The May, 1926

RADIO HOME

20¢

HENRY M. NEELY

In this issue:

THE RECORD BOYS - - - - NEW TUBES

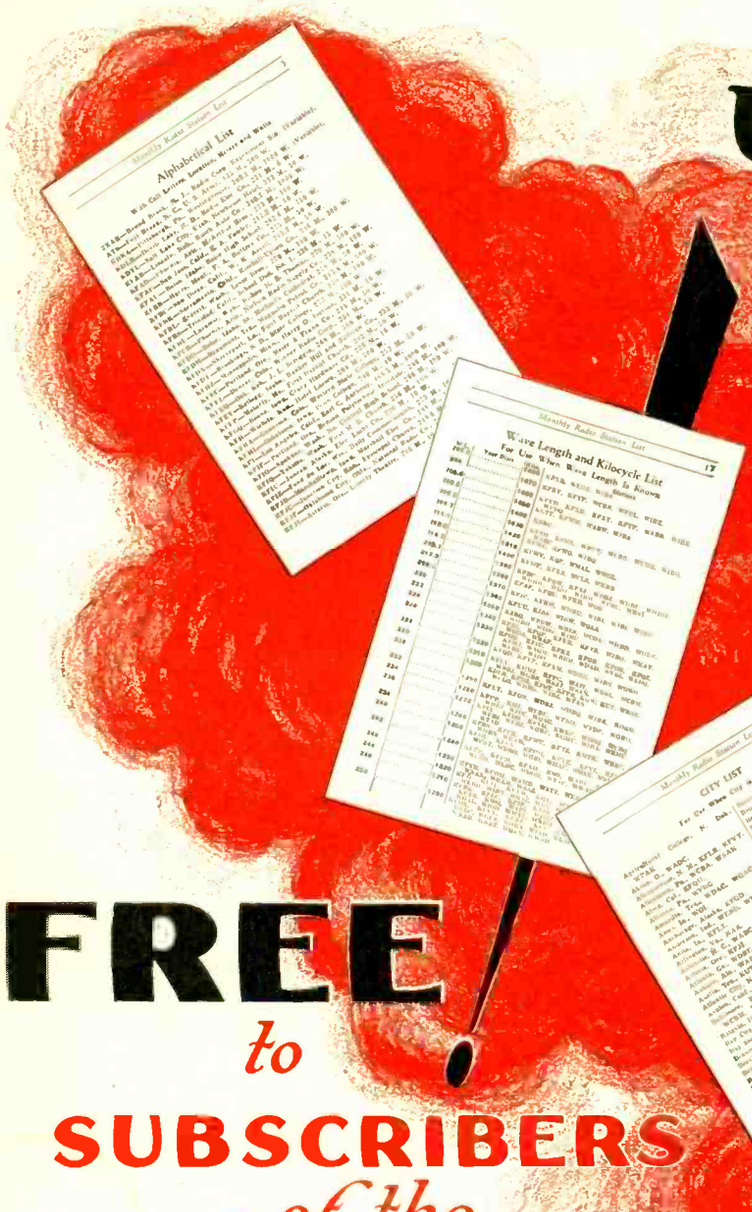
MRS. HANNA'S CANDIES - - THE NEW HAMMARLUND-ROBERTS

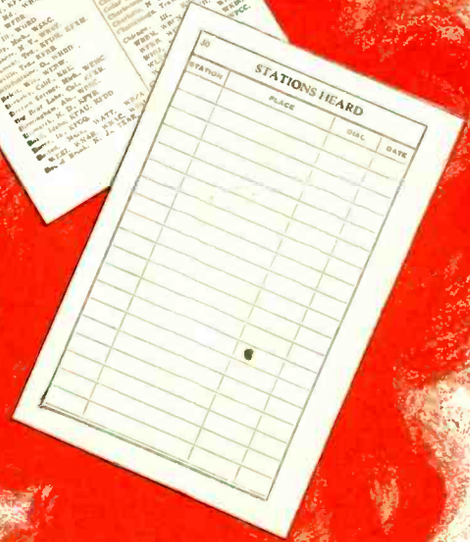
Brought UP-TO-DATE EVERY MONTH

Complete List of Broadcasting Stations, Their Call Letters, Slogans, Wave Lengths, Cities—all Arranged for Rapid and Easy Finding.

THIS is a neat and handy little book, just the right size and shape for the radio set and most convenient for ready reference. It is brought up to date every month and comes to you direct from the presses.

THESE sample pages show some of the different classifications. Just what you want to complete your radio entertainment and keep your monthly logging records filed for future reference.





FREE! *to* SUBSCRIBERS *of the* RADIO HOME

To New Subscribers:—Send us *Two Dollars* for one year's subscription to *The Radio Home* and we will send this monthly Station List for one year free.

To Old Subscribers:—Send us *One Dollar* and we will extend your present subscription three months and send you the monthly Station List for one year.

We do not sell the Station List separately.

The RADIO HOME

Subscription Dept.
PRODUCE EXCHANGE BLDG.

Third and Walnut St.
PHILADELPHIA

LIKE MONEY *in the* BANK

For WOMEN

NEXT month, we will announce the first three prize winners in our Radio Recipe Contest. There's an easy way to make money—for any woman who is a good housewife.

And it's simple. You just get into the habit of listening in on the cooking talks from any broadcasting station. You copy the recipes and try the ones that seem promising. Then, after you've had them on your table and your family has made suggestions as to how to improve the dish, you try the improvement and, if it's good, you send us the original recipe as you copied it, the name of the broadcaster and then tell us of the improvement you made so that all of our readers can get the benefit of your idea.

The prizes? Good ones! First prize, $25.00; second, $15.00; third, $10.00.

Just address "The Radio Recipe Contest" in care of this magazine. You are eligible whether you are a subscriber or not.

THESE PRIZE CONTESTS

For EVERYBODY

OUR COVER PICTURE CONTEST. We want *ideas*. And we'll pay for 'em. We'll give $50.00 for every idea that we can use for a picture for our front cover. We made this offer last month and we'll announce the first winner in the next issue.

We just want the idea. We'll get the artist to do the perfected drawing. Even if we twist and change the idea beyond recognition, we'll pay the money to the man, woman or child whose suggestion started us on the right line of thought.

Address The Cover Picture Contest in care of this magazine.

For the TECHNICAL MAN

MAN-MADE static is causing interference that is one of the most serious problems in radio reception today.

It's beyond the reach of any group of radio engineers and the Government can't do a thing to stop it.

Yet it must be stopped and it can be. Mr. Allen is telling you each month what the problems are and how they can be located and removed. But he needs *your* help and the knowledge that *you* may have gained through similar experiences. Only widespread co-operation will eliminate man-made static.

If you, in your community, have faced this enemy and conquered it, we want you to tell us how you did it so that other readers in other communities may try your methods in attacking their own conditions.

We'll pay $50.00 for every contribution of this kind that we can use. It should not be more than six typewritten pages (2000 words) in length and should contain diagrams clear enough for us to explain to our artists.

Address Mr. G. P. Allen in care of this magazine.

And The Monthly Station List

Look at the opposite page and see what Aladdin's lamp has made the genii produce for him.

Then clip the coupon to the right and send it to us with two dollars.

We'll do the rest.

"The little wrinkle that makes my 'B' batteries last longer is using the right size Eveready with a 'C' battery"

"I USED to think that because the Eveready 'B' Battery No. 772 cost less than either of the larger Heavy Duty Evereadys that I was saving money. As a matter of fact, on four or five tube sets, that was false

Follow these rules, and No. 772, on 1 to 3 tube sets, will last a year or more; Heavy Duties, on sets of 4 or more tubes, eight months or longer.

[illegible]r-round use of a set is [illegible]f you listen longer, your "B" batteries will have a somewhat shorter life. If you listen less, they will last longer.

Our new booklet, "Choosing and Using the Right Radio Batteries," is free for the asking. It also tells about the proper battery equipment for the new power tubes.

[illegible]YT — No. [illegible]6, for 4, 5 more tubes. $5.50

[illegible]GHT — Eveready Dry Cell [illegible]dio "A" Battery, 1½ volts.

[illegible]READY Batteries [illegible]-they last longer

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

Manufactured and guaranteed by

NATIONAL CARBON CO., INC.
New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

Tuesday night means Eveready Hour—8 P. M., Eastern Standard Time, through the following stations:

WEAF–*New York*	WGR–*Buffalo*	WGN–*Chicago*
WJAR–*Providence*	WCAE–*Pittsburgh*	WOC–*Davenport*
WEEI–*Boston*	WSAI–*Cincinnati*	WCCO {*Minneapolis* / *St. Paul*
WTAG–*Worcester*	WTAM–*Cleveland*	KSD–*St. Louis*
WFI–*Philadelphia*	WWJ–*Detroit*	

VOL. IV NO. XII
MAY, 1926.

The Radio HOME

A HOME Magazine for the Radio Family.

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Broadcasting Section

Technical and Hook-Up

THE RADIO HOME (which is a continuation and enlargement of RADIO IN THE HOME)—is published monthly by Consolidated Publishers, Inc. (James S. Gradwell, President; Henry M. Neely, Vice President and General Manager; Harry S. Dale, Treasurer; Leslie G. Biles, Secretary; G. W. Kraft, Assistant Secretary and Treasurer).

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BACK NUMBERS may be secured at 20 cents each while there is an available supply. Copies over one year old cannot be supplied.

CHANGE OF ADDRESS, Renewal or Discontinuance instructions must be sent two weeks in advance of date they are to go into effect, and it is essential that both old and new address be given.

AGENTS—We have an attractive proposition for those who wish to make extra money in their spare time. Every aerial on a house is an open invitation to come in and talk radio and we find most families welcome the agents who show them this new kind of family radio magazine. Address the Subscription Department.

NEXT MONTH

NEXT month we will announce prize winners in our three very popular contests. The picture on our cover in June will be the one evolved from the suggestion of the man who wins the first $50.00 prize.

Mr. Allen's article on Interference will include the experiences of two readers and each of these readers gets a prize of $50.00.

Miss Anderson will have an article giving the up-to-date information about electric refrigerators which has been broadcast from various stations and in this article will include the first three winners of our radio recipe contest—the first one winning $25.00, the second $15.00 and the third $10.00.

Mr. Harris will have another of his interesting talks in his department, "Radio and the Music Student," and Mr. McBride will cover for you the latest news from Washington.

Betty Ann Gray will tell you about George Olsen and his music and there will be a lot of other features of interest to the non-technical listener-in.

IN THE technical section Mr. Patterson is going to begin his promised series of articles telling what we know about static and what is being done to overcome it.

Mr. Nakken will continue his series on "How to Understand Radio" and Mr. Turner will describe the simplest kind of hook-up with the most modern apparatus designed, especially for the man who is building his first set. We are experimenting now with another popular circuit designed to work entirely from your house electric light socket without any batteries and we hope to give you complete instructions next month.

There will also be the department of Questions and Answers and a number of other articles of interest to the technical reader.

Our Advertising Policy

IN OUR issue October, 1923, we introduced an entirely new and revolutionary policy in radio magazine advertising. We have maintained this policy ever since. The 1923 announcement was:

"Radio in the Home is devoted entirely to better class radio—the only kind that is fit to go into the American home. Radio in the Home is not in the market for general radio advertising. We make our own tests of apparatus and our own investigations of the financial and commercial reliability of firms, and we solicit advertising only from those manufacturers whose products we ourselves are willing to guarantee in the light of these researches.

"This is to assure our readers that they can depend on the things they see advertised in our columns. It is a reader service."

We have rigidly adhered to this policy and will continue to do so. Manufacturers who contemplate advertising in this magazine should first send samples of their products to us at Delanco, New Jersey. Here we maintain a completely equipped laboratory, Station 3XP and are prepared to make any tests required under this policy.

Editorially Speaking *and*

Let's Be Fair to Radio

and to the Dealer and the Service Man

By HENRY M. NEELY

NOT long ago we received from one of our readers—let's call him Smith—a complaint about one of our advertisers—let's call the advertiser Brown.

Smith claimed that he had had Brown build for him a very fine radio set with complete equipment and install it, the whole job costing him well over $300. He wrote that he had had very good reception for a short time and then something went wrong and the set had never been right since. He claimed that he had had Brown come to his house at least a dozen times and that Brown insisted on charging $5.00 for service on each of these calls. Smith wound up his letter by declaring that the set itself was defective and he saw no reason why he should pay a service charge under such circumstances.

Now it just happened that I knew Brown very well and had known him for many years. I knew him to be thoroughly reliable and absolutely honest and so I was disposed to doubt the assertions made in Smith's letter.

Investigation proved that these doubts were well founded. Smith's set turned out to be one of the best super-heterodynes that we had ever operated. His trouble was, in the first place, that he insisted on tinkering with the set and, in the second place, that he simply would not learn to keep his batteries on charge in spite of the fact that Brown had rigged up for him one of the simple switching arrangements which we gave in an article in our February issue.

Even when he knew his batteries were fully discharged, he insisted on trying to use his set and the consequence was that he had ruined 150 volts of perfectly good storage B batteries, a fine A battery and two chargers.

When these facts were brought to his attention, his answer was, "Well, I don't want to have to bother about such things. I want a radio set that will play for me when I push a button and stop playing when I push another button. That's all I want to know about it."

Now this case of Smith is not by any means an unusual one. Every dealer and every service man is being driven gray-haired by the Smiths in his community.

Would Smith buy an automobile without learning how to operate it and care for it?

Would Mrs. Smith buy a vacuum cleaner without learning how to clean it and hook up the various attachments?

Would any of the Smiths buy a piano or violin without learning how to play it?

Would Smith buy an oil heater for his house without learning what to do when something went wrong with it?

For some reason or other, the Smiths seem to take the attitude that radio should be perfectly automatic and free from all trouble. They do not expect any such performance from anything else in the world they buy but they do expect it from radio. Why?

I can understand, of course, that Smith regards radio as an extremely intricate technical proposition and that it is unfair for the dealer to expect him to become an expert in order to receive concerts. Almost all of the Smiths have a general knowledge of machinery and so they do not find it so difficult to drive a car or fix a vacuum cleaner or attend to an oil-burning hot-water system. But electricity is a mystery to them and radio is the most mystifying of all forms of electricity. They, therefore, make up their minds in the first place that any knowledge of radio at all can not be obtained without long and close study and they are not disposed to give up this time and effort to get the concerts.

In a way, I can sympathize with this view. Radio is extremely technical. But the standard sets of today are fairly free from defects which require expert knowledge for their adjustment and the only thing that is asked of the listener-in is that he use ordinary intelligence in keeping his batteries charged and, above all, to refrain from tinkering with the wires when the service man has left the house.

We in the radio business are going through today very much the same experience of the automobile salesman in the early days of that industry. The Smiths of that day held much the same view of the automobile that they hold today of the radio set. They did not know the difference between a carburetor and a magneto; grease and oil and gasoline and their proper use puzzled them as much as do the batteries in radio now and the proper adjustment of needle and air valve was much more difficult than the tuning of a radio set.

But the Smiths stuck at it because they wanted to use the automobile and today they have become so expert that they have a fairly good idea of the cause of a noise in their car almost as soon as they hear it.

It will be so in time in radio. The public is becoming educated in the very simple requirements of the care of a radio set and the time will soon come when the service man will not be called in nearly as often as Smith now takes his car to a garage for overhauling.

Furthermore, every reputable manufacturer has a staff of engineers who are working constantly toward the simplification of the set and toward making it so nearly automatic that even the care of batteries will be eliminated.

I do not expect, in the near future, to see radio quite so fool-proof as the phonograph. That is too much to look for.

By its very nature, the radio set must contain pieces of apparatus of the most extreme delicacy because they must be made sensitive to the radio signal received on the aerial and this signal, as received, even from a high-powered broadcasting station, is so weak that we have no instruments that can measure it directly. Any apparatus that is sensitive to so tiny an amount of energy must of necessity be a delicate piece of apparatus and must therefore be treated with great care. Yet the marvel of it is that engineers have made apparatus which is sufficiently sensitive to accomplish this task and yet which survives the treatment given it by the average fan.

I would almost be tempted to give this piece of advice to the Smiths who read this magazine;—never attempt to fix your set. If it won't play, turn it off, send for the service man and pay him for his job. Don't expect him to do it for nothing. You don't do that with your automobile nor with the tuning of your piano nor with your house plumbing system and you shouldn't expect it in radio.

If you cannot learn to take care of batteries, pay the extra money necessary to get one of these combinations which have a good B battery eliminator in them and which, when you turn off your set, automatically take care of the recharging of the A battery.

You may kick about this extra expense but let's be fair about it; if you refuse to learn how to take care of batteries, what right have you to make Brown pay the expense of going to your house two or three times a month to repair the damage that you have done? If you insist on having radio as nearly automatic as it can be made at the present time, you are the one who should pay for it in cash. Other people pay for it by expending the necessary time and energy to learn how to care for their sets. It has got to be paid for either in care or in cash and every radio man will give you the choice between the two.

But you can't have both.

This same principle holds good also to a very large extent with the quality of the musical reproduction which you may expect from a radio receiver.

It is an unfortunate fact that 75 or more

still Editorially Speaking

per cent of the radio receivers in use today give music of a quality so bad that most people would not find an evening spent with them a very pleasurable experience. Bargain hunting has run rampant in the radio industry, due to a very large extent to the extensive advertising campaigns carried on in the newspapers by department stores during the annual "dumping" season. These campaigns have led the public to believe that the very best of radio receivers can be bought at bargain prices. As a settled proposition, you can depend upon it that this is not true. You never see a Rolls-Royce car offered at 50 per cent off nor do you see a Studebaker nor a Cadillac nor any other standard make. You do not see the best of pianos nor phonographs nor vacuum cleaners nor any other standard device offered at less than half of the list price.

Why, then, should you expect a radio receiver to be the only exception to a settled rule of merchandising? Here again, for some unknown reason, the public seems to expect radio to be bought and sold on principles which have long been discarded in the merchandising of any other apparatus.

In actual efficiency and in musical quality of reproduction, you will get just about what you pay for in radio the same as you do in automobiles or anything else.

Buy a set at a bargain price and you will probably get bargain reproduction. Really good sets don't have to be dumped on the market and whenever you see a set being dumped, you should approach the purchase of that set with considerable suspicion and place the burden of proof squarely up to the man who is trying to sell the set. If, through some peculiar shift in business, it actually happens that a first-class set can be offered in limited quantities at bargain prices, you should be sure of your ground and, once sure, then you know that you are indeed getting a bargain and not merely being made a part of the dumping ground for a commercial failure.

It costs a lot of money to make and market the very highest grade of radio merchandise and it is only this grade of merchandise which will give the very highest grade of musical reproduction.

It is a straight ordinary common sense matter of logic. No matter what business you are in, you know that you cannot turn out the best product in your line without using skilled labor, which costs money, without including the very best of parts, which costs still more money, and without maintaining a sales force composed of the highest possible type of men—and such men cost even more money.

Radio is simply another piece of merchandise. The same principles which govern the merchandising of an automobile or furniture or anything else must of necessity govern radio, the principle difference being that in radio the public has not yet become sufficiently educated to know the good product from the bad. The public can, however, very largely protect itself by applying to the purchase of a radio set and to its service afterwards, exactly the same principles which they apply to the purchase of the automobile or the piano or the phonograph or the vacuum cleaner.

You see, this does not mean that you must be an expert to assure yourself of a very fair degree of certainty of satisfaction with your radio set after you get it. You don't have to be an expert in the automobile to assure yourself of satisfaction with the car. You know that there are certain makes of cars which have become standard, you know that there are certain dealers who can be depended upon to back up all of the guarantees with which the car is sold, you know that there are certain charges necessary at the garage when you take your car there for necessary repairs, you know that there is a certain amount of up-keep and a certain amount of care necessary—and that is all you have to know except where to get the money to pay for it.

The radio set is exactly the same. You don't have to know about spark plugs or carburetors or mixing valves or transmission or anything of that kind. You don't have to know what is underneath the hood nor what makes the wheels go round. All you have to know is the ordinary common sense method of doing business and that is the method that you use in buying a car.

Do the same thing for radio. Let's be fair about this radio proposition.

The mere fact that radio appears to you to be a miracle of science need not lead you to believe that it is also a miracle of merchandising. We merchandise miracles these days just about the same as we merchandise bread and butter or shoes or overcoats. It is a plain basis of deciding upon the quality of goods which we want and then making up our minds that, if our standards are high, our price will probably be fairly high with it because we know that it costs money to build high standards into merchandise. Service also costs money. There should, of course, be a certain service guarantee included in the price of every radio installation just as there is one sold with every good automobile. But, if you took your new car out and ran it smack into the side of a house and wrecked both of them, would you expect the dealer to give you another car and rebuild the house for you?

That's about what you're demanding of the radio dealer when you expect him to give you free service in the kind of cases represented by my friend Smith.

Radio sets are today performing wonderfully. As to general satisfaction, the average is quite good enough to be used in the pyorrhea ads. And, to revert to cigarettes, such popularity certainly must be deserved.

GRIDLEAKS

by E. K. BERGEY

YOU—*The* AUDIENCE

What on Earth Do You Want in Broadcasting And How on Earth Are We Going to Find Out?

By G. C. FURNESS

Manager Radio Division
National Carbon Company, Inc.

OF ALL people, the circus managers ought to be the happiest—so it seems to us who are engaged in the business of entertaining via radio.

The public knows just what to expect of circuses and the circus owners have eliminated all guess work concerning the universal public tastes with regard to the side-shows, the menagerie tent and the "big top." The circus-goer knows his circus of today, tomorrow and forever is "bigger and better"—and that's just exactly what he wants it to be.

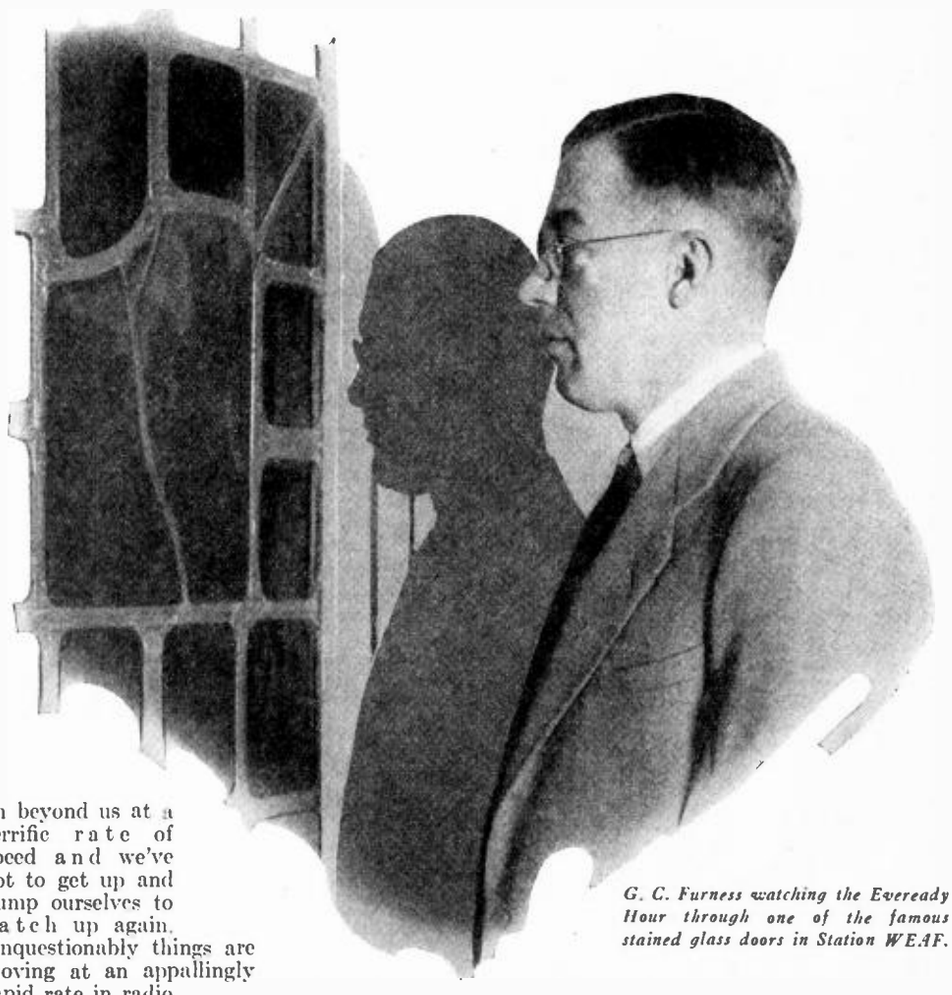
Next in the list of those "other fellows" whose pathways seem to us to be strewn with roses, are the theatrical producers. What could be more blissful than to present a new play tonight and wake up tomorrow with the almost certain assurance of success or failure? Perhaps some of our theatrical friends will get a laugh out of that. But the fact remains that we who are striving to entertain by radio broadcasting would feel that we were in the sweetest of clover if we could hear the applause—or the silence—from our radio audience at the close of each performance. For the present, at least, we wouldn't ask anything sweeter.

