasant chatter with a slight increase in volume. The set, otherwise working perfectly, is quite satisfactory with another speaker [eliminating the faulty diagnosis of tube overload.—The *Service Editor*]. This test can be made by connecting to the plates of the 45's with the dynacoil still in the circuit.

"The resonance effect can be removed by stiffening the cone with applications of airplane dope or shellac to each side and permitting it to dry *thoroughly*." The Service Editor has found rubber cement to be effective in this treatment, particularly on large cones. Other readers of the *Service Bench* have recommended the use of collodion and "Newskin"—which are practically the same as airplane dope. Lewis S. Maxfield, of Hartford, Conn., reminds us that the serviceman can make an excellent collodion cement by dissolving an old tooth brush (or anything of celluloid or pyroxylin) in amyl acetate. Tooth brushes with transparent handles will make the best collodion. Strain the collodion through a cloth to remove the bristles.

THIS MONTH'S SERVICE SHOP

The unusual features of the S. O. S. Radio Repair Shop of Honolulu, T. H., photographed in this month's heading, are the a.c. to d.c. motor generator, for servicing d.c. sets, and the Tungar rectifier supplying current for spot welding. The bench is conveniently arranged in the form of a semicircle, and voltage outlets, a.c. and d.c., are provided along the facing for every possible receiver requirement. S. O. S. charges $1.50 an hour—the minimum charge—plus the list price of parts.

Thrilling

Fiction

"The Murder of the Art Student"

FACE down lay the body of Luis de Castro . . . on one side, an overturned fire bucket . . . on the other, an army revolver . . . and, leaning over him and screaming, the painting-class model, a robe loosely wrapped about her shapely figure!

This was the scene that greeted the eyes of Lawrence Vanderpool upon his return to the etching class room! This the bombshell that shattered the peaceful atmosphere of the art school!

Read how Lawrence Vanderpool solves the *"Murder of the Art Student"* by following vague clues and slim threads of evidence to a smashing, dramatic, unexpected climax! This absorbing novel appears complete in the October *Complete Detective Novel Magazine!*

"Hell's Hacienda"

HELL'S HACIENDA! Flames flicked ugly tongues between widening cracks and timbers in the ceiling and began crawling swiftly with gluttonous hunger on the underside! A shower of sparks hissed into the room! The *casa* was gutted by fire!

Barricaded behind overturned furniture in the fire-swept living room of their headquarters, the bloodthirsty Mexican *bandidos* pumped lead at the two Americans amid the roar of the flames!

Read *"Hell's Hacienda,"* a thrilling tale of adventure and romance along the Rio Grande. Enjoy a pleasant respite from humdrum, every-day life. Read this full, book-length novel in the October *Wild West Stories and Complete Novel Magazine!*

"The Men Without Shadows"

This story will take you right out of present-day affairs far ahead to the year 1999. A great Intercontinental War is raging . . . nations are again battling for greater trading outlets!

Then, suddenly, fantastic Green Apparitions appear . . . man-like creatures taller than giraffes . . . with the agility of stags and the velocity of wind-driven clouds . . . having large, bulbous heads, projecting searchlight eyes and the general appearance of gossamer vapor!

Read Stanton A. Coblentz's *"Men Without Shadows,"* an unusual thriller of mankind's battle with strange creatures from another planet. This and numerous other stories, including the first installment of a new novel, *"When the Universe Shrank"* by J. Lewis Burtt and *"Into the Hydrosphere"* by Neil Jones, appear in the October *Amazing Stories.* Buy a copy—you'll enjoy these astounding tales!

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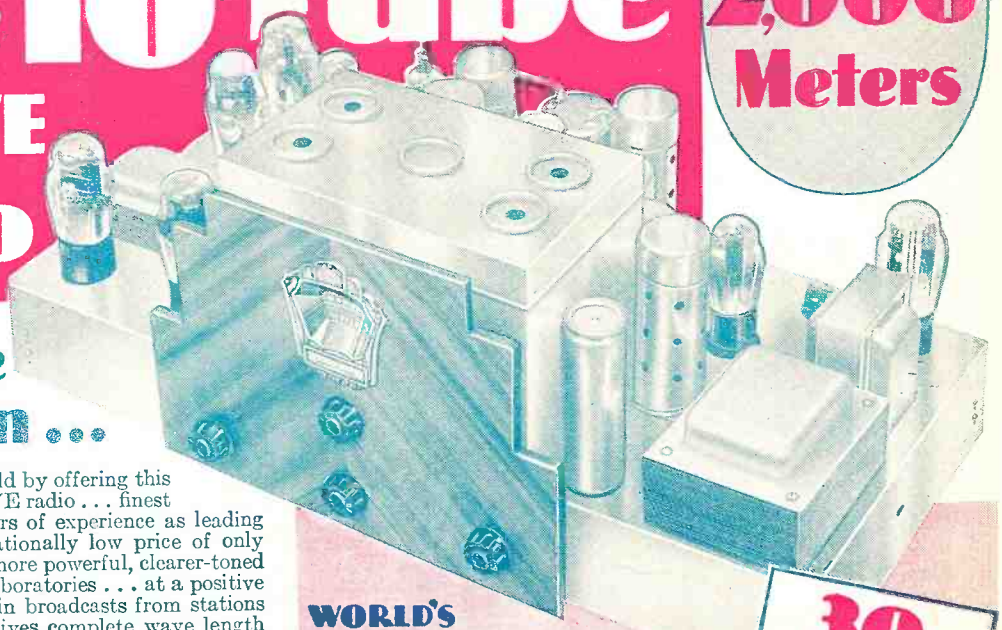

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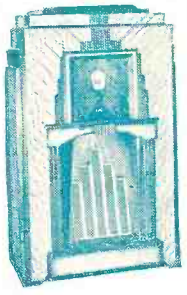

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