The tantalizing feature of the predicament in which the professional radio broadcasters find themselves today is the fact that they have more than a sneaking suspicion that the great radio audiences of the country already have developed certain definite tastes and are exercising these tastes more and more by tuning in those broadcast programs which satisfy them and tuning out those which fail to do so.

In other words, program directors are certain that the radio public is beginning to know a "wow" from a "flop."

No director hopes to produce even a single program that will please every radio listener, but we all are striving to sound out public sentiment and public taste generally with respect to broadcasting programs. The future trend of radio broadcasting is certain to be influenced by what we discover concerning the public attitude toward the programs we have produced in the past and are producing today.

Radio broadcasting is so comparatively new and yet has experienced such a remarkably expanding field that we have just barely begun to get over the first tremendous thrill of the thing. Even now there is the decided feeling that if we tarry too long at trying to analyze what has happened or what is happening, we may find when the analysis is completed that the trend in radio has moved on beyond us at a terrific rate of speed and we've got to get up and hump ourselves to catch up again. Unquestionably things are moving at an appallingly rapid rate in radio.



G. C. Furness watching the Eveready Hour through one of the famous stained glass doors in Station WEAF.

Almost from the beginning of broadcasting, the writer has been interested in radio as a listener. During the past two and a half years the writer has also been associated with the production of the Eveready Hour and within this latter period has tried hard to retain his viewpoint *as a listener,* hoping that it might assist in the guidance of the Eveready Hour along the pleasant paths of popular approval.

Perhaps there is no group of professional radio entertainers in the country which has endeavored more earnestly to provide acceptable entertainment via radio than the group associated with the production of this weekly feature. Perhaps, also, there is no group which has labored more diligently all through its career to diagnose the general state of health of the Eveready Hour, in the eyes of the radio public.

Just two things have been taken for granted from the start. The first is that there is a tremendous demand for radio entertainment. The second is that the radio audience will determine whether we succeed or fail to provide some of this desired entertainment.

Of course, the staff which produces these programs, has its own notions of what is good and what is poor radio entertainment. But every member of this staff tries to bear in mind the fact that those who are really keeping score on the radio programs are the millions of people all over the country who are listening in week after week. We may carefully prepare and carefully present on the air a program that we consider a masterpiece, but what really counts in shaping our future course, is what the listeners, seeking entertainment for themselves, think about it.

Right here it may be well to explain that there is nothing in this policy or viewpoint which is so strictly binding as to leave no room for the proper exercise of whatever creative genius the staff may possess.

In the first place, no person or group of persons is certain enough about the exact tastes of the radio public to formulate a set of hard and fast rules as to what shall and shall not be done in radio broadcast programs. In the second place, almost everyone who has had anything to do with radio broadcasting knows that to some extent the radio public has been and always will be amenable to certain guidance in the development of its tastes. Some educational work always has been and always will be possible.

And so our task must be viewed from several angles. First we must strive to utilize to the limit of its powers whatever showmanship we possess in our staff. Then we must make use of our knowledge of human nature in judging of its acceptability. Finally, we must do our level best, after each program has been presented, to check up and see how close we came to the bull's eye of popular approval.

In other words, our instinctive showmanship and our instinctive knowledge of human nature must prove up fairly consistently if we are to maintain a position worth while in the field of radio entertainers. It is this "proving up" process that is turning us all prematurely gray.

The theaters and allied public entertainers have audiences that are numbered usually in the hundreds and on rare occasions in the thousands.

Each radio audience is numbered in the millions.

Theater audiences are brought together in actual physical gatherings, their hundreds under the same roofs, where there is ample opportunity to provide for them surroundings and settings calculated to produce unanimity of thought and impression.

Each radio audience is scattered over hundreds of thousands of square miles, some of its members in sumptuous homes, some in very modest establishments, none of them visible to the radio entertainers and none of them able actually to see the entertainers or the settings for the entertainment that is coming over the air.

Finally, the theater management can watch the specific and the general effects of its entertainment upon its audiences; can judge by applause or lack of it the measure of acceptability of the performance.

The radio entertainers perform to an audience that is hidden and, for the time at least, mute.

How do we set about the business of finding out what the radio audiences think of our productions and what are some of the most important things we have discovered in this way; things that are having a direct bearing upon the development of this new art of radio entertaining?

Speaking for the Eveready Hour, the answer to the first question is:

We deliberately seek our criticisms and suggestions from every possible source and we weigh these as carefully and as nearly free from prejudices as it is humanly possible for us to do.

The methods of securing these criticisms and suggestions may interest the reader.

The Eveready Hour rarely, if ever, has asked over the air for comments or criticisms of its programs. The directing staff, from the very beginning of its efforts, has held to the belief that the great majority of radio listeners do not want to be asked to write letters of comment. We have had a theory that our refraining from asking for what is known as radio "applause," would actually have the effect of bringing to us the best possible types of criticisms—the unbiased, constructive, *spontaneous* criticisms, which we want equally as much as we want applause.

Thus far the policy has borne fruit. We haven't discovered all there is to know about the desires and the tastes of our audience, but the suggestions and criticisms which have come to us have been definite, constructive, helpful.

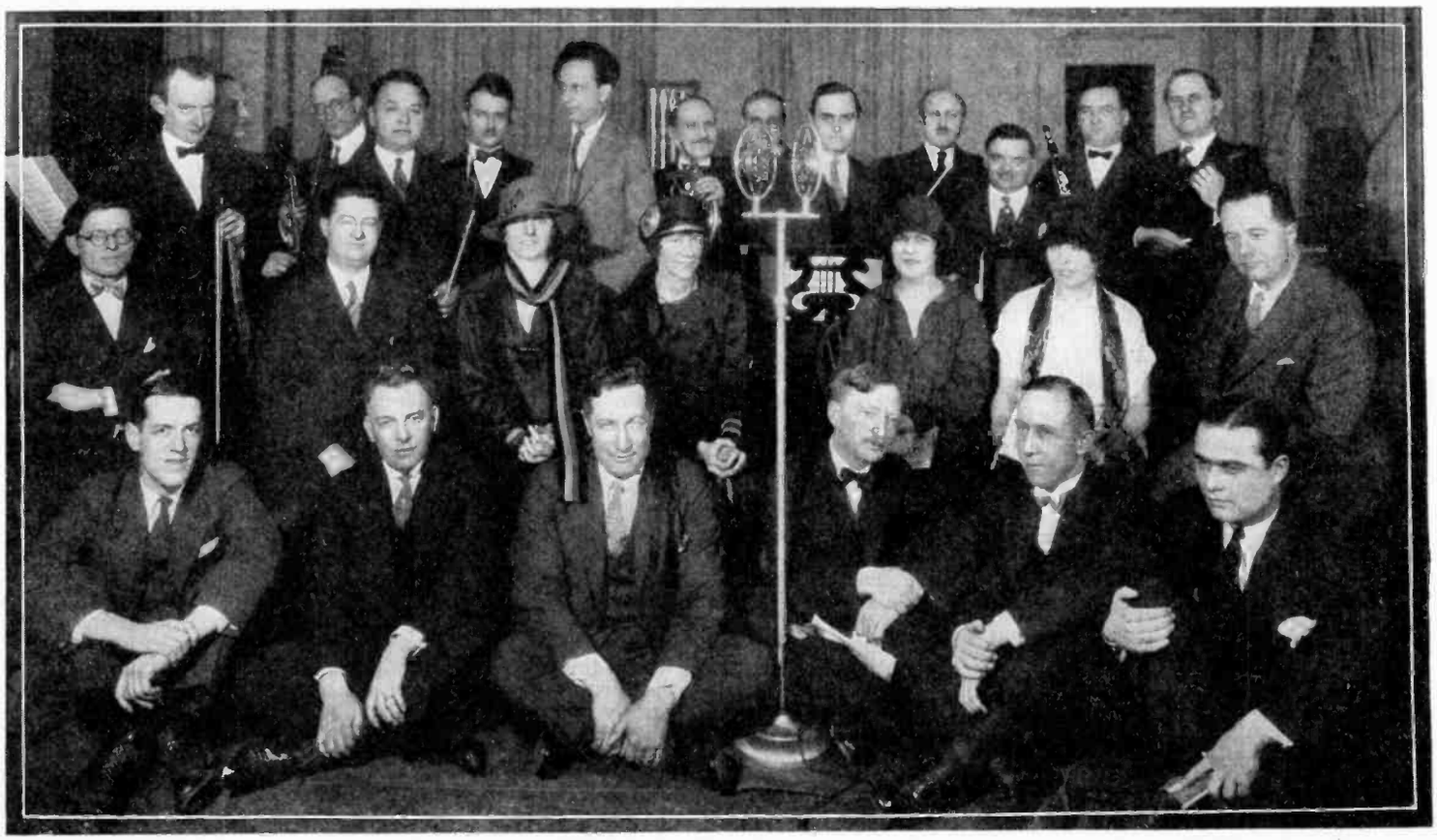
Another method that we have followed has resulted in hundreds of criticisms offered at a little closer quarters.

First, we have carefully gathered from week to week the comments of all of us who are engaged in the production of the Eveready Hour. These comments have concerned every phase of the work and it has been surprising how varying have been our individual opinions of the productions which our staff has created.

Second, we ask regularly for the views of our employes who are scattered over various sections of the country and who, in themselves, comprise a good average slice of what we call the radio public. We have nearly two hundred volunteer Eveready Hour critics among our employes and their families who report their views on each week's performance on a printed form specially prepared for this purpose.

In addition, we have sought from time to time to obtain constructive criticisms from other similar groups which have been available to us.

In other words, we have sought expressions of opinion from people who are close enough



The Eveready Entertainers—From left to right, first row—Tom Grizelle, pianist; Charles Harrison, tenor; Wilfred Glenn, bass; Paul V. Stacey, program director; Harry Gilbert, musical director; Douglas Coulter, asst. program director.

Second row, left to right—Max Jacobs, orchestra leader; Wesley Howard, tenor; Betsy Ayres, soprano; Rose Bryant, contralto; Irene Reddick, mezzo-soprano; Olive Stacey, soprano (wife of Paul Stacey); Jackson Kinsley, baritone.

to us to tell us not only what they think of our work, but why they think this or that. We have been able to some extent to talk with these people personally, to go back of the mere face value of their statements, to reason with them and let them reason with us and thus get as close as possible to their studied convictions on the subject of radio broadcasting in general and the Eveready Hour in particular.

The printed form on which our volunteer critics make their comments on the Eveready Hour, is the result of much careful planning to bring out helpful criticisms. It begins with the request that the critic express his "enjoyment of the program in the following terms: excellent, good, fair, not good."

That brings from the critic at the outset his general impression of the program as a whole.

Next, the form asks for specific comments, providing blank spaces in which the critic may say whether he thinks the "technique of the program was good, bad or indifferent," whether he likes that *kind* of program, how often he thinks we should present a program of that kind and whether he has any comments on "either the musical selections or the spoken word, or otherwise."

Then the form asks: "What comments have you heard others make regarding this program?"

The entire questionnaire is designed with a view to bringing out the best judgment and the sincerest reactions of the critic. He has an opportunity first to give his general impression, next to analyze that impression and finally to compare his own views with those of others whom he has heard comment on the program.

It may be interesting here to show briefly what a wide variety of tastes there are among these volunteer critics.

On March 23, of this year, we presented what we called a "Sob Ballad" program. It was just that—a program devoted largely to heart-throb songs of past and present.

One of our volunteer critics, whom we know to be a lady of refinement and good taste in most things, said she thought the entire program was excellent and she would like to hear that sort of program four times each year. Another critic, who is a writer, said it was a "hick town" program for "hick town" people.

On March 30 of this year we presented a straight orchestral number of rather high class, though not classical, music. One critic, a lady, was so enthusiastic about it she wanted us to present a program of that sort once each month. Another, a man, condemned the entire program from start to finish and said that others he had heard comment on it also thought it was "very poor."

These criticisms we have quoted from represent, of course, the extremes. Between, there was a wide range of opinions on both programs. These volunteer critics of the Eveready Hour do tell us what they sincerely think about our work, we believe, and the critics themselves are fairly representative of the radio audience as a whole.

Recently we presented a program which was in itself a request—though an indirect one—for definite public comment on radio broadcasting. It was called the "Listening In" program and was of the "continuity" type, a distinguishing feature of the Eveready Hour. The program told a story of a typical evening at home in a typical American family, describing with dialogue and music the great variety of tastes in radio programs, ranging from the taste of the ten-year-old son and the flapper daughter to the typical business-man-master-of-the-house and his aged parents, the grandmother and grandfather of the household.

The end of the program found Grandmother and Grandfather talking quietly between themselves at the end of an evening

An Eveready Hour in the making. Left to right—Paul F. Stacey, program director; Wilfred Glenn, bass soloist and radio character actor; G. C. Furness, manager of the radio division of the National Carbon Co., Inc.

in which no single number which came over the air had pleased everyone in the household.

"Well," said Grandfather, with a chuckle, "the only way anybody in this house can hear the program they want is ter have individual radio sets—one for every member of the family. Then, mebbe, we could shet ourselves up in our own little rooms and take our pussonal pick right out o' the air—all by ourself. As 'tis, you see, everybody demandin' this, that and t'other kind of radio fare—well—too many tastes spoil the ether."

That program was designed to inspire in its hearers a desire to write to us and tell us what they liked and what they did not like in radio programs; to induce them to criticize Eveready Hour programs of the past and to make suggestions for programs of the future. We were delighted with the response it brought, for among the multitude of letters which came in spontaneously was a vast amount of material which we believe will give us considerably more definite knowledge of the tastes of the radio audience than we have ever before been able to assemble. A careful analysis of those comments, taken with all the other criticisms and suggestions we had previously gathered from many and varied sources, will perhaps be the most complete analysis ever made of the impressions of the vast radio audience.

There are some outstanding things which we have discovered already through our first efforts at this analysis. One of these is that a great many of the Eveready Hour listeners decidedly *do not want jazz* in any considerable quantities in Eveready Hour programs. Not only were there comparatively few requests for jazz, but there were convincingly numerous petitions that we refrain from injecting jazz into our programs.

Just how truly these letters reflect the sentiment of a majority of the radio audience of the country, is of course impossible to say. Careful reading of these particular letters, however, leaves a decided impression that the public does not want jazz on the Eveready Hour. The reasons given are two-fold; either they do not like jazz or if they like it they say it can be obtained in super-abundance from other sources.

Another outstanding impression that we gain from careful study of all these voluntary opinions, is that the vogue for the story-telling type of program—what we know as the "continuity" type of program—is highly popular. Because many requests were made for repetitions of the "Galapagos," "Evangeline," "Golden Wedding" and other programs which are considered somewhat typical of the Eveready Hour, and because of many suggestions that we treat other subjects in the same general manner, we gather that radio broadcasting of the future will experience even greater demand for the sort of program which tells a story of romance, adventure and action.

It may be well to explain here that there are two general types of continuity programs. One tells a continuous story in dialogue, with an occasional background of interpretative music. The other is primarily musical in structure, the music being really in the foreground with the spoken word used to link the separate musical numbers into a continuous whole.

Beyond any question of doubt the criticisms among our listeners show a constant demand for old ballads that bring back fond memories of days long past. It is entirely possible that reminiscence of a sort that has a musical background, may be one of the pet addictions of the radio audience, if we judge from this analysis of the Eveready Hour audiences.

But sounding out clear and bell-like above all the shouting and the tumult is another note which we believe is most important of all, because it is so typically American. It is an insistent demand for *something new*,

This is the crew who "suffered" on Galapagos with Red Christiansen. Red is the fourth from the left. The rest are of the Eveready group.

something different—something that will give the surprise from which Americans, of all people, get a real kick.

Seldom is this desire expressed directly. Frequently, though, it is the dominant note in a letter from a listener who would like to hear this or that idea tried out over the air. He doesn't say that the surprise element is the thing which actuates his suggestion, but it is impossible to mistake the yearning for a new, a different sort of thrill.

Very frequently this same yearning is exhibited simply through a request that we continue our present program policy. The thing often said of the Eveready Hour is that it is different. It is known among its regular listeners as a sort of searching, pioneering aggregation of radio entertainers.

Then there are symptoms of a love for the classics in music among these critics of the Eveready Hour. There are many requests for grand opera, some for light opera. Just what proportion of this particular audience wants this type of program, and how much of it, is rather difficult to say. But there seems to be a rather firm demand for the "high brow" stuff.

Of course it will take weeks, perhaps months, to analyze thoroughly and weigh carefully all the material of value in this collection of criticisms and suggestions. When it has been done we may find in the finished analysis some information which we do not now suspect and we may find that some of our former convictions may have to suffer decided readjustment.

Sometimes it seems that the most sensible thing radio producers can do is to continue such analyses of radio public opinion as these, study them thoroughly and constantly, decide that the popular demand is for fifty per cent of this sort of thing, twenty per cent of that, ten per cent of that, and so on through the list—and then proceed to build programs that will yield just those proportions of what there is to offer in the field of entertainment.

Sometimes it seems that it might be more sensible still to hew to certain distinctive lines, build up a distinctive audience that will appreciate this particular type of program, and let the future take care of itself.

Certain it is that we producers of radio entertainment never will know all there is to know about what the public wants. But we share the golfer's suspicion that after the first hundred years things will be—oh, so much simpler!

AN EVEREADY PROGRAM COSTS YOU ONLY 6½c

Did you ever stop to figure how astonishingly cheap radio entertainment is—even including the original cost of the outfit?

See the article on Page 52.

The famous Eveready male quartette.

Oo-La-Lay-Ee-Who-o-o!!

Here We Are— The RECORD BOYS from WJZ

Al has just whispered in Frank's ear, "What you doin', you ole round head?" Sammy at the piano.

PHOTOS BY THOMAS COKE KNIGHT

AL BERNARD FRANK KAMPLAIN and SAMMY STEPT

By ELIZABETH A. ANDERSON

These Three Entertainers, and Their Side-Kick, Norman Brokenshire, Have Made Thousands of Serious Listeners Enjoy Many Hours of Plain Durn-Foolishness on the Air.

WHEN the Record Boys, Al Bernard, Frank Kamplain, and Sammy Stept go on the air from WJZ, they are certain to play to a "full house." It is fortunate that the capacity of the ether orchestra, orchestra circles, boxes, balconies and galleries is unlimited. Otherwise, I am afraid there would be many disappointed folks turned away from every performance.

The Boys themselves say that unquestionably their enthusiastic reception by radio listeners has done much to boost the box office receipts when they do appear on the stage nowadays. The house is usually sold out long before the evening of their appearance. Here is a tale that one manager tells with great gusto.

"A dapper young darky stepped up to the window Thursday afternoon and drawled out,

"'One seat in de gallery foh de Record Boys foh Saturday night.'

"'Sorry; all sold out.'

"'Yes sir—Ah knows dat—Ah means foh next yeah,' said the smiling darky."

There is no doubt in my mind that the air is "sold" for them a year ahead or for as long as they want to go on, for they are good and they have had an increasingly appreciative audience ever since October when they first started to broadcast from WJZ.

I can speak first hand for one family circle that is hypercritical and as the men of the family say "hard boiled" when it comes to radio programs. Strange to say we are unanimous in our choice of WJZ during the Record Boys' half hour. One is much more apt to hear, "Can't you cut out that chatter? Norman Brokenshire has just thrown a good lead to Al Bernard and he's going to crack a good one," than the all too familiar, "Can that chestnut and tune in something good."

Analyze your reactions to their programs and you will probably come to somewhat the same conclusion that I did. Their humor is always so spontaneous and uniformly clean; their songs are always good; *they seem to have such a good time themselves.* You have hit the nail on the head with this last conclusion. I wish you could see them at work; it is all one good lark to them.

I thought as much and so one bright spring

morning, I stepped in the WJZ studio in New York to see if Mr. Glover, the publicity man of the station, thought I might be able to get some good photographs of the Record Boys and sit in the studio through their performance that evening. He looked a little dubious when I mentioned photographs because he said that he had been trying for months to get some special pictures for his own use.

Just then a tall good-looking chap with his arms literally full of letters came through the room and Mr. Glover said, "Here's Al Bernard now. Let's see what he has to say on the subject."

When the preliminaries of introductions were over—for I met all three of them then—Frank Kamplain and Sammy Stept had come in, too, to help carry the mail—I persuaded them to let me get some photographs that evening before they went on the air.

That was certainly my lucky day, for we went into one of the studios and I sat chatting with the Boys as they went through some of their letters and it wasn't long before we were on the best of terms. It seemed to me as if we were old friends chatting, and they told me bits of their experiences.

"Here's another fellow that says he has a bet up we are colored"—came from Frank Kamplain as he opened an important-looking missive. My inquiring look brought the explanation that there seems to be quite a number of fans who share this feeling and that the same query had also often come from people who bought their records. Haven't you noticed that they have that liquid quality of voice that is so seldom heard except from the Negroes and that is such an asset to them?

The explanation is simple—Al is from New Orleans, Frank's from Birmingham, and like Octavus Roy Cohen they come by the lingo naturally. They have worked together for years in vaudeville, as well as on the air, and in recording for most of the phonograph companies.

Sammy Stept, who as you doubtless know, is the one who plays the piano, does not come from the South like the others, but from Pittsburgh. That, however, is apparently not a real handicap for he certainly is some syncopating kid. Al Bernard and Sammy compose the songs, you know, and Frank sings them.

"Harmonica Jim," "Oolong Is in Wrong in Hongkong," "Hokem, Smokem Yodelin' Indian Man," and their first ballad, "A Long Way Down (to That Little Old Town)" are among their hits familiar to most of us who listen to the Record Boys. Al and Sammy work together on the melodies and on the lyrics. Usually each has his finger in both pies.

I could not help wondering as we talked what effect the presentation of a song over the air had upon its sale in sheet music form.

"Sales sometimes increase 100 per cent after we give a favorite number in one of our radio programs," they told me and added: "It also affects the sale of records very materially."

Later investigation of music and record departments of a number of big stores confirmed this statement.

"My Puppy, Bud" has been a consistent favorite. Many admirers request this song; I think that they must realize that Bud is very close to the hearts of the Record Boys.

The snapshot of Al Bernard with Bud was taken when they were in camp during the summer, near New Orleans. I felt as if I knew Bud, too, after I had heard the song and as if Bud might be talking to me as I listened to their tales about his accomplishments.

"I guess we'll have to sing, 'Well, I Swan, I Must Be Getting On' again soon," one of the boys said as he handed me a letter.

"Al, what's the matter with your song about the Farmer and Napoleon? I have been waiting three or four weeks to hear you repeat," wrote one of his admirers.

"Would you believe it?" Al said to me, "That old song, as far as music and record sales are concerned, was as dead as a door nail until the first night we sang it. Soon requests for it were made in music stores all over the country."

"Come back Marguerite" is another old-timer that has been reborn through the Record Boys' programs.

There has been quite a bit of discussion here at Station 3XP as to

MY PUPPY'S NAME IS BUD

Words and Music by
Al Bernard & Sammy Stept.

Published by Harold Dixon, Inc.
1595 Broadway, New York, N. Y.

(1)

You 'member how I used to sing
About my little poodle,
But now I've got a Boston Bull
And, folks, he's got some noodle!
I bought him from a man named Pete
Down in Indiana
And the bestest thing my doggie does
Is play a grand piano.
He surely is a handsome hound,
And don't think that I'm crazy
'Cause he's a dog that loves to work—
At no times is he lazy.
He's the first one up in our house
And wakes us with his barking,
And he'll say to me,
"If you don't get up,
I'm gonna start a-squaking."

Al and his "Puppy Bud" down at camp near New Orleans.

CHORUS

My puppy's name is Bud; I'll say his name is Bud,
He's black and white with great, big feet,
But when he's dressed he's hard to beat.
All dogs in the neighborhood
Just step aside, 'cause he looks so good.
They lay down in the mud when they see my puppy Bud.

(2)

He fell in love with a funny cat
That lives down in our alley,
The cat is known as Tom Around,
But Buddy calls him Sally.
The cat goes out while Bud stays in,
That makes it vise-a-versa;
While Bud gets fat the cat gets thin,
Tell me what could be worser.
So Buddy said to Sal one day
"I'm getting sore and sorer,"
But Tommy said, "Now listen, Bud
"I've got a sweet Angora."
So Buddy said, "If that's the case
It's all O.K. with me,
But when I catch the both of you,
I'll chase you up a tree."

which of their songs is the funniest. "Hello! Hello! Are You There?" has several votes. "The Pipe-Fitters Ball," "Railroad Take Me Back," and "It Don't Do Nothing But Rain" have their champions, too, but after seeing the Record Boys in action, I believe my choice is the "Dice Song." There is something inexpressibly funny about the way Al rolls it out.

"Some people calls dice galloping dominoes, and other folks calls dem African Golf; dey's lots of folks calls dem speckled beauties, but I calls dem lumps of ruination." As I sat there in the studio, watching his actions, and heard that soft African intonation, the illusion was complete. I could well understand why many in the radio audience wonder if the Record Boys aren't Negroes after all.

It is funny to see Frank and Al singing one of their duets before the same "mike," Al bends over when his turn comes and Frank goes up on tiptoe. The former is so tall and the latter so much shorter.

They have such a good time of it too as they broadcast. It's a pity that the audience cannot see them for they apparently enjoy every moment of the time that they are in the studio.

The night that I was there a man from Atlantic City, New Jersey, who said that he always made it a point to hear the weekly program, seemed to be enthralled too. He told me as we left the studio, that his wife had asked him before he left in the morning, what show he was going to take in that night and he had said he thought he would go down to WJZ and see if they would let him watch the Record Boys.

"You can bet it was worth coming here to see. Why, it's the best show I've seen this winter," was his sincere praise.

There is one thing that is evident the instant they begin to broadcast—an entire freedom from any nervousness or constraint. The program moves so smoothly and with such informality that you feel as if they must be making it all up as they go along. The very spontaneity of their patter has much to do with their popularity.

I knew it could not be quite so easy as it seemed and so I asked Al if they ever rehearsed for their radio programs.

All set for "When Spring Comes Peeping Through," as Norman Brokenshire begins "How do you do—and now folks—" Frank Kamplain (to the left), Al Bernard (next) and Sammy Stept at the piano.

"Sure, but not so much as for some of our other work."

"But we do read all of our letters faithfully," he said, indicating the immense pile. "We came in this morning to get the mail before we finished making up our program for tonight. Hey! Sammy, don't forget 'Harmonica Jim' is a 'request' song tonight."

I calculated that there were about 250 letters representing a single mail. They were not all short by any means. Most of them had some word of commendation for the last program. The dog song and "Hokem, Smokem, Yodelin' Indian Man" both seemed to be general favorites.

A man from Ellicott City, Maryland, said, "Frank, so far as I am concerned, you could yodel your head off. I sure do like to hear you," and hundreds will agree with him.

He continued, "I think it would be appreciated by the majority of the radio fans if you would sing 'When Spring Comes Peeping Through' at the beginning of each week's program."

Another man from West Palm Beach, Florida, telegraphed that a box of fruit was on the way as an evidence of the writer's appreciation for the Yodelin' Indian Man in the last program.

It was a surprise to me to hear that Palm Beach received each week's program with great clarity, so I asked about other distant points.

"They hear us fine in New Orleans. There is going to be a big radio party down there tonight and my mother and father will be listening in so we'll have to make this a 'knock-out'," Al informed me.

"Lots of our old friends of our vaudeville days in the South write that they hear us and like our programs," he continued.

"Those were the hard days for work. I can remember the hardest day I ever put in was one in Macon, Georgia, where I made twenty-one appearances in one day, between movie showings.

"One time we were booked for a performance in Athens, Georgia, which in those days was often dreaded by the theatrical men because of an engaging trick the Georgia State University boys had of stampeding the gallery when an actor did not meet with their approval. Fortunately for me, I met an old friend on the street soon after we arrived and he said he'd pass the word to the boys to be quiet that night. Well, they were and they gave us a great ovation at the end of the performance.

"Now when we go to different cities for occasional showing, we find our radio friends filling the theatre and it's 'Al' and 'Frank' and 'Sammy' on all sides. Not long ago we were in Washington, D. C., where we could not offhand think of a soul we knew but as we walked up the street that morning, we heard, 'Hello Al, Frank and Sammy' a dozen times before we

Composing is serious business to Al and Sammy, but Frank has fun kidding them about a disputed note.

Your RADIO FAVORITES

The Silver Masked Tenor

The popular soloist of the Silvertown Cord Orchestra is shown without his mask and with his wife and baby. *December, 1925*

Roxie and His Gang

The last photograph of this famous organization was printed as a big double-page engraving. *October, 1925*

The Happiness Boys

Here is the intimate story—with photographs—of two lads who count their friends by the million. *February, 1925*

Jean Sargent

The director of women's features from station WHT, Chicago, wrote three articles for us. *January, March and April, 1926*

Goldy *and* Dusty

Behind the scenes with a team whose crooning songs soothe the nation on Tuesday night. *November, 1925*

Mrs. Julian Heath

An intimate interview with the woman who is raising the standards of American housekeeping. *April, 1925*

Wendell Hall

The Red-Headed Music Maker had a splendid portrait of himself made and sent it to us for reproduction. *December, 1924*

WEAF Grand Opera Company

Here is a group of artists who are carrying the best of music into the homes of America. *November, 1925*

The Piano Request Lady *of* WLW

The personal side of the girl who will play any composition you request from Station WLW Cincinnati. *April, 1926*

Godfrey Ludlow

A picture and a biography of WJZ's favorite violinist and his wonderful instrument. *March, 1925*

We have on hand a limited supply of these back issues. Any or all of them can be supplied at twenty cents each. (Stamps accepted). Address

The RADIO HOME

Produce Exchange Building

3rd and Walnut Streets, Philadelphia, Penna.

reached our hotel," he concluded.

A letter from a grateful fan in Guatemala, Central America, was among that day's mail and said that the writer had had perfect reception of the program of the week before as had a number of other people in the vicinity.

"You sure have entertained my customers and loafers," was the comment of someone who signed himself, "Behind the Counter Tom Cat," of Tifton, Kentucky.

"Here's one," volunteered Frank Kamplain, "from an old friend of my mother's who lives in a Mississippi town. She says the last time she saw me I was a dear little boy walking up the aisle in the church down home.

"You see," he continued, "my father was a deacon in the Baptist Church and my brother is a minister. They did not think much of vaudeville when I first started—but it's all right now."

"We're a funny combination when you stop to think of it"—spoke up Al. "A Baptist, a Roman Catholic and a Jew! But we get along like three peas in a pod. I never try to take the others to mass and they haven't tried to coerce me to go to church or the synagogue with them."

"You've had an easy time of it since you all came to New York, haven't you?" I interposed here.

"Well, not always, by any means, but you know we forget all about those struggles and hard knocks now when we read such letters as these and hear the sales reports on our records.

"I came to New York in the winter of 1918-1919 and soon started to make phonograph records. The biggest thrill of my life came that season when I shook hands with Thomas Edison who was the guest of honor at a dinner given by the phonograph company," said Al.

Sammy Stept then told me that he had commenced his musical career at the age of nine when he played the piano. After a varied experience that included work on the Orpheum Circuit, in which he was associated with Jack Norworth, Anna Chandler and other well-known theatrical people, he signed up for three years in the publishing business and later went to Pittsburgh and Cleveland to work in night clubs that, like most of their kind, were afterward closed up. When he returned to New York, he met Al Bernard with whom he has been collaborating ever since. An idea for melody or lyrics may come to them any time and if possible, they sit right down at the piano with a piece of music manuscript paper and try to work it out together.

Unlike many composers they are very generous about helping other struggling composers if they can. Not long ago, they had a most interesting letter from two prisoners in the New Jersey State Prison in Trenton, thanking them for their good programs which the prisoners all enjoyed thoroughly, and asking if they thought it would be possible for them to give a song the prisoners had composed and of which they were enclosing a copy, in their next program. The song did not sound like much as they first tried it so they had it rearranged for them by Harold Dixon. The song made a hit when the Record Boys gave it over the air and they have had many requests for repetitions. In a heart-felt burst of appreciation, the prisoners wrote back a letter from which the following extracts are taken.

"We do not know how to express our appreciation for the wonderful manner in which you have handled our song. Please accept our warmest gratitude for the interest you have shown.

"Prison life at its best is a drab, cold thing, but it buoys a fellow up considerably to learn that men on the 'outside'—absolute strangers—are willing to go to the trouble of doing the wonderful service you have done for us. We have both lived violent lives—burglary and robbery being our chief occupation. At the age of thirty years, we have finally awakened to a brand new realization. That is—how foolish we have been in throwing away and wasting a perfectly good life. Yours is the first real kindness we have known in a long time, and please believe us, we appreciate it more than even you probably understand. We do not say this with any mawkish sentimental intentions. We have made our bed and expect to lie in it, but we are simply stating facts in view of your taking a chance on us, and we thank you from the bottom of our hearts."

Kindliness and an interest in their fellowmen characterize the Record Boys' feeling toward their radio listeners and it is this unity of spirit that doubtless has much to do with their success. Their sincerity is felt by all who listen to their programs.

Almost Anything is Likely to Happen in

SPORTS This SUMMER

By PAUL W. GIBBONS

RADIO has taken its permanent place in sport. Baseball, football, track athletics, tennis, basketball and other sports may now be "seen" over the radio by hundreds of thousands of people who either are prevented from being present through being shut-ins, living too far from the scene of conflict or, as is the case so frequently, where the entire seating capacity has been sold to only a fraction of those who are interested in the contest.

Even lacrosse with its rapid interchange and flight of the ball made its radio debut when the Oxford-Cambridge team led the University of Maryland in Baltimore recently. This was flashed out from WCAP, Washington, and WEAF, New York.

Sponsors of the idea of broadcasting sporting events have been wise in selecting for the "Mike" in each instance, an expert in the particular line of sport being broadcast. This has been done in such an efficient, high-class way, that thousands of devotees of football, basketball and other team sports get a greater thrill out of "seeing" the game over the radio than they do at the actual scene of conflict, for the very good reason that they know exactly who carries the ball, who makes the tackle, etc.—information which they seldom get from their seats in the stadium.

This has come to be such an important matter that it is now being recognized by the athletic authorities at the various universities, and in order to supply the thousands of spectators present with as complete information as the listeners-in have been getting over the radio, loud speakers are being installed for use at football games, track meets and other large gatherings.

The University of Illinois was the first to practice this experiment. They have installed an outfit costing approximately $10,000, which will be operated for the first time at their opening football game on November 2 next. The University of California has had an announcing system for three years with satisfactory results.

The loud speaker will be worked with a radio hook-up, employing announcers, microphones and sets of large horns, placed throughout the double-decked stadium. A man on the side lines will give the game, play by play, into a phone on the end of a long cord which has several plug-in stations up and down the field, enabling him to follow the ball at all times.

This radio sport idea is one of the most mutually helpful combinations that has ever been effected. The radio, carrying sport propaganda into even the most remote sections of the country, into the hospitals, to invalids and the aged confined to their homes, has spread the propaganda of sport and increased its followers by the hundreds of thousands, while on the other hand, by the very virtue of this, thousands have installed radio equipment merely to get this sport tie-up and to get, by this method, the thrills which would otherwise be denied them.

With the American and National League teams fighting through their April to October schedule, with Tilden defending his seventh-year reign against Richards, Johnston and other properly avaricious aspirants, with the United States lawn tennis team defending its international title against the increasingly threatening French stars, with Bobby Jones again scintillating on the links, with the American Walker Cup golf team invading England, with that splendid sportsman, Sir Thomas Lipton, threatening to make another game attempt to lift the American Yachting Cup, 1926 should prove sport's greatest year.

MOVING northward on the delayed spring zephyrs, the vanguard of baseball, tennis, and golf devotees arrived in the North in the middle of April, each and every one proudly bronzed with several coats of southern tan.

These more fortunate sportsmen were quickly joined by that greater horde of devotees of these sports who either because of too much business or, more frequently, too little business came no nearer to the sunny south than reading the resort ads after shaking the snow from the morning paper, or the contact gained through an occasional glance at the maps so alluringly displayed in the southern realtors printed literature.

A period of intensive training for the long hard season of outdoor sport is on now. The diamonds are alive with embryo baseball stars. The tennis courts teem with dashing, jumping, running knights of the racket, while every hill and dale of golf links throughout the length and breadth of the land is studded with keen, assiduous sod cutters and sand diggers, each fully equipped with a bag of implements especially designed to dig up any fair green bunker or to mar the velvet surface of the priceless putting greens with a minimum of effort and a maximum of expletive.

The baseball fan has gone into training, eating cardboard in order to accustom his digestive organs to that famous delight of epicures, the ball park sandwich.

Those tennis players who have the entrée to such an advantage are spending several hours each day in engine rooms or other places of intense heat, rushing and jumping about to acclimate themselves to their usual summer ordeal of marathoning under the burning rays of a midday August sun.

And the golfer! This incipient bug is making life miserable for his family by practicing strokes in his living room, using a cane or an umbrella and socking

Above—Max Carey, Pittsburgh Nationals

Ty Cobb, Detroit Americans wearing sun glasses — *Babe Ruth, N. Y. Americans* — *Eddie Collins, Chicago Americans* — *Roger Hornsby, St. Louis Nationals* — *Tris Speaker, Cleveland Americans* — *Glenn Wright, Pittsburgh Nationals* — *Walter Johnson, Wash. Americans*

camphor balls into the mirrors or the reflected visage of an irate wife or unsympathetic in-law.

Baseball;—The return North of the National and American League baseball teams found them minus the usual number of those embryo stars whose hopes for major league berths had to be catalogued under the head of exploded dreams.

While it is unsafe to stake one's total wealth on predictions of pennant winners based on the results displayed by the major league teams in their spring training trip, connoisseurs can form a fairly accurate idea of just which teams will be in the running by making a careful study of the pre-season practice statistics.

For example, knowing ones are already telling the world that the Pittsburgh team, last year's World's Champions, will not finish better than third. We shall see.

They also state with equal emphasis that the New York Giants and St. Louis Cardinals will fight it out for the National League flag.

Young Tyson, the recruit secured to play center field, has pepped up the New York entire outfit. He is a zealous and efficient ballhound and has a wing that will strike terror into the hearts of any of the opposition who take undue liberties on the paths.

Jimmy Ring, obtained from the Phillies and the comeback displayed in the South by McQuillan, backed up by the great promise shown by Wisner, Greenfield and Fitzsimmons assure the Giants of a strong staff of hurlers, while Kelly, Frisch, Lindstrom and Travis Jackson round out a team that will give the opposition many anxious days.

Rogers Hornsby hasn't added any special talent to the St. Louis Cards. Rogers is rounding out the fine nucleus left him by Branch Rickey but Hornsby has imparted a spirit which will turn into victories many games which would otherwise be registered as defeats. Under Hornsby's personal coaching the entire team has improved in hitting and batting never lost any ball games that we ever heard of. St. Louis was second only to Pittsburgh in hitting last year and Hornsby doesn't intend to let any team outhit the Cards this year if he can help it.

Killefer, the former Chicago Cubs manager, is also proving a tower of strength to the Cards. He is a masterful coach of pitching material and under his care the St. Louis curving staff is sure to do better this year.

Pittsburgh, last year's champs, haven't been exactly asleep. The two recruits obtained from San Francisco, Paul Waner and Hal Rhyne, and for whom the Pirates paid $100,000, are said to be two of the best young ball players who ever splashed into the big leagues. Pittsburgh is said to have got its money's worth and one hundred thousand bucks is a lot of change.

It should be a great three-cornered battle for the National League title and who can tell —maybe some dark horse will rear up and kick all the advance dope overboard. This is what makes the national pastime so intensely interesting—the unexpected so frequently happens.

Most of the National League managers who have looked over the American League teams in the South are of the opinion that, barring accidents, the Philadelphia Athletics have the best chance to arrive at the end of the season leading the clubs in the junior division of the Major Leagues.

They are basing this mainly on the ancient adage that "youth will tell" and there is no gainsaying the fact that Connie Mack has at last got together an expert aggregation of peppy ball players.

GOLFDOM'S BIG FOUR

Left to right—Bobby Jones, Jim Sweetser, Gene Sarazen and Walter Hagen. The formet two stars are to be mainstays of our Walker Cup team which is invading England, while Sarazen and Hagen will lead our Pros in an international clash across the seas.

Bucky Harris and his Washington team of vets, however, will not be easily counted out. We'll be able to give you a more accurate line on this about September 15, next.

In any case, regardless of who wins the penant, hundreds of thousands of baseball devotees throughout the country will fight their way into the ball parks or tune in on their radios if only for the following few thrills:

Ty Cobb, in his twenty-second campaign, looking like a debutante of twenty-one.

Tris Speaker circling for a fly ball in center field.

The rhythm and whip of Walter Johnson.

Max Carey fluttering along the towpaths.

Traynor and Wright guarding the Pirate left flank.

Eddie Collins doing anything at all.

Hornsby and Ruth leaning against one, fast or slow.

For these are things that won't last forever.

Tennis;—As the tennis season approaches its opening, and with the memory of some recent events in the indoor competition in New York and in the early outdoor season on Southern courts fresh in our minds, the question is being asked on every hand, "Is Tilden slipping?" There is an old adage which has been successfully followed by sportsmen from time immemorial and that is, "Always back class until it loses."

Until his recent defeat in the National Indoor Championship in New York by Rene La Coste, the French ace, Tilden has been invulnerable since he won the world's championship seven years ago, but in the light of his defeat by La Coste, which was repeated by the French youth several days later in the International Indoor matches, supplemented by the champion's defeat by Vincent Richards in Florida and his being pressed to five close sets by young Chapin this Spring, will be taken by many to be the handwriting on the wall.

Sight must not be lost, however, of the fact that Tilden, playing in tournaments of semi-importance, is seldom the Tilden who steps on the court to defend his national title, or to take up his racket as a representative of the United States in defense of the Davis Cup.

Tilden has the competitive soul to the *nth* degree. He always seems to have something in reserve, and he has been on the brink of defeat so often, only to emerge victorious, that many think he seeks the precipice in order to provide himself with additional thrills.

Many close students of tennis, however, are of the opinion that Tilden's championship armor is in great danger of being pierced this year. In addition to the reverses just mentioned they take cognizance of the champion's close shave at the hands of both La Coste and Borotra in the challenge round of the Davis Cup matches at the Germantown Cricket Club, Philadelphia, last September. Tilden was twice within a stroke of defeat at the hands of Borotra and three times within a stroke of defeat at the hands of La Coste, and many of the national officials who were present at that match are of the opinion that La Coste actually defeated Tilden on that day. A clean service ace when he was at match point, miscalled by the linesman, in the opinion of many robbed the phlegmatic French star of a well-earned victory.

Of course Tilden was far from his best in those matches and yet is that not always said when the king's crown is threatened in any line of sport endeavor? In the recent international indoor matches in New York, Tilden's mental poise was not conducive to bringing forth his best tennis. He was facing the forced closing of his play, the failure of which occurred at the conclusion of the matches and was presaged with certainty on the eve thereof. This failure Tilden knew would bring financial loss not only to himself, but to many of his friends who had invested their money to help forward his dramatic ambitions.

Tacked on to this worry was another embroglio in which Tilden became engaged with the officials of the U. S. L. T. A. when he tried to force them to sanction an exhibition match in Madison Square Garden for a French charity which did not seem to inspire the French team, La Coste, Borotra and Burgnon as patriotically as it did Mr. Tilden.

These things, as before mentioned, were of course not calculated to inspire Tilden to produce his best brand of tennis in the international matches. But with his play closed, and the champion going South for a much-

needed rest, a partial return to his old form might have been looked for. His defeat by Richards at Jacksonville, however, and the close contest given him by Chapin in North Carolina should prove most encouraging to Richards and William M. Johnston of California, who seem to be Tilden's only serious rivals for his championship.

Tilden appeared in Philadelphia last month to play a round robin in singles against Brugnon and Manuel Alonso on the occasion of the opening of the Penn Athletic Club's new $70,000 tennis court, which by the way is the finest tennis court in the world. It was a subject of universal comment among the capacity gallery which attended those matches that Tilden looked to be in very bad physical shape. He was drawn and haggard.

The champion, however, has a penchant for making quick recoveries and his trip to the South and a much-needed rest from his unsuccessful theatrical labors and worries may again find him the Tilden of old when he steps on the court at Forrest Hills to defend his championship and when he takes up his racket at the Germantown Cricket Club to represent the United States in the defense of the Davis Cup.

Tennis experts who have studied closely the performances of the leading college players are of the opinion that Howard Chandler, of the University of California, the present holder of the intercollegiate championship, and Cranston Holman, of Leland Stanford, national junior titleholder, must be reckoned as serious contenders in the various championship tournaments during the forthcoming outdoor season.

Chandler performed spectacularly in the intercollegiates at Haverford last summer when he lifted the crown against one of the strongest fields ever brought together in the final round, defeating Holman, conqueror of Carl Fischer. Unfortunately, he was not active in the summer competition in the East and was not placed in the rankings of the leading players, although this was an injustice as he very properly should have been ranked in the first 10 ahead of Holman.

Holman spurred on by his achievements in reaching the final round of the intercollegiates performed frequently and dazzled tennis followers by his sensational victories. His outstanding performance took place in the West when he defeated Bill Tilden in a keenly fought exhibition match. He will be watched closely this season, particularly in the intercollegiates. His arch rival undoubtedly will be Chandler, who will defend his title. That he will make a strong bid to retain his crown is evidenced by his recent victory in Berkeley, Calif., when he defeated Bill Johnston, second ranking player in the United States, 6-3, 6-1.

Holman is now on a tour of the Far East, and the competition there will stand him in good stead.

Vincent Richards of New York, and Howard Kinsey of San Francisco, have been selected to represent the United States Lawn Tennis Association in international play abroad this summer.

Richards, who ranks No. 3, and Kinsey, No. 6, were selected after the other top-ranking stars, W. T. Tilden, W. M. Johnston and R. N. Williams, declined invitations to compete for business reasons.

The players will join the members of the American women's team in Paris for practice prior to the opening event of the international schedule, the team matches against France beginning May 28. They will play in the French hard court championship June 2.

In England the men will play an international match against a picked British combination June 17-18 at Eastbourne, while the women players are competing in the Weightman cup matches at Wimbledon. All of the Americans will play in the English championship, starting June 21, and should make a splendid showing. It may be Richards' big chance to win the world's title at Wimbledon.

STARS OF THE TENNIS WORLD

Left to right—William T. Tilden, R. Norris Williams, Vincent Richards and William M. Johnston. Photo by International Newsreel.

Golf;—In the realm of golf they are asking the same question as tennis followers are asking of their champion—

"Can Bobby Jones successfully defend his throne against the onslaught of Francis Ouimet, Jess Sweetser, the youthful Watts Gunn and others?"

This is more speculative than it would seem to be on the surface. It is the unanimity of opinion of the experts that Bobby Jones is the greatest golfer of all time, and while a veteran insofar as competitive experience is concerned, having gone to the round before the semi-final in the National Championship at Merion in 1916, at the age of 19, just 10 years ago, so at 29 he is a youth in years. He should be at his best for many years to come.

On the other hand, form holds less true in golf than in virtually any other sport. Just to cite an example: In golf a star can vary ten strokes in a day. A duffer can vary even more. High or low can be riding the crest one afternoon and sinking into the trough twenty-four hours later.

A few years ago Abe Mitchell led George Duncan thirteen strokes after the first day's play of thirty-six holes. Duncan on that day had an 80-80. The next day Mitchell had an 84 the first round and Duncan had a 71. Duncan got back all thirteen strokes in eighteen holes, finally beating Mitchell by a decisive margin. No other sport could have shown such a tremendous upset among champions.

The American Walker Cup team sailed for England on the Aquitania on May 5 to invade Britain with their drivers and mashies to wage an international contest against England's best divot diggers. The team consisted of Captain Robert A. Gardner, Bobby Jones, Francis Ouimet, George Von Elm, Jesse Gilford, Jess Sweetser, Roland MacKenzie and Watts Gunn.

Young Gunn, the youthful Atlantan, who made such a sensational showing in the National Amateur Championship last season, and was runner up to Bobby Jones, is making his first appearance on an international team. Despite the fact that this is the first time he will have been under fire in the international play, he has shown himself a sterling shot-maker with lots of courage. He should give a good account of himself.

Meanwhile, the American pros are planning an invasion of England, and Walter Hagan is arranging for the tour. The team will be recruited from among those who will play in the British open and includes Hagen, Mac Smith, Jim Barnes, Bobby Cruickshank, Leo Diegel, Al Watrous, Johnny Farrell, Tommy Armour, Al Espinozo, Bill Mehlhorn, Emmet French, Joe Kirkwood, Gene Sarazen, Gil Nichols, and possibly one or two others.

They sail on the Aquitania on May 26. The matches will take place at Wentworth, near London, George Duncan's home club.

Women's golf has undergone a most pronounced change in the last few years. Improvement is everywhere noticeable, more so even than in the case of men's amateur golf.

Women are no longer afraid of the game. They are hitting the ball. To watch some of them lash into a tee shot and send the ball whizzing out 200 yards or more is a revelation to many.

This changed attitude toward golf was well illustrated during the qualifying round for the North and South championship recently played at Pinehurst. Playing the tenth hole, 365 yards, Miss Collett's drive put her in a position where the green was entirely out of sight. Her ball was off to the right and she was forced to play from a hanging lie. To reach the green it was necessary for her to play a deliberate slice that would carry her ball around some pine trees midway to the green. The wind was from the right to left.

All of these circumstances meant one of the most difficult strokes in golf, yet Miss Collett played the shot without a moment's hesitancy and succeeded in putting her ball on the sand, a feat that such a critic as Macdonald Smith declared to be one of the finest strokes he had ever seen played. A few years ago such a stroke would not have been attempted.

Uncle Sam's New Junior Order *of* RADIO *Gardeners*

Above is a photograph of "Free" Brigham, the first lad to request membership in the radio gardening club. To the left is Sam Pickard, Chief of Radio Service, U. S. Dept. of Agriculture, Washington, D. C.

By SAM PICKARD

Chief of Radio Service; U. S. Department of Agriculture

IT'S JUST a happenstance that "Free" Brigham's request for membership in the Radio Order of Junior Gardeners was the first one received at Washington by Uncle Bert, the garden expert, who has made his radio debut, by proxy, from over thirty broadcasting stations. A quarter of a million other nephews and nieces of this spokesman for the U. S. Department of Agriculture are also making the dirt fly on the back lot this spring. Promptness, however, is one of "Free's" virtues, for it later developed that he had wasted no time in making out his gardening plans for the spring and summer months.

It matters not whether you are one of the young eligibles or merely a grown-up boy or girl with a crop of youngsters of your own, you will be interested to hear about "Free" and his many cousins who passed up marbles and rope skipping this spring for the new outdoor sport—gardening by radio.

If the radishes are more tender than usual and the heads of lettuce actually produce like the picture on the package—if the cucumber beetles and other garden insects are conspicuous by their absence—then it is just possible that either sonny or his sister, or both, are members of this new radio order.

But to get back to "Free," as the boys call him, out near Sandy Spring, twenty miles from Washington—this young chap, just turned eight, still believes he will drive a railroad locomotive when he gets big. But in the meantime he is going to study and practice gardening. It will be a good hobby, a pleasant, profitable, and helpful one, he believes.

Now, there's a real reason for hurrying home a bit faster from school. Dad has donated a plot of garden and it is the boy's first business venture. He must make good.

Uncle Bert has sent a copy of his instructions along with some interesting literature about gardening. With this equipment, a few tools, and perhaps a slice of bread and butter, "Free" and the other club members hie to their respective garden plots in a thousand different parts of the great United States. The first job, according to Uncle Bert's instructions, calls for staking off the garden and preparing the ground.

Young Brigham and his thousands of cousins in the bonds of the gardening club are collaborating in a great radio experiment this spring. They are going to prove or disprove, by actual demonstration, in terms of cash or its equivalent, the value of radio to the youth of the land.

Thousands of letters are being written to the Department of Agriculture and the State agricultural colleges at this time of the year by boys and girls, asking questions about gardening. Many of these boys and girls are preparing to have a garden of their own and to sell the products in order to get money for a vacation, for helping them through school or for the purchase of something they

All Over the Country Youngsters Are Tuning In to Hear Uncle Bert Tell Them How to Raise Flowers and Vegetables —And They Like It

want for themselves or for their families.

It is perfectly natural for all real live, wide awake boys and girls to ask questions, according to Uncle Bert.

Uncle Bert's visit once each week with his big "class" of boys and girls deals with problems of the vegetable garden, the growing of flowers, the production of strawberries and other small fruits and also the care of tree fruits and grapes. All those who apply for membership are sent a card on which to register. A copy of this talk and bulletins on gardening are then sent to all members, free of charge.

But here we are on the air with a typical list of garden questions that Mary and Sam and all the other boys and girls of the radio audience have been asking in their letters to the Department. Questions are as diversified in nature as are locations from which they are asked.

For instance, a boy right here in Washington wants to know how large a piece of land he should have in order to be successful in growing vegetables to sell in the neighborhood? Uncle Bert tells him that a plot of ground 40 feet wide and 100 feet long, if properly managed, will grow all of the vegetables, except potatoes, required by a family of five. In the terms of money value a plot of this size will grow vegetables during a favorable season that are worth $50 to $60, or even a higher figure.

"What kind of flowers can I plant in a sunny back yard, the soil of which consists of clay, brickbats, gravel, cinders, scraps of old iron, old rags and everything else under the sun?" inquires a little girl from Baltimore. "Petunias, single petunias," was Uncle Bert's answer. "Loosen the top soil two or three inches deep and sow seed of single petunias broadcast and rake it in. Do not plant the seed until the weather is nice and warm and if the plants come too thickly in some places, thin them so that they will stand two or three inches apart. Single petunias will give a great variety of color and bloom practically all summer, and they are not particular what kind of soil they are planted on just so they get plenty of sunshine and an occasional rain or watering."

Another young gardener wants to know where he can get the best garden seeds? An important question to which our Uncle Bert replies as follows: "Good reliable seed dealers are located in almost every city and town of any size in the country and these dealers issue seed catalogs. Get the catalog of one of these dealers and study it. As a rule it is best to pick out the standard varieties and let the other fellow try out the novelties. No one dealer has all the best seeds but many of the seedsmen specialize on certain kinds of seeds.

Here is a question from a girl in Brooklyn, N. Y., who says, "We have a large yard in the rear of our house and would like to grow flowers or vegetables on it but the ground has been tramped until it is very hard. What can we do to make the soil suitable for a garden?" Uncle Bert replies over the air, "There are thousands of such yards and the only method is to dig the soil and loosen it to a depth of 8 to 12 inches, then add enough compost and fertilizer to make it mellow and rich enough to grow crops. If this yard could have been dug up or plowed last fall and the lumps of earth exposed to freezing and thawing during the winter, the soil would be more easily worked this spring. The main point is to avoid working soils of this character when they are wet."

Uncle Bert, the garden expert, who talks by proxy once each week from 33 stations.

One of the young correspondents in West Virginia wants to know what plants he should start in the house for planting in his garden? "Tomatoes, cabbage, peppers and lettuce are among the plants that can be started indoors to best advantage. All of these can be started in a shallow box of soil placed in a south window of the living room," says the expert.

The next question comes from the Middle West. "What crops should I plant in the small garden for the most profit?" "That will depend," replies the expert, "upon the local market, but lettuce, beets, carrots, spring or bunching onions, radishes, celery, tomatoes and peppers are the crops that usually give the highest net returns from a small piece of ground. It is best, however, to grow a variety of vegetables in order to give your customers what they want."

The above questions are typical of hundreds of others boys and girls are asking Uncle Bert. They forcibly demonstrate the extent to which radio is helping the parents solve the problem of directing the energy of youth along constructive channels.

If this great crop of rural and suburban boys and girls form the habit of using the radio for increasing their fund of knowledge and profit thereby, it is reasonable to expect that program directors will make greater effort to meet such a demand in arranging their broadcasting.

It's a fascinating game too—this gardening by radio. Uncle Bert is an artist at story telling and Nature's story, after all, is more wonderful than the Arabian Nights when the mysteries of the little dormant seed and its struggle for life are unfolded by the gardening expert, who, in every day life, is W. R. Beattie, Cooperative Horticultural Investigator, one of the best authorities on the subject in the world.

But after Uncle Bert signs off, there is more to do than tumble in bed and dream about the Lettuce army doing battle with their ancient foe—the Weeds. There are seed catalogues to study, plans of the garden plot to draw, and a few little financial arrangements to consider. Then when bedtime comes, it's just natural to have a sensible dream about the new bicycle or .22 rifle which the garden truck, converted into cash, will buy.

The Radio Order of Junior Gardeners, according to the response from boys and girls, fills a somewhat neglected niche in the average program directors repertoire. Thirty-three stations are using this service and encouraging the boys and girls to enroll. Each applicant is sent an attractive membership card and supplied with the printed information on gardening topics.

Comparatively few people have any idea of the immense amount of work that the Department of Agriculture is doing to increase the general knowledge of the soil and of plant cultivation. There is scarcely a phase of the increased production of food or flowers that is not being very thoroughly covered by some branch of the Department and this new use of radio is designed to reach the youngest possible type of mind.

Whether or not this results in the production of more farmers or of more efficient farmers, it will at least have a tendency to produce in the coming generation a more sympathetic attitude toward the farmer and the economic problems which he is constantly facing.

STATIONS BROADCASTING FOR JUNIOR ORDER OF GARDENERS

KDKA—Pittsburgh
**KOAC—Corvallis, Ore.*
**KOB—State College, N. M.*
KPRC—Houston
KQW—San Jose
**KSAC—Manhattan, Kan.*
KSL—Salt Lake City
KTCL—Seattle
KTHS—Hot Springs, Ark.
WAMD—Minneapolis, Minn.
**KWSC—Pullman, Washn.*
**WAPI—Auburn, Ala.*
WCSH—Portland, Me.
**WEAO—Columbus, O.*
WEEI—Boston
WFAA—Dallas, Tex.
WGHP—Detroit
WGN—Chicago
WHO Des Moines
WJAR—Providence, R. I.
WLBL—Stevens Pt., Wis.
WOAW—Omaha, Nebr.
WOS—Jefferson City, Mo.
WRC—Washington, D. C.
WRVA—Richmond, Va.
**WTAW—College Sta., Tex.*
KFAU—Boise, Idaho
KOA—Denver, Colo.
KWWG—Brownsville, Tex.
WMCA—New York
WHB—Kansas City, Mo.
WNAD—Norman, Okla.
WOAN—Lawrenceburg, Tenn.

Here Are Those Radio
CANDY RECIPES

That You Didn't Manage to Copy Quite Right When Mrs. Hanna Gave Them From Station WJZ.

Mrs. Hanna with Norman Brokenshire before one of the new "Mikes" which will soon be in every studio of WJZ.

By ELIZABETH A. ANDERSON

ALMOST every woman who gives recipes by radio is deluged with letters from listeners-in who have not been able to write down the list of ingredients as fast as they are given. Very often, also, a woman will listen in to a talk without making notes and then say, "My, that sounds good! I wish I had copied it."

That's why this magazine wants to give, every month, some of the recipes that are being most widely demanded. This service is entirely for our women readers and you hard-boiled old hiccupers—or hook-uppers—who don't think women ought to be considered in a radio magazine can go ahead and bury yourselves in the Technical Section—or anywhere else, for that matter—because these articles aren't intended for you.

We figure the old radio set belongs just as much to your wife as it does to you—more so, in fact, if you're like most of us.

So we're printing a magazine with one complete section for the wife and a complete Technical Section for you and, while we're glad to take orders from you about the Technical Section, The Wife is the Editor of this part. *H. M. N.*

P. S.—If this doesn't apply to you just because you haven't a wife, the answer is easy. Go get one.

HOW shall I begin? H. M. N. says that unless you catch your readers' interest in the first paragraph, you may write the most wonderful article that has ever been published and few will read beyond that dud—the opening sentence—to find the pearls of wisdom.

I should hate to kill this story that way for truly I have found Mrs. Elinor G. Hanna with her Candy Institute, and her candy, not to speak of her philosophy, one of the most interesting radio subjects it has been my luck to discover for many a day. Nor should I like to fail the many women who have written to ask for Mrs. Hanna's formulas. In most instances they have taken them down accurately as she broadcasts from WJZ every Friday afternoon during the Woman's Hour, for Mrs. Hanna, as you know, talks very slowly and distinctly, but often these listeners wish to verify the formulas.

This subject of candy making in the home is of absorbing interest to many women who must find some way of increasing the family income but who for various reasons cannot leave home to do so. In addition to the would-be moneymakers, there are the untold numbers of candy eaters, including men, women and children who, once they try a good recipe with unfailing results, love to experiment with others for different kinds of candy.

There I go—before I have really told you anything about how you can make this good candy at home, I am guilty of a slip. I should have said "for-

mula," not "recipe," for you see Mrs. Hanna has reduced candy making to a science and her candies are based on the laws of chemical combination. Each one has been worked out in her candy kitchen—or should I not say laboratory—with painstaking precision under the direction of qualified chemists. If you follow her directions exactly, you can be certain of the result.

Temperature is an essential factor of all candy making. You use sugar, in some form, and liquid, water or cream, in addition to other substances in all candy. Given the same ingredients for three experiments, heat one batch (which, by the way, is a perfectly good word in technical confectionery circles) to one temperature and you have a soft candy; heat the next to a higher temperature and the result is a chewy sweet; heat the third still higher, and the candy is of the brittle type. Vary your ingredients within each temperature group and you have infinite possibilities in different kinds of candies.

This is what Mrs. Hanna has done and in her formulas she gives you the results of life-long experimentation. In recognition of her work in developing the science of candy making, Mrs. Hanna has received an honorary degree, that of Bachelor of Science from the University of Pennsylvania, an honor rarely bestowed upon a woman.

One of Mrs. Hanna's vast number of radio fans wrote to her, "I told my husband about your B. S. degree."

"'B. S. did you say? Well, I'll speak for the world-wide university of husbands and award her a B. P.

"'Palate Benefactor, I mean,' was his reply to my puzzled look."

Strange to say (for I have always rather fancied myself as a candy maker) it was not entirely the excellence of her formulas that I have been trying ever since the first time I heard these talks over WJZ that first sold the idea of this article to me; it was Mrs. Hanna's apparent interest in helping other women to find themselves.

For weeks as I listened to her all-too-short twenty minutes on Friday, the question kept coming up in my mind as to whether Mrs. Hanna was as genuine as she sounds or whether she might not be one of those Pollyanna women who go through life with every action proclaiming that they are living for others. My instinct told me that here was a woman worth cultivating. Besides, had I not tried all of her recipes and found them undeniably good—yes, even salable when I followed directions explicitly and packed the candy in attractive boxes?

At any rate, I decided to prove to myself that my instinct had not played me a trick in my judgment of Mrs. Hanna, so one Friday I stopped in WJZ to see what Miss Bertha Brainard, the charming and attractive young woman who so capably directs the women's programs for the studio, had to say on the subject.

Mrs. Hanna signing off.

Miss Brainard was not in her office, but some one volunteered the information that she was in the studio where I found her having a wonderful time sitting in converse with a fine looking woman.

For a few moments I stood there unannounced and unseen so engrossed were they in their conversation. There was no need for me to question Miss Brainard about Mrs. Hanna—it came to me instantly that it was she—I knew that here was the living justification of my intuitive estimate. A few moments after I joined the group, the red light flashed over the Y studio door and Mrs. Hanna picked up her bag and a sheet of paper and asked me if I cared to go in while she talked.

When the speaker began, as is her custom, with a word of encouragement to the women of her vast radio audience, especially to those who felt the need of some form of self-expression in the real pinch of acute lack of funds to meet their family budget requirements, I watched her very closely to see how much she meant and how much, in the jargon of the day, was just applesauce. She had not gone far before I knew that she meant every word of it. Such a keen appreciation of the needs of other women can only spring from the sympathy bred of a real understanding and a life rich in experience.

At the end of her talk Mrs. Hanna chatted with me for a while. This gave me a chance to piece together the bits of information that I had gleaned from articles I had read about Mrs. Hanna.

To be sure—I must tell you now in case you do not know it—Mrs. Hanna is by way of being quite a celebrity. Much has been written about her getting along in the world. She is, in the true sense of the word, a self-made woman and the honorary degree from the University of Pennsylvania was granted in recognition of her scientific research into the thermometry of sugar. The research goes back over many years, from the time when, as a chocolate dipper in the Page & Shaw candy factory in Boston, the idea began to crystallize, through the experimentation period and teaching of scientific candy making which has centered in the Candy Institute, New York City, of which she is now the active head and the mentor of thousands of women.

At the age of fifteen little Elinor Kelley, (Mrs. Hanna) and her twin sister Ella, when the family finances were at a low ebb, (all of their younger brothers and sisters had the advantage of college training) answered an advertisement of a candy factory and went to work side by side as chocolate dippers. Of good Scotch parentage, the girls were ambitious and began soon to look about them and to see how it was done.

"We had not been there long," said Mrs. Hanna in telling me about their experience, "before we realized how essentially candy making is a woman's work, and how in the factory all the important and artistic phases of it were intrusted to women. Men were used in candy factories for one purpose — for the heavy lifting and manual labor that most women are not strong enough to do.

"We soon discovered

Edgewater Park, N. J., April 6, 1926.

Dear Editor:

Today being Easter Monday, we naturally had to celebrate by having company for dinner. When the question of what to have for dessert came up what should be more natural than when I suggested to the lady who pours my coffee that she should use the hook-up on page 30 of the April issue? Your hook-up is all wet! You evidently did not try the wave length range with the Audiodyne oscillator that you talk about for testing new hook-ups. There was something wrong with the inductance because it certainly lowered my capacity for the rest of the day, and I suffered considerably from forced oscillations in the secondary circuit. They were particularly prominent at the mid point, or what is known as the no-voltage node. The boss claims she used just the instruments specified and hooked them up exactly in the way that the wiring directions called for. Now I tell her that it couldn't be wrong, as I never have any trouble with your hook-ups. She claims that "Whoever heard of ¾ of a pound of chocolate?" Now I ask you, is she right, or am I? She claims that the size of the chocolate unit should be smaller. Please, Mr. Editor, settle the argument!

PERPLEXED.

Here Are the 3XP Style Hook-Ups

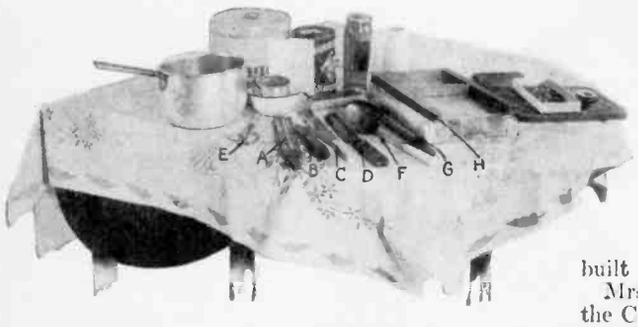


Figure 1. Assemble utensils and ingredients: A. candy thermometer, B. short spatula, or fondant knife, C. long spatula (to raise candy from pan), D. heavy butcher knife to cut caramels, E. scissors to cut paper, F. measuring spoon, G. wooden spoon for stirring, H. confectioners' irons, to be placed on inverted tin pan (a substitute for marble slab). Bread board with oiled paper, nuts and glassine cups, sauce pan, and measuring cup and ingredients in the background.

that in the factory, all candies are classified as three basic kinds, cream, chewing and hard, and from these three, all the great variety of kinds are developed. Men are needed only to handle the large batches of basics.

"The work could be conducted on a smaller scale in the home by making smaller batches of the basics at one time and certainly it was a woman's vocation. We went from department to department in the factory and it was not long before we knew the basic formulas and many adaptations.

"Then we began to realize that we had struck a real snag. We knew the commercial formulas but our knowledge of cooking did not enable us to reduce them to conform with kitchen limitations. Then came the discovery that candy making really isn't cooking after all, but chemistry. Certain definite proportions of ingredients always combine in the same way if conditions are kept uniform.

"We employed chemists to unravel the problem. They scaled down our formulas according to chemical laws. Then we had a real basis for the science of candy making."

Mrs. Hanna went on to tell me that the woman who accepts the scientific methods and discards the old hit-or-miss candy making can produce unfailingly good candy by following her formulas accurately. Provided she can produce a market and the candy is consistently good, she can expect to make money, Mrs. Hanna declared.

"There is perhaps no product for which there is such a universal sale as candy. The world is your oyster. Men, women and children all love candy. Produce good candy, pack it attractively and you can sell it. My students write me from all over the globe of successful trades they have built up selling home-made candy."

Mrs. Hanna told me something about the Candy Institute. She teaches with the aid of an able assistant about a thousand students, women and, yes, men of all ages and kinds—each year. This resident course includes five branches: (1) cream candies, comprising fondant for all cream candies; nut patties, bon-bons, assorted; fudges, assorted, and professional bon-bon dipping, all founded on the cream candy basic formulas; second, hard candies including peanut brittle, glacé fruit and nuts, Scotch kisses, clear candies, etc., all developed from the hard candy basic; third, chewing candies, including French cream caramels, nougat, toffees, butter Scotch and taffies of all kinds from the basic chewing formulas. The fourth branch includes chocolate-covered candies, and the fifth French chocolates and fancy Marzipan (almond paste candies). A different branch is given each day and a student may start on any

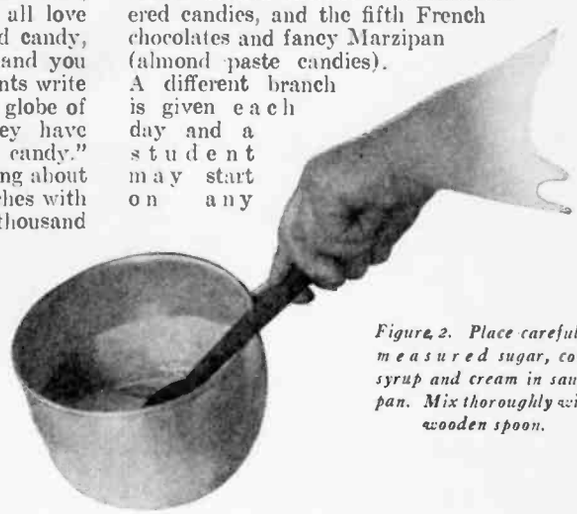


Figure 2. Place carefully measured sugar, corn syrup and cream in sauce pan. Mix thoroughly with wooden spoon.

Figure 3. Insert thermometer, put batch over gas flame (or electric plate), cook as rapidly as possible to 230°, stirring all time to prevent burning or sticking, using wooden spoon to avoid breaking thermometer. (Chocolate in agate cup melting over hot water in the background.)

Basic Formula for Candy Institute Cream Caramels

8 oz. (1 level cup) sugar
8 oz. corn syrup (confectioners' heavy syrup)
1 cup heavy cream
6 tablespoons evaporated milk
2 tablespoons butter
¼ teaspoon of salt

For 3XP Chocolate Nut Caramels add

2 tablespoons melted chocolate
¾ cup chopped walnuts

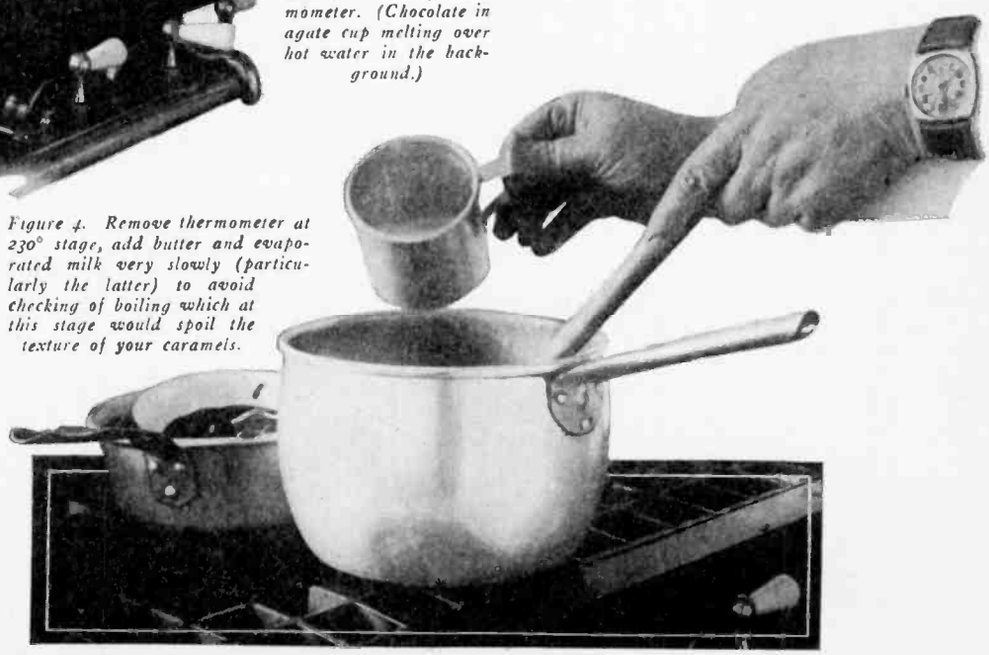


Figure 4. Remove thermometer at 230° stage, add butter and evaporated milk very slowly (particularly the latter) to avoid checking of boiling which at this stage would spoil the texture of your caramels.

of How to Make Cream Caramels

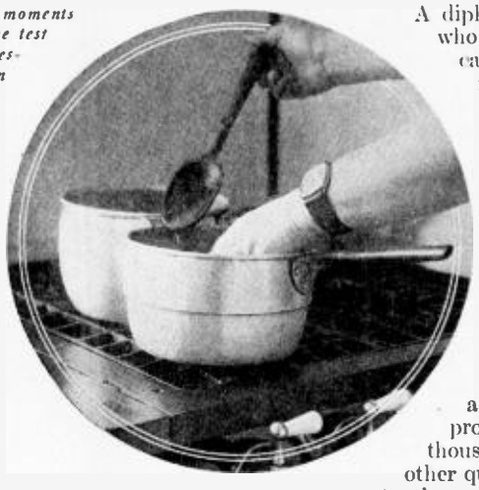


Figure 5. Cook for a few moments and test in cold water. The test is to a certain extent a question of individual taste. In general, when the dripping from the spoon is firm but will bend in the hand after dropping in cold water, the batch has been cooked enough. If you like soft caramels, a soft formed ball is the proper test. Always remove from flame when testing. If test is too hard add a little water, return to stove, boil up and test again.

branch preferred or may take any branch separately.

The Candy Institute correspondence course, which is also under the direction of Mrs. Hanna, enrolls about 3,000 students a year. A diploma is granted to those who submit twelve perfect candies that they have made at the completion of the course. Graduates include many of the most successful home candy makers in the country.

Mrs. Hanna is always glad to advise her WJZ students as well as those who take her resident and correspondence courses on their problems of obtaining supplies, making a market for their products and the thousand and one other questions that occur to them. And now I am sure you are impatient to know the formulas for some of these famous candies.

For the benefit of those who would like to win the B. P. degree from their men folks, I am giving a few of the simplest formulas that she has given over the air. Most of these are at the request of listeners who have heard them and wish to be sure that they have taken them down correctly. From these basic formulas, you can develop any number of distinctive candies by varying coloring, flavoring and form.

Figure 6. Add 2 tablespoons chocolate (more if you like a strong chocolate flavor) that has been melted in a cup over hot water or in a double boiler. Stir to mix chocolate, remembering that chocolate is a drying agent and being careful not to stir to the bottom of the pot after boiling stops. If you do, the batch may be fudged or lose its chew. The nuts could be added now or may be reserved and poured direct in the oiled irons, alternating with the hot candy.

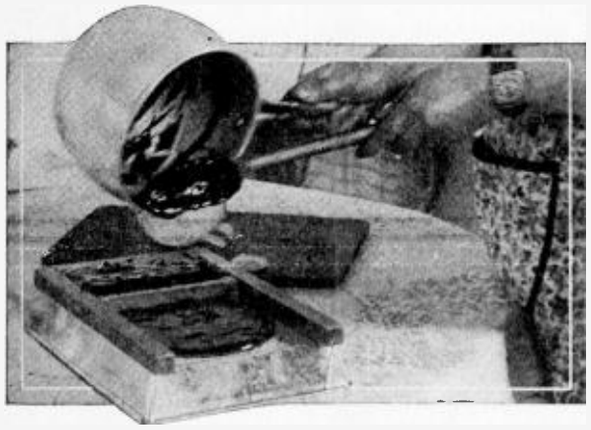


Figure 7. Pour on lightly-oiled inverted pan (my substitute for marble) in oiled irons to full depth, pushing up the second short bar to attain this end. Use any tasteless vegetable oil for oiling the irons and pan rather than butter which may turn rancid. Do not scrape the pan and stop pouring when the hot candy forms pointed drip. Pour remainder, scraping now if you wish, on the pan at the other side of bar, allowing to flow to its own level. Reserve this for nougat roll.

Do you like bon-bons? I mean the luscious, orange, maple and mocha kind that melt in your mouth. Or is your preference for cream nuts, Mexican kisses or perhaps that delicious rich chocolate fudge?

All of these candies when well made and of distinctive flavor are good sellers, too. If you would like to learn to make them, try the formulas for fondant.

First, there is a plain fondant that is excellent for coating bon-bons, caramels or nut centers as well as for peppermints. and second, a cream fondant for centers for chocolates, fudges or other candies of the kind.

For making these cream candies, the kitchen equipment is simple. You may use agate-ware or aluminum saucepans for an ordinary batch for home consumption. I use an aluminum preserving kettle when I make enough fondant at one time for a number of different candies for sale at church affairs or for Christmas or other holidays. It is quite possible to make good confectionery by following the old-fashioned soft ball, bend, brittle, or other cold water tests, but for accurate results—that is if you would be sure of making the same kind of candy each time—I find that it pays to

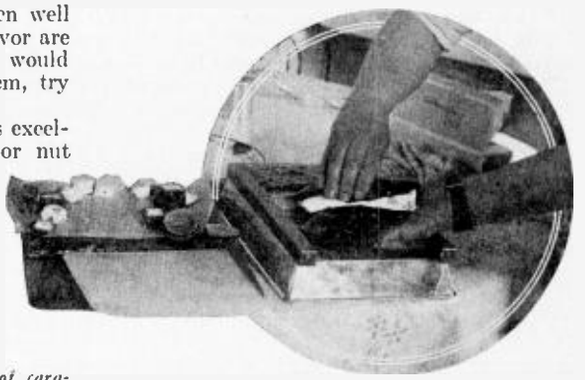


Figure 8. When this part is cool, roll around a strip of nougat (formula for this is given on page 25) that has been moulded in the hands. Cream fondant, nut pattie mixture, fudge, coconut cream or chopped fruit roll may be substituted for the nougat core. Put aside on oiled paper, on bread board, to be sliced when perfectly cool.

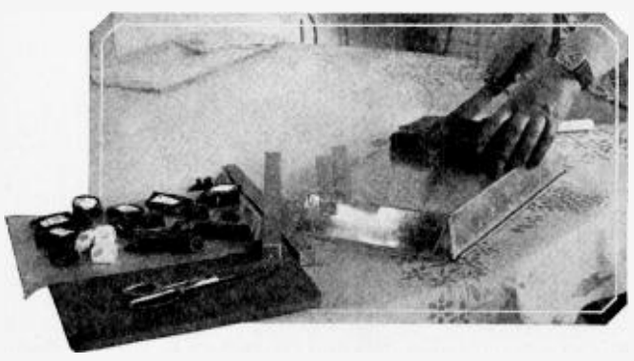


Figure 9. Mark the top of caramel sheet when cool enough to hold marks, to form squares. Allow to stand 8 hours in cold weather or over night in the refrigerator in summer to give clean square cuts. Remove irons. Cut mass along central mark, using a heavy butcher knife, employing a firm sawing motion. Do not press down on edge of the knife or you will have pillows instead of cubes. Cut in strips and then in blocks, wrapping each one in oiled paper or placing in glassine cups.

To vary this, omit chocolate and add butter nuts or pecans to unflavored or vanilla-flavored caramels.

have a candy thermometer; you can buy a good one at from $1.50 to $2.00.

You have noticed, haven't you, that Mrs. Hanna always tells you to pour your candies on a marble slab, in irons instead of in pans? In her laboratory classroom, each student's equipment includes these articles.

After seeing them I shopped around New York and Philadelphia considerably but was unable to find the marble slabs for sale. As I had an old marble top from a discarded table in the attic, I did not bother to go to any of the hotel or restaurant supply stores where such equipment is sometimes available. An old marble bureau or washstand top would serve the purpose as well.

There is no substitute for the confectioners' irons, however. Once you have used them you will never care to go back to pans, for with them the candy has square edges, therefore you have no waste pieces, and they are easier to wash than pans. They consist of two or four long iron bars 12 inches in length and shorter bars 6 inches long. Three irons are put together like a little fence and a short one is so arranged that it can be moved up at will so that the candy can be formed into a rectangle of any desired size. The full depth of the irons gives a finished piece that will exactly fit in one layer of a two-layer pound box. This is the right depth for caramels and fudge. Toffees and similar candies are poured to half depth.

An accurate measuring cup, a long spatula, a fondant knife (for the latter, a short square-end spatula or a putty knife serves nicely), measuring spoons from tablespoon to ⅛ teaspoon size, a wooden spoon for stirring (all of these can be bought in a five and ten cent store) a heavy butcher knife, scissors, oil paper and a double boiler for melting chocolate or for dipping fondant about complete the list.

I am afraid if I allow myself to stray into the further discussion of equipment we'll never get to the recipes, so let's return to the subject of fondant. I have in every instance given the amounts that I find satisfactory for making candy for home consumption, based on the Candy Institute proportions. If you wish to make more or less, vary the amounts keeping the relative proportions of each ingredient.

Candy Institute Fondant Formula

1 lb. sugar ½ cup water
2 teaspoons cornstarch
Cook to 236° or soft ball stage

Put water, sugar and cornstarch in saucepan; stir until ingredients are thoroughly dissolved. Remove spoon and do not stir again. Put on stove with thermometer in place. When crystals (small bubbles) form around sides of pan as boiling begins, remove with a pot-brush or cloth which has been dipped in cold water. Do not shake crystals back into syrup but dip the brush into cold water each time that you remove the crystals.

When cooked to 236° on the thermometer, remove from stove and pour on dampened marble and sprinkle quickly but lightly with cold water which will dissolve any crystals that may have formed. When the batch is cool (but not cold) work the edges toward the center with the fondant knife, back and forth, until you can work it no longer. Then mould together with your hands and place in a covered crock or agate-ware container, covering the fondant with a damp cloth, and put away until needed. It will require at least 24 hours to ripen and will keep indefinitely provided it is covered with a damp cloth.

For cream walnuts, almonds or pecans, roll in balls, placing a halved nut on each one. Flavor with vanilla or any desired flavoring and color to taste with colorings made especially for candy. Colored green and flavored with oil of pistachio or sweet almond and rolled in crushed pistachio nuts this makes a delightful confection.

Add a little caramel (prepared by browning sugar) flavor with maple and finish top with half a pecan meat—if you want a maple pecan sweet.

Of course for more elaborate bon-bons, you may work nuts or fruits into the fondant centers, use cream fondant (formula to follow) marshmallow, jelly fruit or caramel for centers and use the above fondant flavored and colored as desired as a coating. For this process melt some of the stock fondant to creamy consistency in a double boiler and dip the centers in, using a bent wire such as professional candy dippers employ.

Cream wafers are made by dropping this creamy melted fondant on marble or on waxed paper. Peppermint, wintergreen, strawberry, chocolate and maple are favorite flavors.

Candy Institute Cream Fondant, Basic Formula

2 cups sugar 1 cup light cream
¼ teaspoon salt
Cook to 240°

Put cream, sugar, and salt in saucepan, stir until thoroughly dissolved. Place on stove with thermometer. Stir constantly after boiling begins to prevent burning. Remove crystals that may form on sides of kettle, when boiling begins, as directed for plain fondant.

When cooked to 240° or soft ball stage, remove from stove, pour on dampened marble or on a heavy porcelain platter. Work with fondant knife as directed for plain fondant. Cream fondant may be used immediately for fudges; for centers for chocolates or bon-bons allow it to stand several hours in cold dry place before dipping.

Chocolate Nut Fudge

3 X P adaptation of Cream Fondant Basic

Into above batch of cream fondant work four tablespoons melted chocolate, and 1 to 2 teaspoons heavy cream. The amount of additional cream will depend upon the kind of chocolate used and whether it is a dry or damp day, but as chocolate is, in general, a drying substance, it is almost always necessary to add a little more liquid. Next work in a scant cup of broken walnut or pecan meats. I add a little more salt and just a dusting of powdered cinnamon, but vanilla may be used if preferred.

Pistachio fudge, colored green and flavored with oil of pistache, with chopped pistachio nuts and almonds is another favorite.

3 X P Mocha Pecan Creams

Make cream fondant as directed above; keep in damp cloth in covered crock in cool place over night.

Work in mocha flavoring or a little concentrated coffee made by allowing ½ cup of ground coffee to come to boil in 1 cup of water and straining. If color is not deep enough work in few drops of caramel. Make into balls placing a half pecan on opposite sides or roll in crushed pecans.

There are innumerable other ways of adapting these basic formulas and I am sure some of our readers have already tried their own versions of cream candies. We shall be glad to hear of any that you have found particularly delicious or salable.

And now let us turn our attention to the second class which Mrs. Hanna designates chewing candies. Caramels are probably the favorite of all chewing candies and can be just as delectable if they are well made as they are horrible when improperly made. My personal experience includes many ventures into this field, from the sticky mess of my school girl attempts, which afforded my brothers much amusement to recent (before I tried Mrs. Hanna's formula) jaw cracking, tooth-breaking atrocities that usually found their way into the garbage pail. Since I visited the Candy Institute I have made caramels several times, always with perfect success. I am not going into detail here as H. M. N. liked the samples I gave him so well that I made a batch in the 3 X P model kitchen and we photographed the various stages of the process for your benefit. These pictures are shown on pages 22 and 23. This "step-by-step" style of picture has proved so popular for radio that we are trying it for cooking.

Taffies, Toffees and Butter Scotch

These chewing confections, a degree harder than caramels, can in their variations be developed from the basic formula that I shall give next.

Toffees (a British concoction) differ from taffies only in that they contain nuts.

Butter scotch may be made in three degrees of chewiness; the crisp butter scotch wafers (cooked to hard candy degree), the firm but chewy blocks like taffy in consistency and cooked to taffy temperature and the soft blocks for chocolate covering which are cooked to temperature for soft caramels. In any case lemon flavoring or none is used and a little more salt than for taffies or toffees.

Candy Institute English Walnut Toffee

Basic Formula

¼ cup white sugar
¼ cup brown sugar (light)
4 oz. corn syrup
5 tablespoons heavy cream
2 tablespoons (scant) butter
2 tablespoons walnuts
¼ teaspoon vanilla
⅛ teaspoon salt

Mrs. Elinor G. Hanna making Bon-Bons.

Cook sugar, corn syrup, cream and salt to 240°, then add butter and cook to 250° or firm bend stage. Remove from stove; add nuts and vanilla. Pour on oiled marble in irons to one half height. When cool enough to handle mark in squares, cut in pieces of two blocks and wrap in waxed paper.

Cinnamon Taffy

Same formula omitting nuts and substituting oil of cassia, to taste, for vanilla. Add red coloring to desired shade after you add butter. Do not put coloring in too early as it fades with cooking.

Cocoanut Toffee

Same formula substituting finely shredded cocoanut for nuts and caramel or lemon flavoring.

Butter Scotch

Same formula, omitting nuts and adding more salt to taste. Flavor with lemon or not at all.

With the exception of nuts and flavoring salt is the only ingredient that can be varied without changing the results.

Candy Institute French Nougat Formula

6 oz. (¾ cup) sugar
6 oz. (¾ cup) corn syrup
3 tablespoons water
1 egg white
1 oz. (2 tablespoons) honey
1½ oz. unblanched almonds
1½ oz. pistachio nuts

Cook sugar, corn syrup and water to 290° or crack stage. Do not stir after boiling begins. While syrup is cooking beat white of egg in a bowl, add honey and beat stiff again. When syrup is cooked pour in steady slow stream over beaten honey and egg. Stirring with a circular motion quickly while pouring, until syrup has all been mixed with the egg and honey. Adding coloring desired, stir until thick to allow air to lighten the mass. Drop in chopped nuts gradually and spread on oiled marble in irons to full height, pressing with wooden paddle or spatula.

Do not try to make nougat on a damp sticky day. It will be sticky rather than light and good if you do. Choose a cool dry day for this confection.

It may be cut in blocks, covered with chocolate and wrapped in oiled paper, or used as a center for caramel roll.

In order not to neglect the hard candies I am printing one that Mrs. Hanna gave over the air some time ago. This peanut confection is a great favorite with Norman Brokenshire who probably has told you from time to time how good it is.

Candy Institute Honey Peanut Crisp

¾ cup sugar
4 tablespoons corn syrup
6 tablespoons water
½ teaspoon salt
2 tablespoons honey
2 tablespoons butter
½ teaspoon vanilla

Cook sugar, corn syrup, water and salt to 270° then add honey and butter and cook to 300°. Take from fire, flavor and add as many chopped salted peanuts as batch will hold.

Table to Serve as Guide for Different Flavors and Colors for Caramels

UNCOLORED

Flavors	*Add*
lemon	grated cocoanut
sweet orange	salted peanuts (chopped)
maple	marshmallow layer in center
mocha	seedless raisins any preferred nuts

COLORED RED

Flavors

raspberry, plain or add pecans
blood-orange, plain or marshmallow
strawberry wintergreen

COLORED GREEN

Flavors

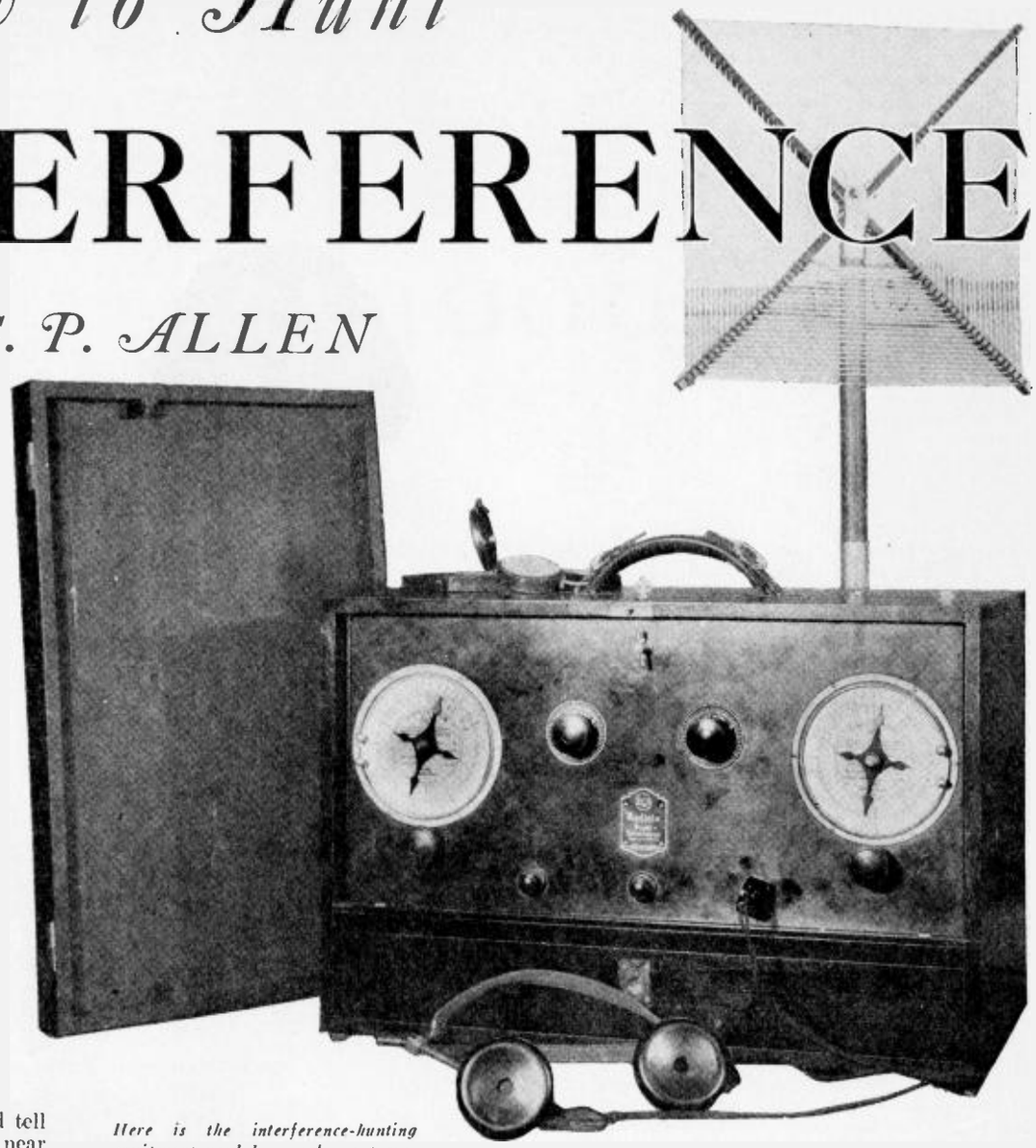
oil of pistache—pistachio nuts
oil of almond—almonds alone or with pistachio nuts

I have made all of the above combinations following the basic formula with perfect success. "The proof of the pudding is in the eating" and each time critical candy eaters have pronounced them good.

How to Hunt INTERFERENCE

By G. P. ALLEN

This Second Article Gives the Experience of One Public Service Company and Explains Why You Mustn't Blame the Electric Light People the Minute You Get an Annoying Buzz in Your Set



Here is the interference-hunting equipment used by one large power company. It is a super-heterodyne working on a directional loop.

LET'S indulge in a little fortune telling! We are betting a Fahnstock clip against a worn out B battery that the first thing you did after reading the article on interference in the April issue of this magazine was to call up your local electric light company and tell them that the transformer on the pole near your house was defective, and that if they fixed it they would be saving a lot of money. Be honest now! Didn't you?

Through the courtesy of the National Electric Light Association and of some of the large power companies in the east we have been able to secure a great deal of information for you regarding radio interference.

This history of radio interference with one large power company is interesting to follow. The first complaint received was looked upon by the company as something out of the ordinary. It came in the early part of 1923. That complaint was investigated, and no other complaint was received until December of the same year.

The next complaints were coincident with the first of the neutrodynes and super-heterodynes. During the winter of 1923 and 1924 the number of complaints increased to fifty. This past winter the complaints numbered six hundred. It is more than likely that by the time this article gets into print the number will be increased to one thousand.

With complaints of interference assuming such proportions, it became necessary for the power companies to make up their minds as to what attitude they should take, as public service companies, in regard to them.

The first thing they investigated was the effect that radio was having on the use of electric current. One company discovered that *an actual increase occurred in the light bills* of fifty families, after they had installed radio sets. This is no haphazard guess. The total current consumption represented 495 months. Previous to the installation of their radio sets these families used 15,503 kilowatts. After the installation of radio sets these families used 21,637 kilowatts. This was an average increase of 8.20 watts per customer.

Another company in a different section of the country figures the increase in revenue due to the use of radio sets is going to amount to *half a million dollars yearly.*

The decided increase in revenue caused by the use of radio sets indicated that the more radio is used, the greater the increase in current consumption might become. If noises originating in the power system could be eliminated it would not only add to the good will toward the company, but also promote greater use of radio by making it more attractive.

Furthermore, substitutes for batteries were being introduced, and if a quiet system could be obtained, there was a greater chance for increased sales of power by promoting their use.

Obviously, not every company could, or should, go into the radio business. The interference caused by its own system could be traced in some manner and eliminated.

The next fine point to come up was "where does a power company's liability begin and end?"

It is now generally accepted that the responsibility ends at the customer's meter. If the interference can be traced to the house side of a meter the company is not to blame. If it is on the street side of the meter, it is up to the company, and immediate steps should be taken to locate the trouble.

If you are run into by a man driving a Studebaker automobile, the Studebaker Co. is no more liable for the accident, than the power company is when they sell you power, and you make a nuisance of yourself by operating a device with the current that spoils

radio reception for the neighborhood. You do not intend to do it, and are surprised when it happens. Neither does anyone intend to hit you with his car, but it sometimes happens. However, only twenty per cent of reported cases are due to power company service systems, and of this twenty per cent, half are due to street lighting circuits.

Granted that the power companies are under obligation to take care of noises originating in their supply systems, some means had to be taken to discover whether it was in the system or caused by some consumer of power.

Small companies cannot afford men solely for this work. A new man is valueless because he does not have sufficient familiarity with the system. "What type of man is best suited for this work?" That was the next question that had to be met.

In order to be valuable to the customers the man assigned to trace down radio interference supposed to be due to a light company's lines must know, and like radio. He must also know thoroughly the lines of the lighting system on which he is working. In addition, such a man must have a pleasing personality, a temper not easily ruffled, and persistence which will force him to keep after a thing until it is done.

And above all else, he must have tact. There is no sense in sending out a man who is going to make an angry customer more antagonistic toward the company through lack of diplomacy.

A man of the type required cannot be found in the usual rank and file of a lighting company's personnel. Obviously he must be found fairly well up in the ranks of the company. The public cannot expect a four or five thousand dollar a year man to chase down their radio troubles for them. *Yet, that is the man who is doing the work.*

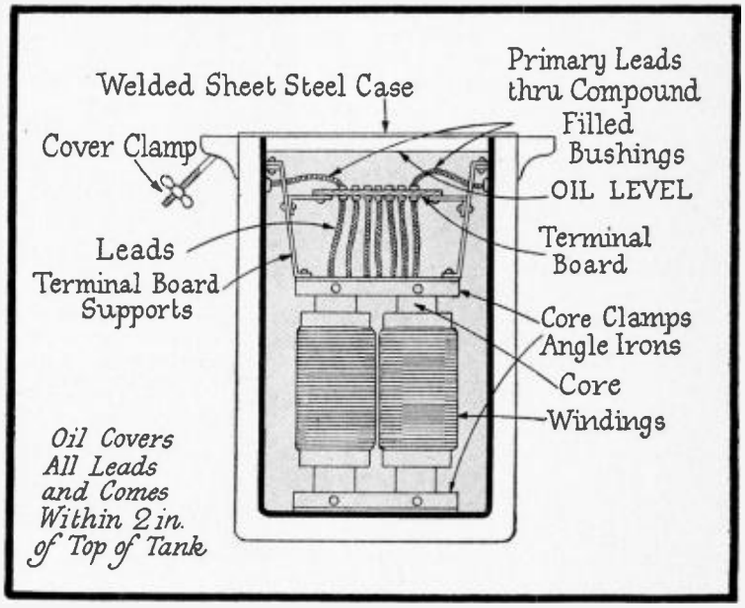
It takes a member of the engineering staff to be sufficiently familiar with the entire system to know it well enough to work on all parts of it. Such men are filling their regular positions in the day time and chasing interference at night.

One large company did the work at first by the voluntary services of two of its engineers. It now has six cars equipped with sets, and twelve men are devoting many of their evenings to it.

Running down a radio complaint costs anywhere from ten to six hundred dollars—in some cases, even more. How would you feel if you were investigating troubles for a power company and arrived at a customer's home to find that the noise had only been heard once and had not been heard since? How would you like to find no noise in the set that you had brought along with you, and then find the trouble due to a worn out C battery in the customer's set?

Unless you can be very, very sure that the trouble is not in your own set, you have no right to call up the local light plant and complain. Many times the representatives of the power companies have called to find that the complained-of noise had disappeared, or that the trouble was due to some defect in the set which the owner could correct.

Only last night, I was cussing out the Pennsylvania Railroad



Above is a sectional view of the kind of power-line transformers blamed by most radio fans for interference. Mr. Allen's article explains its construction and shows that most of such complaints are not justified.

crossing signals near my home. The complaint was unfounded, as investigation showed later in the evening. The trouble was in a corroded battery connection on my set. The time synchronized with the running of the trains, but the real trouble was in the vibration set up by the train shaking the corroded connection.

Before you make any complaint of any sort, it is up to you to go over your set very thoroughly and be sure that the trouble is not in it. The next thing to be sure of is that it does not come from some electrical apparatus that you are using in your own home.

Interference in radio sets may be caused by motors, sign flashers, heating pads, violet ray machines, flat irons, door bells, light switches, storage battery chargers, annunciator systems, stock tickers, ignition systems, electric elevators, electric furnaces, moving picture equipment, and high voltage testing equipment.

When you get a noise in your set, disconnect the antenna and ground wires from your set. If you get the noise just the same, the trouble is somewhere in the set itself. If you can not get at the trouble yourself you should take the set to a competent service man.

If the noise stops when the antenna and ground are disconnected, the trouble is somewhere else. If you have a set that uses a loop, disconnect the loop and join the posts with a wire. If the trouble is in your set you will still hear the noise. If it is outside your set it will stop.

The next thing to do is to open the main switch on the house meter board. If the noise stops when the main switch that supplies the current to the house is pulled the trouble is somewhere in your own house. You will then have to try out one piece of electrical apparatus after the other until you find the one that is creating the disturbance.

Power companies are going so far now as to have apparatus that they sell to consumers tested in their own laboratories to be sure that none of it can cause radio interference.

The electric lighting companies are doing their bit to help eliminate radio interference. There is no reason why you should expect them to help you until you have done everything possible to locate the trouble yourself.

To that end we are printing a series of questions for you to sit down and answer before you blame anybody. Unless you can answer all of these questions, and answer them fully, you have no right to blame the power company in your town for radio interference.

The chances are better than ten to one that by the time you have answered all the questions you will have located the source of interference for yourself, and will not need to bother the power company at all.

In closing, let us explode once and for all the beautiful theory that radio interference is caused by a "leaky transformer"! I saw the private records of one large power company. Out of all the cases of "leaky transformers" that had been reported, but three were due to transformers themselves. In each of these three cases the trouble was due to a wire from the secondary touching the shell outside the transformer.

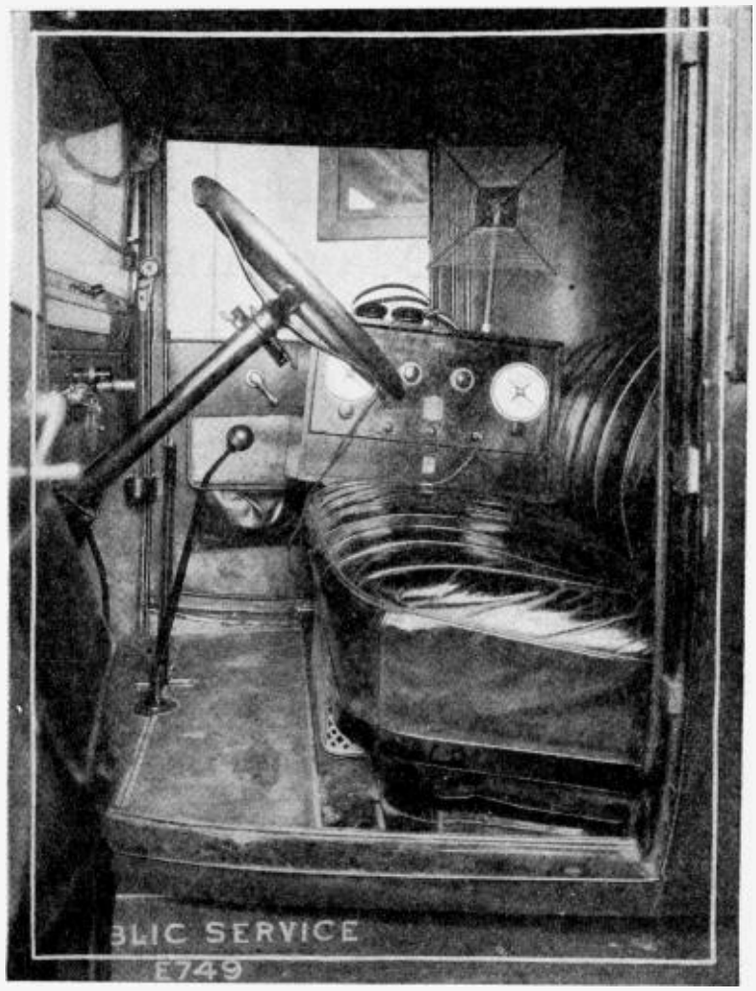
If you will look at the diagram of a transformer that accompanies this article, you will see that the transformer is filled with oil up to the top, and that therefore any of the so-called shorts that are popularly attributed to transformers could not occur.

In spite of what I have said in defense of transformers, there are "freak" happenings now and then which are interesting. One is reported by the Bureau of Navigation of the Department of Commerce.

An old piece of tin carelessly thrown against a transformer on a 2300 volt electric light and power line in Oklahoma was found to be the cause of many complaints from the radio listeners in that vicinity and was noticeable for more than fifteen city blocks. Removal of the piece of tin by a radio inspector resulted in the elimination of the trouble.

And now, in conclusion, let me say that we are still offering to pay $50 for any usable letter of about 2000 words from a reader who will give practical details of how he or his community traced down such interference and eliminated it.

We have received a number of such letters in response to our offer last month and one or two of the prize winning contributions will be printed in our June issue.



The interference-chasing set installed in an automobile ready to trace down the sources of radio troubles.

Proper Form For Interference Complaint

BY FILLING out this questionnaire you will probably discover for yourself the cause of your radio interference.

1. *Name of party complaining.*
2. *Address of party complaining.*
3. *Type and make of set.*
4. *Do you use antenna or loop? If loop, have you attempted locating noise by loop bearing? If so, what do you blame?*
5. *Number of stages radio amplification ordinarily used.*
6. *Number of stages of audio amplification ordinarily used.*
7. *When does the trouble ordinarily occur?*
8. *Continuous? Day only? Night only? If intermittent, give exact time it starts and stops for seven days:*

Sunday starts	*Stops*
Monday starts	*Stops*
Tuesday starts	*Stops*
Wednesday starts	*Stops*
Thursday starts	*Stops*
Friday starts	*Stops*
Saturday starts	*Stops*

9. *Does it synchronize with the lighting of street lights?*
10. *Does it synchronize with a neighboring factory?*
11. *How many listeners in your vicinity are having the same trouble? Submit a copy of their report along with this. Give their names and addresses below.*
12. *Nature of noise— low frequency hum? Similar to static? Roaring? Hissing?*
13. *Can the interference be tuned to a maximum?*
14. *If so, is it broad? Sharp?*
15. *Near what station setting is the noise most experienced?*
16. *Is there any change in the tone or intensity of the disturbance when the main house lighting switch is opened?*
17. *Has anyone who understands radio sets and circuits examined your batteries and your set? If so, to what did he assign the trouble? Give his name and address.*
18. *Has the following test been made? With the antenna and ground leads disconnected and these terminals shorted by a piece of wire, is any noise present when the receiver is operated in the usual manner? This test will definitely indicate whether outside interference is present, and the relative amount of the total interference experienced that may be charged to it.*
19. *When did you first notice the disturbance above referred to?*
20. *How long has your radio set been installed?*
21. *Give any other information directly connected with the interference.*

This table is a compilation of several such tables suggested in a report on Radio Interference, compiled by the National Electric Light Association, 29 West 39th St., New York City. Permission has been given this magazine to reprint from the report. Copies of the report are obtainable for a nominal charge.

Radio and the MUSIC STUDENT

Conducted by G. W. HARRIS

Bizet's "The Pearl Fishers"

GEORGES BIZET, one of the most distinguished French composers of the nineteenth century, was born in Paris, on October 25, 1838, and died on June 3, 1875. Nurtured in an artistic atmosphere—his father was an excellent teacher, his mother a sister of the talented pianist Mme. Delsarte, and his uncle, a musician, was the founder of the famous Delsarte system—he showed his musical proclivities in early childhood, and was admitted to the Paris Conservatory when only nine years old. There he was a highly successful pupil for ten years, studying the piano with Marmontel, the organ with Benoist, harmony with Zimmermann, and composition with Helevy, whose daughter he married in 1869. In 1857 he won the Conservatory prize contest for an operetta and in the same year also won the Grand Prix de Rome.

Returning to Paris, he produced his first grand opera, "Les Pêcheurs de Perles," in 1863, and in the same year composed "Vasco di Gama," which was not performed. "La Jolie Fille de Perth" was staged in 1867, and a one-act opera, "Djamileh," in 1872. None of these enjoyed more than passing success at the time, and it was a long while before Bizet's music gained general recognition. This came with orchestral performances of his overture, "Patrie," and the two symphonic movements, and the full tide of popular favor was turned with his incidental music to Daudet's play "l'Arlesienne," produced in 1872. The orchestral Suite made up from this very poetical score was popularized in America by the late Theodore Thomas.

With his masterpiece, "Carmen," Bizet was at last to appreciate and enjoy a real and striking dramatic success—but it was his last work. "Carmen" was produced in March, 1875, and just three months later he died of acute heart disease.

"Les Pêcheurs de Perles" ("The Pearl Fishers"), grand opera in three acts, the libretto by Carré and Cormon, was first produced in Paris, on September 29, 1863. London heard it, as "Leila," in 1887. It was performed at the Metropolitan Opera House, New York, in 1896. This opera contains music of great charm and originality, exhibits in its orchestration Bizet's mastery of 'local color,' and in several of its scenes discloses a dramatic force that foreshadows the power and variety of "Carmen."

The scene is laid in Ceylon, in ancient time, and the story deals with the love of two pearl-fishers for the priestess Leila.

Act I opens with a chorus, "On the Strand." The people are assembled on the shore of the island for a ceremonial dance and festival. Zurga (baritone) announces that a chief must be chosen to head the tribe, and is himself named. Nadir (tenor) appears, after a long absence in the forest. (Nadir: "Plains and forests.") Zurga welcomes him, as the dance continues, and they renew their friendship of former days.

Nadir recalls their visit to the temple, when a woman as beautiful as a goddess suddenly appeared, with whom they both fell in love and over whom they quarreled. Zurga, as a boat now approaches, relates how each year on a certain day a strange woman comes to pray on the rocks above the village. No one dares to look upon her face, but her prayers protect and help the tribe. Leila (soprano), closely veiled, steps from the boat, followed by Nourabad (bass), the high priest. The people greet her with the chorus "Deign to accept our gifts," and ask her intercession with the spirits of the deep.

Adjured by Zurga, Leila promises to remain veiled, to live in purity as the priestess and protectress of the tribe, to invoke good and drive evil away. Zurga swears that if she keeps her oath, she shall receive a pearl of great price, but if she breaks it, death will be her punishment. She solemnly repeats the oath. Chorus: "Brahma, divine Brahma, may thy hand protect us." Leila proceeds to the temple with Nourabad. The people disperse.

As night falls, Nadir, left alone, confesses that he has recognized Leila as the aforetime apparition in the temple, and he determines to tell Zurga. (Nadir: "Once more I think I hear.") He lies down on the ground and falls asleep. The priests build a fire on the rocks, as Leila and the chorus sing "O Brahma, god, O sovereign master," and Leila follows with the aria "In the cloudless sky sown with stars." Nadir awakes, and recognizing her voice, calls softly to her. She answers subtly in her song, and in the darkness he hastens to her.

In the next act, after a chorus, "Darkness falls from the heavens," Leila begins her soli-

SCHEDULED FOR MONDAY EVENING, MAY 24

BROADCASTING over the WEAF Link on Monday evening, May 24, the WEAF Grand Opera Company will present in tabloid form Bizet's opera

"Les Pêcheurs de Perles"
("The Pearl Fishers")

with the following cast of characters:

Leila (Soprano).....Genia Zielinska
Nadir (Tenor).....Giuseppe di Benedetto
Zurga (Baritone).....Carl Rollins
Nourabad (Bass).....Nino Riusi

Chorus and Orchestra, all under the direction of Césare Sodero

This will be a rare treat for music lovers

SCHEDULED FOR TUESDAY EVENING, MAY 18

TO BE broadcast from Crosley Station WLW, Cincinnati, on Tuesday evening, May 18, by the Formica Symphony Orchestra under the leadership of William C. Stoess

Grieg's "Peer Gynt" Suite

No music-lover will want to miss this

tary vigil in the ruined temple. (Leila: "I tremble, I fear.") She hears the cries of beasts in the jungle, and coming gradually nearer, Nadir's song. (Nadir: "O my beloved, a hidden flower art thou.") She joins in the duet, "By this narrow path," and Nadir passionately declares his love.

As they embrace, Nourabad, who has been watching them in secret, calls the people and tells them that the priestess has broken her vow. Nadir protects Leila, and the pearl-fishers threaten him with their knives and demand his death (Chorus: "No! Death! Death!"), but Zurga appears and commands them to depart. As Nourabad tears off Leila's veil, Zurga recognizes her. A storm breaks in fury, and the people kneel in prayer (Chorus: "Brahma, divine Brahma"). Nadir is carried off, and the priests lead Leila away.

Act III shows Zurga standing in the door of his tent by the sea, stricken with remorse for having condemned Nadir to death. Leila is brought to him, and implores him on her knees to save Nadir's life.

Zurga now declares his love for her and his jealousy of Nadir. She curses him. Nourabad comes in to announce the coming sacrifice, and the people follow and begin a barbaric dance.

As Leila is led out by Nourabad, she sees her lover in chains. (Nourabad: "O sombre gods.") Seeing a light in the sky, the people hail the dawn and advance, brandishing their knives, to strike. But Zurga, who has set fire to the camp, intercepts them and shows them it is not the dawn.

As the terror-stricken pearl-fishers hasten to save their families from the flames, Zurga breaks Nadir's fetters, and the lovers embrace. Nourabad brings back the people, and, in aiding the lovers to escape, Zurga is struck down by a knife thrust and dies as they disappear, after having climbed to a rock high above the shore, the opera ending with the beautiful trio by Leila, Nadir and Zurga, "No more fear, but sweet embraces."

Grieg's "Peer Gynt" Suite

NORWAY'S greatest music maker, Edvard Hagerup Grieg, born in Bergen, on June 15, 1843, was descended from a Scottish Covenanter, Alexander Grieg, merchant, who emigrated from Aberdeen to Norway soon after the battle of Culloden, in 1746. His father, as had his grandfather, served as British consul at Bergen. His mother was a daughter of Edvard Hagerup, for many years mayor of Bergen, the second city of Norway.

From her Grieg no doubt inherited both his predisposition for music and his intensely patriotic nature. She was a loyal daughter of Norway, and was a pianist and a singer of conspicuous ability. She began to give her boy piano lessons when he was six years old. He made good progress in his musical studies, and even composed several little pieces of his own, but before his fifteenth year there was no serious thought of a musical career for him.

In that year Ole Bull, the celebrated Norwegian violinist, visited his father's house, and having heard the lad play some of his youthful pieces, prevailed upon his parents to send him to Leipsic that he might become a professional musician.

Thither he went in 1858, to remain a student at the Conservatory for four years and to be graduated with honors in 1862, despite an attack of pleurisy which destroyed one of his lungs and compelled him to return home for a year of rest and recuperation.

At Leipsic, Grieg came under the dominant influence of Mendelssohn and Schumann, and his own individuality for a time nearly suffered eclipse. On returning home, however, he fell in with Rikard Nordraak, a young Norwegian composer of brilliant promise, who died in 1866, before completing his 24th year.

Nordraak was ambitious to produce genuinely national Norse music, and, brief as their friendship was, it served to set Grieg, whose talents lay in the same direction, on the right path. Now fairly launched upon the career of a pianist and composer, he became a "determined adversary of the effeminate Scandinavianism which was a mixture of Gade and Mendelssohn," and with enthusiasm entered upon the work of developing independently in artistic forms the musical idioms of his people.

In 1867 Grieg married Miss Nina Hagerup, his cousin, who inspired many of his beautiful songs, and whose singing of them helped

The WEAF Grand Opera Company in rehearsal. Césare Sodero conducting. This is as the group appears when the evening starts, but it doesn't take long for the closely draped studio to get hot and stuffy and then coats and collars come off, sleeves are rolled up and—the whole scene looks different!

to spread her husband's fame in many European cities. In 1867 also he founded in Christiania a musical union of the followers of the new Norse school, which he continued to conduct for thirteen years. Besides giving concerts in the chief Scandinavian and German cities, and making a visit to Italy, Grieg at this period was increasingly industrious in composition. He was remarkably active for a semi-invalid.

Franz Liszt, happening upon Grieg's first violin sonata (Opus 8) in 1868, forthwith sent him a cordial letter of commendation and encouragement, inviting him to Weimar. This letter induced the Norwegian government to grant him a sum of money that enabled him to go again to Rome in 1870, where he met Liszt, and the two musicians at once became firm friends. At their second meeting Liszt played from the manuscript Grieg's piano concerto (Opus 16), and when he had finished said: "Keep steadily on; I tell you, you have the capability, and —do not let them intimidate you!"

Thenceforward the recognition of his genius steadily increased. In 1872 he was appointed a member of the Swedish Academy of Music; in 1883 a corresponding member of the Musicial Academy at Leyden; in 1890, of the French Academy of Fine Arts. In 1893 the University of Cambridge, England, made him a Doctor of Music, at the same time that it honored with the same degree Tschaikowsky, Saint-Saëns, Boito, and Max Bruch. Grieg's later years were spent chiefly at his home near Bergen, and he died there on September 4, 1907.

In his music, Grieg utilized the characteristics of the folk-songs and folk-dances of that Northland he loved so ardently, often etherealizing them into things of weird but compelling beauty. And this gives to his work an exotic touch, and at the same time a certain fascination, for he succeeds in evoking as if by magic the moods of the place and the people.

On the wings of his music we are carried to the Land of Fjords, we breathe its inspiriting air, and our blood dances and sings with its lusty, yet often melancholy, sons and daughters. Intensely nationalistic as his music is, it is at the same time remarkably individualistic in style—every bar of it is stamped with the mark of his peculiar genius.

He never wrote an opera, or a symphony — never attempted anything but what he knew was within his powers. He was a lyricist, of exquisite delicacy of feeling, and by clinging to his own ideal of the beautiful he proved that real masterpieces can be created in the smaller, even the smallest, forms.

It was one of the proudest days in Grieg's life when he received, in January, 1874, a letter from Henrik Ibsen asking him to write the music for a stage presentation of "Peer Gynt." That fantastic and imaginative "dramatic poem," with its scenery of mountains and fjords, and its characters of human beings, elves, and trolls, had been published seven years earlier, but had been deemed impossible for the stage.

Grieg composed for Ibsen's play a number of inspired pieces which made the production a far greater success than had even been hoped for. Subsequently, four of these pieces grouped as an orchestral suite and played in concert halls helped probably more than any of his other works to make him known the world around as an original and fascinating composer. The titles of these four famous pieces are: 1. "Morning" (or, "Daybreak"); 2. "Aase's Death"; 3. "Anitra's Dance," and, 4. "In the Hall of the Mountain King."

"Morning" is an exquisitely beautiful idyl, representing daybreak in Egypt. Peer Gynt stands before the statue of Memnon in the hush of dawn and watches the rays of the rising sun strike upon it, when, true to the ancient tradition, the statue sings. The melody of this piece is of extreme simplicity and lyric beauty, as pure and fresh as the dawn. As the sun rises higher the music swells in volume and power, until a full and joyous climax is reached. Then the music diminishes and dies away in broken snatches.

"Aase's Death" is one of the most sorrowful adagios ever penned, and withal a movingly beautiful one, cast in the form of a funeral march. After many adventures, Peer returns to his mother's hut in his native village, and finds her on her death-bed. He remains with her through the night, in the course of which she dies. Scarcely more than a musical transcript of a mood—the mood of gloom produced in Peer by the death of his old mother, Aase—the piece is extremely interesting, and its simple, song-like melody is made the more impressive by a most felicitous harmonic treatment, which throughout the piece is highly ingenious and characteristic of Grieg and gives it a somber sincerity and strength.

"Anitra's Dance," dainty, most charming in invention, and tinted with the art of a magician in tonal colors, is light and rapid, tender and winningly graceful, full of arch defiance, playful witcheries, and coquettish confidence. Anitra, the light-limbed and dark-eyed daughter of the Bedouin chief, has won the special favor of the prophet, and dances alone before him after her companions have retired. Peer is enraptured and promises to make her an houri in paradise and to give her a soul, a very little soul, in return for her love and service. She is not much tempted by that offer, but at length consents to fly to the desert with him if he will give her the large opal from his turban.

"In the Hall of the Mountain King" provides a startling contrast. This is a grotesque dance of the trolls — gnomes, goblins, kobolds — or Norwegian mountain sprites. After deserting the unfortunate Ingrid, Peer fled still farther into the rugged mountain forest, where he was surrounded when night came by a crowd of trolls, who alternately teased and entertained him by their pranks and antics, until they were scattered by the sound of the distant church bells at dawn.

The baroque style of the music admirably depicts the clumsy nature of these folk.

Aids to Appreciation

EXCERPTS from Bizet's opera "The Pearl Fishers" are procurable in phonograph records as follows:

Columbia Records—

"Methinks Again I Hear" (Nadir's song in Act I), sung by Florencio Constantino (7031M), $1.50.

The same, sung by Dino Borgioli (2018M), $1.00.

Victor Records—

"In the Depths of the Temple" (duet from Act I), sung by Caruso and Ancona (8036), $2.50.

"In the Temple" (duet from Act I), sung by Clement and Journet (8017), $2.50.

"As in Former Times" (from Act I), sung by Galli-Curci (6124), $2.00.

"I Hear as in a Dream" ("Methinks Again I Hear" from Act I), sung by Caruso (6026), $2.00.

The same, sung by Smirnov (6105), $2.00.

"O My Beloved" (Nadir's aria from Act II), sung by Caruso (513), $1.50.

Aids to Appreciation—"The Peer Gynt Suite"

THE best book in English about Grieg is Henry T. Finck's "Grieg and His Music," published by Dodd, Mead & Co., New York.

Ibsen's "Peer Gynt," translated by William and Charles Archer, is published by Charles Scribner's Sons, New York, at $2.00.

The "Peer Gynt" Suite arranged for piano is published by G. Schirmer, New York, at 65 cents; and also by Oliver Ditson Co., Boston, at 75 cents.

Phonograph records of the "Peer Gynt" Suite are available as follows:

Brunswick Records—

"Morning" and "Anitra's Dance," played by Capitol Grand Orchestra (2407), $0.75.

Columbia Records—

"Morning" and "Aase's Death," played by Columbia Symphony Orchestra (A6109), $1.25.

"Anitra's Dance" and "In the Hall of the Mountain King," played by Columbia Symphony Orchestra (A6110), $1.25.

"Anitra's Dance," played as violin solo by Toscha Seidel (33042D), $1.50.

Edison Records—

Peer Gynt Suite, complete, played by Sodero's Band (80216), $1.50.

Victor Records—

"Morning" and "Aase's Death," played by Victor Concert Orchestra (35470), $1.25; played by Pryor's Band (35007), $1.25.

"Anitra's Dance" and "In Hall of Mountain King," played by Victor Concert Orchestra (18042), $0.75.

Reproducing piano records:

Duo-Art—

Played by Percy Grainger, Parts 1 and 3 (6522-4), $3.00; Parts 2 and 4 (6530-3), $2.75.

Played by Carolyn Cone Baldwin, Parts 1 and 3 (60829), $2.25; Parts 2 and 4 (61348), $2.00.

Welte-Mignon—

Played by Olga Samaroff, Parts 1 and 2 (C1479), $2.00; Parts 3 and 4 (C1480), $200.

Ampico—

Played by Howard Brockway, Parts 1 and 2 (55725H), $2.00; Parts 3 and 4, played by Brockway and Marguerite Volavy (55244H), $2.00.

Come On, Senate; We Want That RADIO BILL

The Public, the Industry and the Broadcasting Stations are Crying for Relief, So Why All This Delay?

By

R. S. McBRIDE

Washington Representative of the Radio Home

The world's greatest artists are now singing and playing for the radio audience. Without proper regulation of stations, their music will be ruined by interference. The photo shows A. Atwater Kent signing contracts with Louise Homer (left) and Anna Case (right) for the Atwater Kent Radio Hour over the WEAF network.

RULES for navigation of the high seas have been growing up, first by tradition and later by national or international agreement, from the earliest times. All of these rules have as a first consideration the safety to life and property, the delivery of goods and passengers promptly and in good order at the desired destination.

Beginning in the early years of this century similar rules for navigating the ether seas began to be needed, and numerous conferences in this country and with other nations have resulted in some broad principles for this traffic. In the United States, however, we have not had as complete regulations as really seem necessary for ether traffic. Basically, this is the most important reason why the best minds in the industry have been working for the adoption of new legislation by the Congress of the United States during the present session.

We really need radio legislation: we must have the proposed radio law this year. This is a very strong statement; but it is a completely defensible one.

Unfortunately, ether traffic is not as simple and controllable in all respects as the movement of ships on the sea.

When any boat sets out from its dock it has a single, well-known destination, or certain course with definitely established ports of call. He who would travel upon it knows with reasonable certainty where and when he may leave the vessel.

But as an ether voyage is undertaken by the radio message it may end everywhere or nowhere. There is such a thing as definite point-to-point communication and this is now the basis of our principal commercial radio business. But most of the radio messages are privateers of the ether seas which rove without destination and lay their course to any point of the compass without guide or control once they have left the sending antenna.

This would not be so bad a situation were each message a simple and independent thing. Thus it makes no difference to a liner depart-

ing from New York harbor what may be the destination of yachts or pleasure craft that flit about. All that is necessary is that the pilot on the bridge shall steer clear of them as he passes down the harbor.

But in the *radio* harbor of New York every little transmitting station, although only of a few watts power, is actually in collision with every other radio station within its range at once when it begins to send on the same wave length. It is just as if each vessel had to have the whole of New York harbor to itself in order to be safe, or it sometimes seems almost that bad.

We might say that there is little harm in the rambling promiscuous effort of such small-power radio stations, because the Leviathans of the air easily overpower them and are received by every would-be listener almost without regard to the five-watt effort. In a sense this is true, but there are many stations which are more like a high-speed steel-prowed destroyer than a row boat. They are small by comparison with the Leviathans of "superpower"; but still they are quite powerful enough to do great damage even to these big fellows if in collision.

As a matter of fact the best technical investigators seem to have definitely proven that two stations of moderate power are not possible on the same wave length unless separated practically by the full width of the American continent. This practically means that for each radio harbor, (that is each radio wave length) we can have only one boat. And unfortunately Nature has determined for us within the range of ordinary radio listeners' ability that there are less than one hundred such radio harbors.

The Department of Commerce has recognized all these principles and despite a very inadequate legislative authority, has made a surprisingly satisfactory arrangement for the use of all available wave lengths. This was not much of a problem five years ago because at that time there were very few broadcasting stations in existence.

Today the situation is very different because there are approximately 600 broadcasters and half as many more who would like this privilege. Actually there is no way that has been proven by thorough court test in which the Department of Commerce can decline to grant the broadcasting privilege to these newcomers even though there be no comfortable room to accommodate them on our radio ether map.

The Department *must* be given adequate authority to limit the number of licenses in the interest of the public. Otherwise there will be only confusion replacing the present congestion and all of us listeners will fail to get even the present amount of protection from the Government.

The radio industry has been good to all of us and very courteous to the Department of Commerce in voluntarily acceding to Departmental regulations which, at many points, had a very doubtful basis in law. Mr. Hoover has complimented the industry on exhibiting the finest example of self-regulation to be found in industrial history.

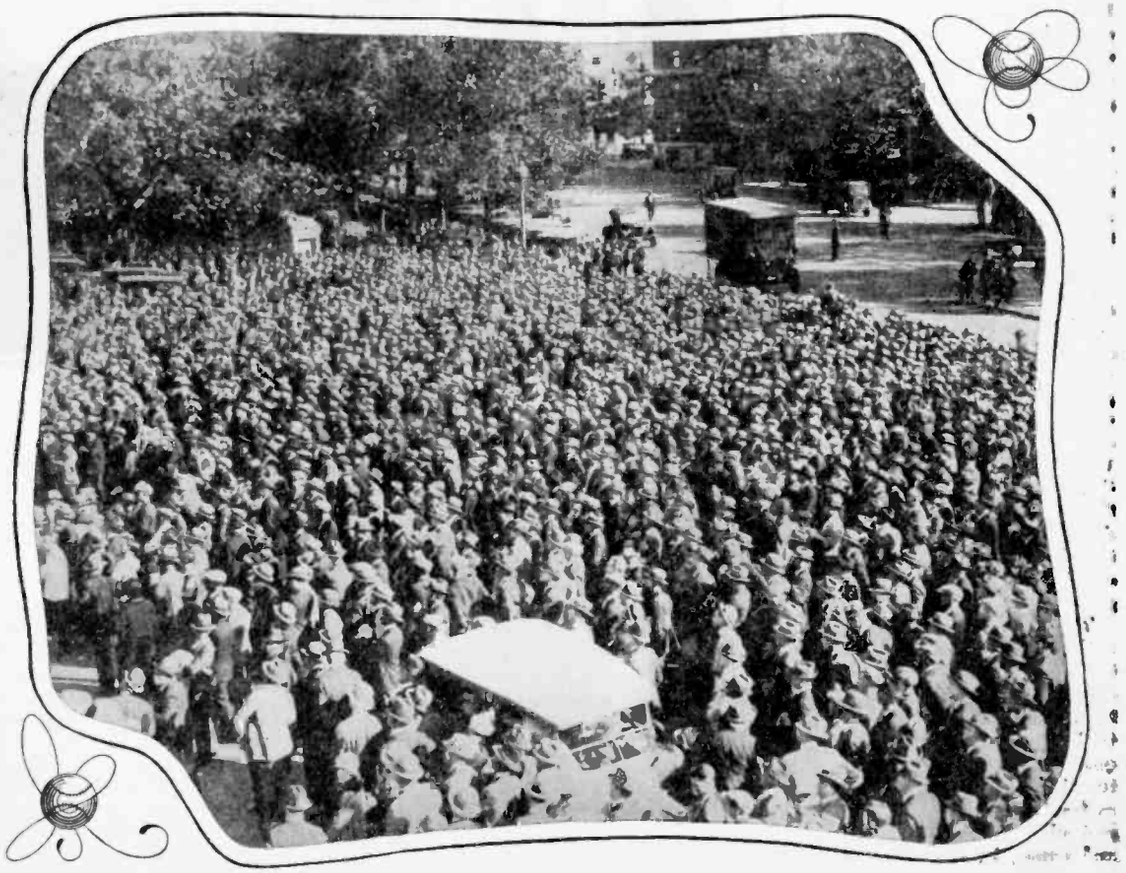
But even in so fine a group there are some who must be controlled by force; they seem unaffected by the plea for the greater good of the general public.

One such concern, in a rather mild sort of a way, has clearly pointed out the tremendous possibility for damage to every one of us listeners if his methods were widely practiced This broadcaster simply appropriated for his own use the wave length which he desired, doing this altogether without Government approval, and, in fact, quite contrary to the definite regulations of the Government.

Just imagine what would happen if all the other hundreds of would-be broadcasters should try the same tactics. No one would be able to tell at what minute his favorite station would find itself in competition with one or a dozen other stations, each blithely sending some variety of entertainment or education upon the same wave length. The heterodyne whistles and the other forms of most

What the White Radio Bill Provides

1. *Retains the ether as "the inalienable possession of the people.*
2. *Requires licenses for all who would operate stations to transmit radio signals.*
3. *Makes all regulations "as public convenience, interest, or necessity requires."*
4. *Forbids licenses to aliens or the transfer of license rights to anyone without Government approval.*
5. *Limits licenses to five years and forbids monopolistic effort in radio.*
6. *Forbids "vested property right in the license" and provides for revocation upon failure to serve public properly.*
7. *Affords appeal from Department decisions to a radio commission or to the courts in case of need.*
8. *Forbids paid propaganda by radio without appropriate announcement, but in no way restricts legitimate radio publicity.*
9. *Requires licenses for operators of stations and permits before new stations may be built.*
10. *Creates a "Federal Radio Commission" of five members to hear appeals and advise regarding any important radio matter referred to it by the Secretary of Commerce.*



Radio brings the sporting events to countless thousands gathered, like this, in groups in every city in the country. They haven't bought radio sets—yet. But they will. And even now they form part of the vast radio audience that is looking to the Senate to take some action this session on the pending radio bill.

annoying interference which now occasionally destroy what would otherwise be a delightful and a profitable hour are as but the buzzing of a mosquito in contrast with the din of a boiler factory by comparison.

Representative W. H. White, of Maine, has been studying the situation and cooperating with the Department of Commerce for several years. Out of his effort has grown one of the most constructive and helpful forms of proposed legislation that has ever been offered for the consideration of the radio industry since the advent of broadcasting.

The House of Representatives Committee on Merchant Marine made a careful study of this bill and held hearings in which all interested parties were given full opportunity to present their comments on the bill. As a result there was reported to the House and passed a splendid set of regulations giving ample authority to the Secretary of Commerce to regulate this form of traffic.

It now becomes the duty of the Senate of the United States, working particularly through its Committee on Interstate Commerce, to consider this bill and determine whether it shall be adopted.

Everyone who has the best interest of the radio industry and the radio listener at heart seems to favor this bill. It corresponds in its major portions with the recommendations which were made to the Department by the last annual conference at which manufacturers, broadcasters, and the radio public were ably represented. I, for one, hope that the Senate will find opportunity to pass this bill and that the President will sign it, making it a law.

One of the fine features of the White bill is the great emphasis placed upon "public convenience, interest, or necessity." Every act in which discretionary power is to be exercised by the Secretary of Commerce must be carried out with this dominating principle in mind. Whether or not a new license shall be granted, the nature of service to be rendered, the wave length, power, and operating practice, all are determined by this test. Thus, you and I, the radio listeners of the country, are recognized as the ones whose wish and interest must prevail.

This bill will not be a cure-all, for there will remain many problems of great importance still to be solved. It does do, however, everything that can at this time be safely done by legislation. It very wisely does not try to lay out in minute detail all of the requirements for every station. To have attempted this latter would be just as absurd as for the Congress to undertake to prescribe just where each of us shall dock his row boat and canoe, by our summer cottages or tents.

And even under the law there is no expectation that even the least of the Department's inspectors will bother with such detail.

The important thing is that the major rules for ether navigation will be safely prescribed. The Leviathans of the air and even those of lesser size which do a large and important service to the people (the listeners) will, however, have very definite requirements laid for them. And, too, these high-power stations will be given certain rights of way upon the air which must not be interfered with, even locally, by the ether row boat or pleasure launch nor by the fine private yacht.

On the other hand there will be laid out by the Department great ether areas on which the amateur can paddle about and splash recklessly at will. These areas will be so defined that he can have a splendid time whether it be a one-watt canoe or a hundred-watt private yacht he drives upon the ether waves.

But he will not be allowed to play around the dock where the trans-Atlantic ether liners take on their passengers, mail, and freight. Nor will he be tolerated if he attempts to get in the way of the finer broadcasting stations which are really giving us each night as marvelous ether tours as a personally conducted voyage about the Mediterranean could possibly be.

One rather amusing theory has been proposed by one of the members of the Senate of the United States. This Senator says that everyone who wishes should be permitted to have a broadcasting station and that the biggest of them should never exceed 500 watts. He even goes so far as to say that the interconnection of stations to give a national circulation to important programs should be forbidden.

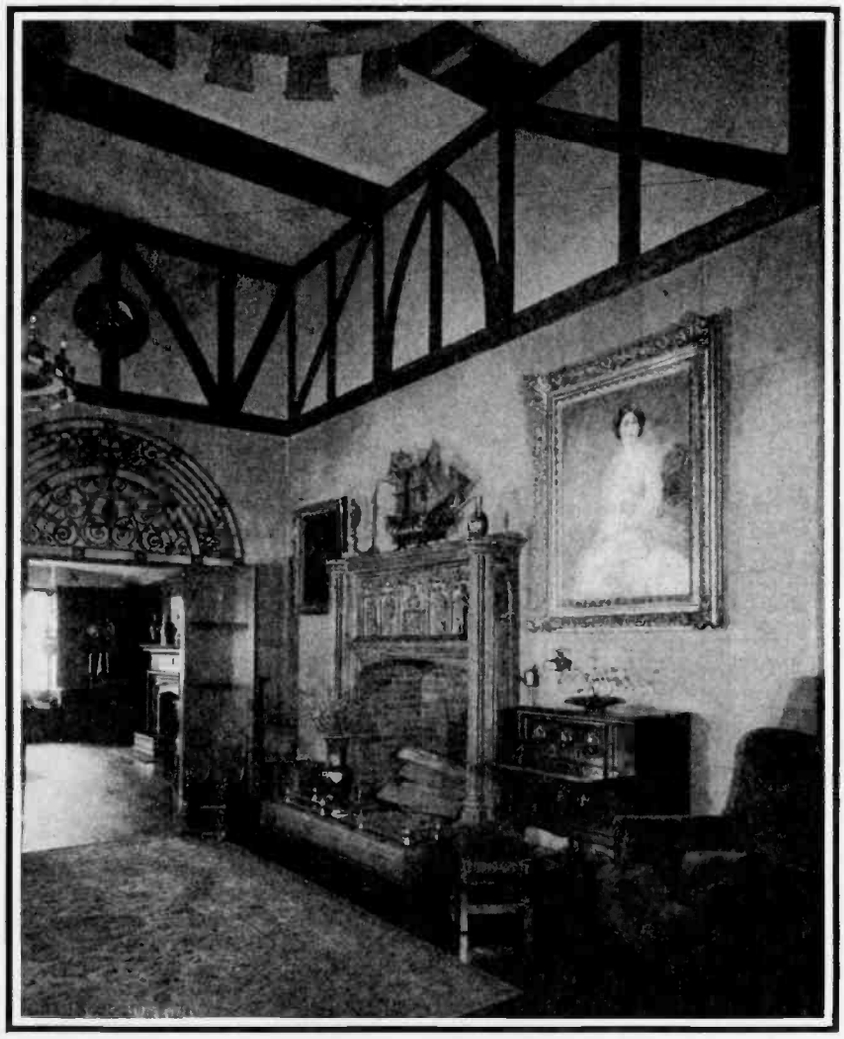
I wonder if this same Senator thinks we should have legislation forbidding any boats more than 100 feet long and that no company offering trans-Atlantic service should be permitted to own more than one such boat. I, for one, am not a good enough sailor to choose the Mayflower or a like ship for a pleasure trip to Europe (or a business trip either for that matter). We passed the Mayflower stage more than a century ago. And it is equally true that we have already within six short years passed the stage when 500-watt stations adequately serve the bulk of the listeners.

On the high seas there are far too many hazards even at the best. Fire, storms, icebergs, and many like dangers even today, take toll of many lives. But the greater the ship the less likely is it that these dangers shall become the cause of loss in life or serious damage to property.

So, too, in our ether navigation. It is doubtful whether a 500-watt station can be guaranteed safe passage for any message or program under every condition of radio weather more than thirty miles. Is it not silly, therefore, to insist that this is the highest power station which we may have?

Five thousand watts will almost certainly guarantee safe passage for the message a hundred miles; and that is little enough distance in a nation of great distances such as this.

Uncle Sam has provided for the safety of navigation on the high seas and on inland water by many aids to navigation. There are light-houses, light-ships, buoys, radio compass stations, and all manner of guides for the pilot. The master of every ship which is subject to regulation must have a license which can be obtained only when it is known that he is a competent and trustworthy individual. Life-boats and rafts, signalling equipment, and many forms of safety apparatus are prescribed. Not content with these mechanical safeguards, the Government maintains



When radio becomes part of the family life in a home like this, as well as in the humbler homes where it really started, it is only fair that Congress should provide some authority to prevent "air-pirates" from marauding in the ether. The photograph shows an Eagle neutrodyne in the home of Arthur Stephen Ford, 27 West 67th Street, New York City.

facilities for sending storm warnings and patrols the areas which are infested with icebergs at certain seasons. Practically all of this service to sea traffic is furnished by the Department of Commerce. A splendid tradition has been built up in this Department that there must be insured to every traveller the maximum of comfort and of safety.

It is logical that the similar problems involved in radio should be entrusted to the Secretary of Commerce and his staff. It is already well demonstrated by experience with this Department that the element of service to the public will never be forgotten in the planning or execution of radio rules. It is more than a fortunate circumstance that gives promise of having the radio regulations managed in this Department.

Some of those who have been talking of radio regulation make great point regarding monopoly, patent, copyright, and rate-fixing matters. No doubt these all are exceedingly important to some individuals but for the present we listeners are not half as much concerned about them as we are that Uncle Sam shall give some of his Department of Commerce officials authority enough to police the ether routes for us.

As things now stand it will be the Senate of the United States that determines whether or not you and I have this protection of an improved radio law. About the time this article reaches the readers of *The Radio Home* our senators will have this matter before them in a form that they may safely act upon. If you and I do not hear by the middle of May that the Senate has passed such a bill it will be up to us to make our wishes known. One of the most effective ways to do this is a letter to the senators from your own state.

I hope that this form of urging will not be needed, but if it is needed we need have no hesitance about exerting our influence. There is nothing in the way of "hokus-pokus" in the proposed bill. It is a simple straightforward law giving the Secretary of Commerce the right and responsibility for regulating radio stations of all kinds in the public interest. If the middle of May arrives and the prospects for passing this bill are not first-class I, for one, intend to use my influence in an effort to stir up action.

I anticipate that there will be no real opposition to the bill. But inertia, which leads to inaction, is just as fatal as opposition. If the need does come I trust that every other reader of *The Radio Home* will join with me in demanding that the Secretary of Commerce be given the same privilege for the safeguarding of our interests as he has for the safeguarding the interests of those who use the navigable waters in and about the United States.

A Whole City Sings

to Radio Music

Receivers and Loud Speakers in the Parks of Los Angeles Announce the Selections, Give the Pitch and Start the Crowds off, and the Stunt is Proving Increasingly Popular

By DR. RALPH L. POWER

Mrs. Mabel Socha, Vice President, Los Angeles Park Commission.

ONE of the most striking developments in the recent advance of radio's usefulness is found in the new radio department of the Los Angeles Park Commission.

The original experiment was tried out in Westlake Park where the Sunday afternoon attendance rapidly rose from 1,500 to 10,000 and even double that number on special occasions.

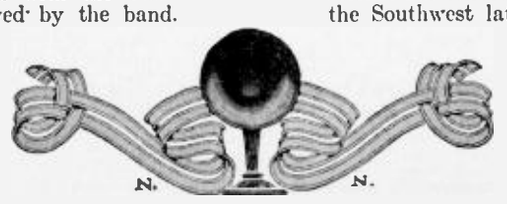
A remote control line was established between the park and one of the local broadcast stations. From two until four o'clock on Sundays the programs are sent out from Westlake and broadcast from the radio station. Seven other parks have good sized receiving sets and the identical conditions of Westlake are carried on in the other recreational centers.

Take, for instance, the community sing at Westlake. The leader gives the pitch for the audiences in all the eight parks, the Westlake audience starts the number and the people in the other parks join in. Certainly there is no other place where such a condition could exist—thousands of people out under the skies joining together in community sings via radio.

The programs are also enjoyed by those who cannot get to the parks. Those who live on the outskirts of the 400 square mile area of Los Angeles write in about these community sings and general programs as do radio fans West of Salt Lake City.

The programs are varied and include, besides the community sings, vocal, instrumental and band music but, strange to say, the popular vote has been for more classic numbers and less jazz for, as one of the writers voiced it, "You can get all the jazz music you want in dance halls."

Each program closes with the Star-Spangled Banner played by the band. Those in the audience at the park rise to sing as do those who are out on the lake in boats of all kinds.



Fan mail from the San Diego naval base also discloses the fact that the park programs are received aboard ship and the sailors and officers alike stand smartly at attention during the closing number of the park programs. This was also true of sailors aboard the Idaho at sea recently when a radiogram was received in Los Angeles regarding the reception of the program.

The Board of Park Commissioners also has a portable receiving set for Exposition Park and Sycamore Grove where most of the state societies hold their picnics. Hardly a Sunday goes by without several of these gatherings and, as the regular receiving sets are at the band stand, the portables are installed in the picnic places.

The public address system has been installed in Westlake, Lincoln, Griffith, Hollenbeck, Sycamore, South, Exposition and Pt. Firmin parks.

One of the finest features of the entire plan, according to radio fans, is the fact that the solitude of the average radio studio is not transmitted. Instead, the listener hears the quacking of the ducks on the water, the swishing of canoes out on the lake and the applause of the audience.

This year's Christmas carol choir, which paraded through the city's park system in vestments, was the first carol gathering to have its music sent via the ether waves of the park commission's radio equipment.

Certainly nothing in the field of radio science has stirred the interest of fans in the Southwest lately quite as much as these park programs. It makes a great play on the emotional instincts and has made for a greater solidarity in neighborhood gatherings and in many sectional community sings.

In addition there is also a remote control line to the Coliseum which is the new huge amphitheatre seating 75,000 where the 1932 Olympic Games will be held in Los Angeles. From the Coliseum radio fans hear famous football games of the season and other notable sports events.

Any feeling which the members of the Commission may originally have had about the community sings and other radio programs has long since disappeared.

In fact other communities are falling in line. The Pasadena Chamber of Commerce has purchased a receiving set for Brookside Park where people will listen to the Los Angeles Sunday programs of the Park Commission. Other communities along the foothill region and in seaside colonies are also doing the same thing.

The entire pioneer radio work as well as the later broadened activities of the Park Commission's radio endeavors has been under the direction of Mrs. Mabel Socha, vice president of the Commission, who has long been a leader in civic movements. It was Mrs. Socha who conceived the original plan and who carried it through.

Technical and Hook-Up Section

Power For Your Speaker

Reproduction Without Distortion Demands Special Tubes and Voltages So High That Your Set Must Be Built To Work From the Light Socket

By HENRY M. NEELY

JUST about this time of the year the average radio fan begins to ease up in his interest in radio, apparently on the assumption that it is the tag end of the season and if there is anything new or particularly interesting coming, it will not be divulged during the Summer months. He therefore is contented to use his radio set as it stands until next September or October and to devote his spare time to his garden or his flivver or base-ball or golf, or any of the out-of-door things which rightfully claim the major share of his interest during the hot weather and the long hours of daylight saving.

Most of us who are in the radio game as a business are coming to share the views of the fan. I would love to find out right now just what the various manufacturers are planning to put out next season so that we could devote our next three or four issues to telling our readers all about it and so work up some interest which could rightfully materialize in the Fall when the devices are placed upon the market.

Unfortunately, most of the manufacturers are just as secretive toward magazine editors as they are toward the general public although we do manage now and then to edge our way in through a half open laboratory door and see some of the things that are going on in there.

This alleged staff of so-called editors have been rather carefully considering the plans for this magazine for next Winter and in the course of this consideration, we have discussed the tendencies which seem to us to promise the most wide-spread interest.

I think that we are fairly well agreed that the one outstanding tendency will be improvement in the *quality* of reception rather than the development of new circuits designed to get greater distance. We believe that the distance feature of radio will by no means be overlooked but we are inclined to think that no greater distance can be expected until and unless devices are developed for reducing the static or noise level of reception. In other words, the circuits which we are now thoroughly familiar with will reach out to the point where the noise is louder than the signal and no man can comfortably listen to radio under such conditions unless his one aim and object in owning a set is the collection of a long list of call letters on his log.

We get from virtually every section of the country the report that this particular phase of indoor sport is rapidly losing its hold upon the public in comparison with the immense growth of the audience which cares little or nothing for distance *per se* but which does want to be able to tune in a fairly near station and have a delightful evening's entertainment with musical quality that will satisfy even a trained ear.

In order to improve the quality of sets, most experimenters seem to be devoting their entire attention to the audio end of the circuit. This is all very well in its way though we have proved to our own satisfaction at our laboratory that there are many circuits on the market which introduce quite enough distortion in the radio frequency section to spoil the quality no matter how good the audio amplification is. Still, there are many other circuits which seem to be quite clear of this charge in the radio frequency circuits and therefore it is a very desirable thing to work on the audio end in order to provide as nearly perfect reproduction as possible.

I think the industry is coming to realize more and more that audio amplification without distortion is getting to be a problem of building a young power plant which is beyond the reach of the ordinary batteries. The tendency is toward the use of special amplifying tubes with something like 450 volts on the plates and a correspondingly high negative grid bias. This means, of course, that the amplifier must be plugged in on the house lighting system and that, in turn, means that there must be included in the outfit a complete rectifying and filtering kit.

I look for the next year to produce a number of such devices. Each one will probably require certain apparatus and I doubt if apparatus designed for one such circuit can be successfully substituted in another circuit. It is probable that the efficient operation of these devices—at least for the first year or two—will depend upon a very careful balancing of every single unit part and therefore it is unlikely that power plants of this kind can be built cheaply. I have an idea that the cost of the power plant alone with its tubes will just about equal the cost of a fairly good radio set today.

But it will be worth it. I have heard several such devices in operation and there is simply no comparison between the musical quality which they put out and the quality of even a good set using the present methods of amplification.

When I speak of the tubes to be used in these power plants, I have in mind tubes especially built for this purpose and not of use for any other purpose. In fact, I rather look for a gradual trend away from interchangeable tubes as we are using them today and it would not surprise me at all to find that the very best of our future circuits will almost require a different kind of tube in each socket.

As we are working now, our tubes are simply a compromise. The A type of tube can be used in any stage of radio or as a detector or in any stage of audio. When you consider that the problem of every stage of amplification in your set is electrically different from the problem of the stage which goes ahead of it, you will see that this method is a compromise and no compromise ever reaches maximum efficiency. I do not think that this change is going to come about over night but I do believe that the trend is in that direction.

Meanwhile, I find forming in my own mind a picture of the most popular set for next year.

In this picture, I see one stage of radio frequency, detector, one stage of ordinary audio using any of the three popular coupling methods and then after that the power plant. I rather imagine that the first three tubes indicated in this picture will take the form of the new triple tube described by Mr. Patterson in his article on page 39. A very small battery with an automatic trickle charger such as the Philco or Balkite outfits will supply the filament current for this tube and the power plant will supply the A current for its own tubes and the B and C for the whole outfit.

Until we get undistorted music of ample volume, we will not win for radio that vast and prosperous public which now has pianos and phonographs but which will not invest in radio because the reproduction which they hear in the homes of their friends is such that they would not have it in their own homes.

For the past two years, this problem has been attacked through the re-design of apparatus intended for use with the present tubes. That was natural because our reception must always be limited by the efficiency of the available tubes.

It did not take long, however, for these engineers to discover that the apparatus was delivering just as good quality as was possible with tubes of the "A" type and so the problem was put squarely up to the designers of tubes.

The power outfit is their answer. New tubes have been developed and put on the market, new amplifying circuits and associated devices will be available and so the industry has shifted the problem over to the fan who spends his money.

"There is the stuff," says the industry. "It's expensive—yes. But it delivers the goods. And it's *class*.

"You can have a Ford, a Studebaker or a Rolls-Royce.

"You pays your money and you takes your choice."

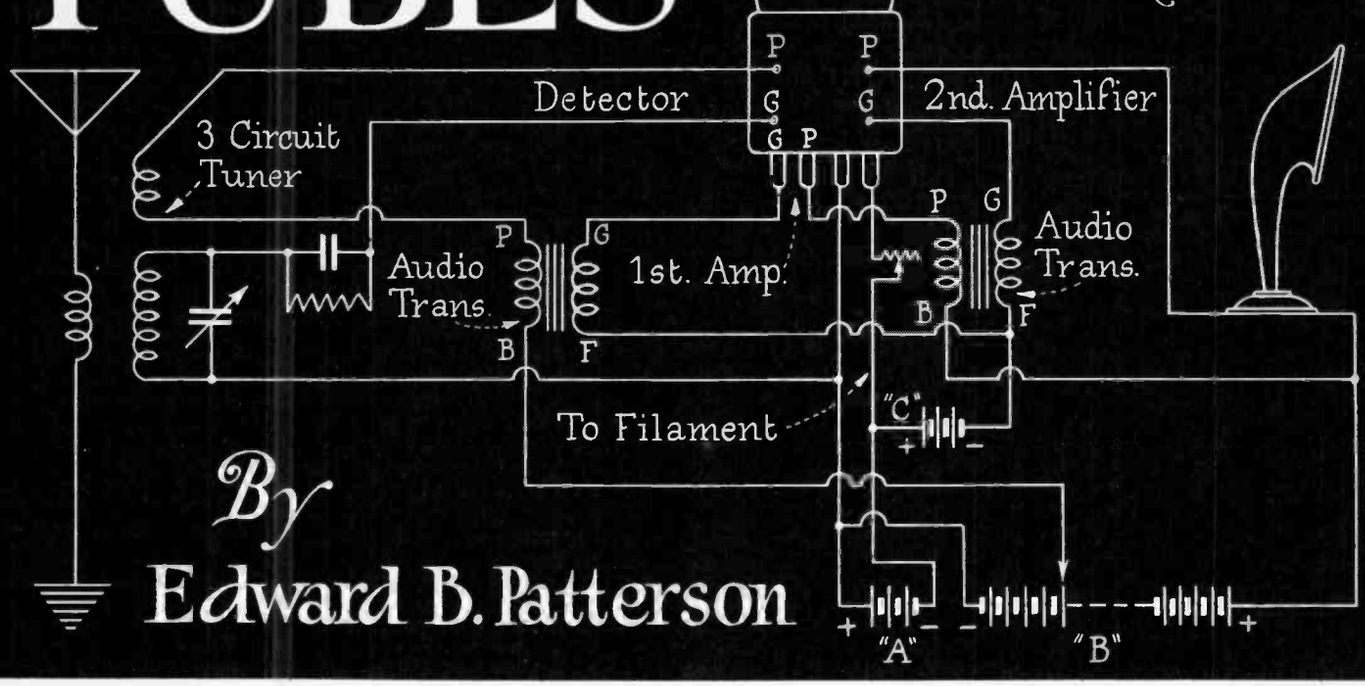
NEW TUBES

Three Tubes in One

The "Equi-Potential" Cathode

Tubes for Operation on AC

Tube With Renewable Element



By

Edward B. Patterson

Figure 1. Ordinary three-circuit tuner hook-up adapted for the new three-in-one tube.

THREE tubes in one!

Loud-speaker volume on one tube!

Yet there is such a tube and very shortly it is expected on the market. Its filament requires one-quarter of an ampere at a 5 volt potential, the same as a single ordinary tube. Its plate current is about 5 milliamperes depending on the circuit used.

The new tube can be employed either as a radio frequency amplifier, detector and audio amplifier, or three audio amplifiers, or two radio and detector, etc.

Sounds rather interesting, doesn't it? But you are still waiting for the "catch." Well, there isn't any. Ordinary apparatus—three circuit tuner, audio transformers, etc., "A" and "B" batteries can be used as with the regular tubes. A socket having more contacts than the regular ones will be needed but this is to be sold with the tube.

So much for that tube. Now another development.

An alternating current tube having a high amplification factor, a long life due to a renewable heater operating directly from the alternating current mains without transformers and other paraphernalia has also been perfected. When it will put in an appearance on the market is not known.

In addition to this tube, another one, a combination AC tube of three in one, is also under consideration.

All the tubes have such a marked bearing on receiving set design of the future that they demand attention immediately and therefore they will be taken up in the foregoing order.

READERS of this magazine may get the impression that we are over-emphasizing the importance of tubes. We don't think we are. We feel quite sure that all of the important changes now pending in radio are directly tied up to the development of new tubes.

Elsewhere we are stating our belief that nothing radically new in circuits is to be looked for in the near future. Tubes, however, are a different story.

There is probably more real, intensive engineering work now being done on tube development than on any other phase of the radio industry and any man who is trying to keep abreast of radio progress will have to watch closely every step in tube manufacture because it is these steps that are going to govern the other changes that take place.

That's why we are talking a lot about tubes and why we are planning to give you every bit of new information we get just as quickly and as completely as we can. *H. M. N.*

The one-quarter ampere tube really works if one is to believe the ears and the eyes. How this tube was located makes a long story which can not be divulged at present.

In a certain eastern city under cover of the night the writer and a witness started off and after winding about the said city and stumbling upstairs, the home of the tube was found.

In a small cabinet standing alone on a bare table was a receiving set connected to an ordinary horn loud speaker. It was pounding out the music from one of the local stations and with real volume, too. To give a touch of mystery to the discovery of the tube the owner should have been in a silver mask but he was not.

The lid of the cabinet was opened and there sat or stood a single, solitary tube surrounded by a three circuit tuner, two audio transformers, grid condenser and leak. The tube had the exact appearance of the regular quarter ampere tubes and was liberally covered on the inside with the silvery magnesium.

The following paragraph is for the skeptics.

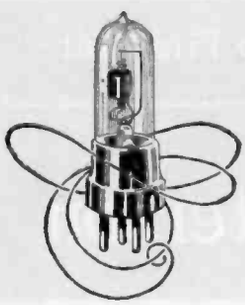
Yes, it is possible to feed energy into a small set from a larger concealed one and make it appear as though the little set were working overtime. This, however, can be detected by tuning the little set and if different stations come in you can feel reasonably certain the little set is the main performer. Accordingly, this was done and different local

stations and a superpower station at a fair distance were received on the speaker.

The owner of the tube said he had a two tube set which was the equivalent of a six tube receiver and incorporated two stages of tuned radio frequency amplification, detector, and three stages of resistance coupled audio amplification. In addition he has the equivalent of a nine tube super-heterodyne set with only three tubes! We did not see these sets and hence can say nothing about their operation although it is understood to be remarkable.

The owner was reticent in telling of the construction of the tubes and therefore we do not feel inclined to reveal its inner parts. However, it can be said that the tube has a filament, three sets of grids and three sets of plates. They are arranged in such a manner that space is conserved and shielding is not necessary.

The accompanying drawing of the tube and its circuit in Figure 1 shows nothing unusual in the laboratory model except that it has more leads than the ordinary tube. It is also interesting to note that tubes similar to the one shown were in operation a year ago and that plenty of time has been given to experiments to make the tube a real commercial product and not a laboratory job, which must be handled and treated with care.



Whether the new tube will appear in a special receiver or whether it will be available as a tube alone is not for us to prophecy at this time. At any rate the same fundamental hook-up as the accompanying diagram was and can be used, as well as the regular multi-tube circuits.

It appears safe to go on record as saying that if tubes similar to the one demonstrated become available to radio fans, then the chances for revived radio interest are greater than ever before.

Although this is a brief summary of the new tube, the alternating current tube must have its share of space.

The alternating current tube seems to be a natural development when we consider that the marked trend in receiver design is in reducing radio to the same level or basis as the other household devices such as the electric phonograph, washer, iron, etc., which operate directly from house current.

We must realize that tube receivers of today require power (called "B" supply) for the plates of the tubes and power ("A" supply) to light the filaments. The "A" and "B" supplies are the real costs in maintaining the receiver in operating condition. We can neglect the little "C" batteries required on some sets as this item is exceedingly small.

If we wish to make the receiver operate from the house current there are two points which cannot be overlooked. Most houses are supplied with alternating current and the vacuum tube demands direct current for its successful operation. The vacuum tube is rather human and if fed alternating current it shows its resentment which takes the form of a hum in the head-phones or loud-speaker.

We therefore must either give the tube its direct current or else redesign the tube so that alternating current may be applied satisfactorily.

Radio fans are familiar with the various arrangements to supply direct current to the vacuum tube. batteries and rectifiers built into Some of them merely consist of one unit to facilitate charging. Others more elaborate contain rectifiers with the well-known filter systems. Such devices connect directly to the alternating current house mains and in turn are supposed to give the tubes the desired direct current.

To date, outfits for "B" supply purposes have been most prominent and many of them can be considered successful.

The current required of a "B" supply unit is of the order of hundredths of an ampere. For example, a receiver may draw three one-hundredths (.03) of an ampere or 30 milliamperes for the plates of four or five tubes and yet such a current drain is only one half the amount required for the *filament* of a single 199 type tube.

Less progress has been made along the lines of "A" supply devices which rectify the alternating current into direct current. However, systems are used in which the filaments of the tubes (in many cases small tubes) are connected in series thus serving to keep the current consumption low.

It does not appear necessary to dwell on this particular phase of the subject longer because we are well acquainted with the facts. Let us pass along to the second line of thought—building a tube for AC operation.

Changing the construction of a tube is not a matter to be considered lightly. It is one which requires engineering skill and experience.

Every radio fan knows that the vacuum tube requires a stream of electrons in order to function. Although some fans have been accustomed to think that a heated filament wire is the only source

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of RADIO IN THE HOME published monthly at Philadelphia, Pa., for April 1, 1926.

State of Pennsylvania
County of Philadelphia

Before me, a Notary Public in and for the State and county aforesaid, personally appeared

George W. Kraft, Jr., who, having been duly sworn according to law, deposes and says that he is

the Secretary & Treasurer of RADIO IN THE HOME and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Henry M. Neely Pub. Co., 909 Public Ledger Bldg., Phila.
Editor, Henry M. Neely..Delanco, N. J.
Managing Editor, none.....none
Business Manager, Henry M. Neely, Delanco, N. J.

2. That the owner is:
Henry M. Neely Publishing Co., 909 Public Ledger Bldg., Phila.

Stockholders owning 1% or more are:
Henry M. Neely.....Delanco, N. J.
John C. Martin.....Wyncote, Pa.
George W. Kraft, Jr., 5008 Larchwood Avenue
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James B. McKeown...1503 Erie Avenue
Harry E. Darr, 622 S. Washington Square
Norman Neely.....1809 Chestnut Street
G. P. Allen.....Edgewater Park, N. J.

3. That the known bondholders, mortgagees, and other security holders owning 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None None

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

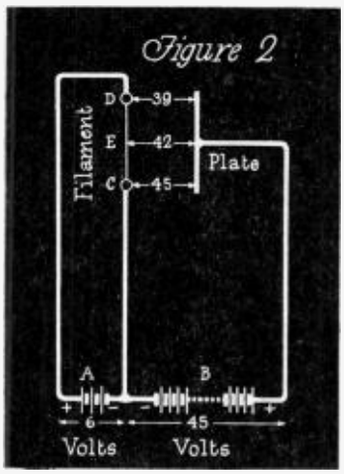
George W. Kraft, Jr.,
Secretary & Treasurer.

Sworn to and subscribed before me this 26th day of March, 1926.

SEAL John C. A. Rigney,

My commission expires Feb. 9, 1929.

of such an electron stream, this, of course, is not the case. Some types of tubes secure the electron supply from a tungsten wire heated to a high temperature. On the other hand a wire coated with oxides of barium, strontium, and calcium as used in other types of tubes gives a copious supply of electrons at a comparatively low temperature which serves to reduce the amount of current required in heating.



Now if a heated wire gives off plenty of electrons when coated why not a heated thimble? But why the use of a thimble, may be one question to be answered.

We are coming to the "equi-potential" cathode which forms the basis for the alternating current tube.

We should digress at this time to consider briefly this type of cathode which was developed some time ago for other purposes than the AC tubes.

The word cathode merely signifies the negative electrode and since electrons (negative electricity) are emitted from the filament of a vacuum tube, this part is the cathode whether it be in the form of a heated wire or not.

To understand why the equi-potential feature is desirable refer to Figure 2. Assume that we have a tube requiring 6 volts for its filament and 45 volts potential on the plate. The grid can be left out of the discussion.

The electrons given off by the heated filament are negative electricity and since the plate is positive the electrons will be drawn away from the filament to the plate. But the drawing power of the plate depends upon how positive it is with respect to the filament.

On the diagram we note that 45 volts is the difference in potential existing between the end of the filament "C" and the plate. This is true because the resistance of the heavy wires is negligible.

The difference in potential between "D" and the plate, however, cannot be 45 volts on account of the 6 volt "A" battery. Point "D" is 6 volts positive with respect to point C on the filament and hence the potential difference between D and the plate is only 39 volts. Between point "E," the center, and the plate the difference is only 42 volts.

From the above we must expect that more electrons will be drawn from the "C" end of the filament than from the "D" end. In the ordinary receiving tubes this difference is not serious although it can be realized in a transmitting tube, where the action can be very undesirable.

In addition to the above defect there are other reasons for the equi-potential cathode. From actual experience we know that it is not generally satisfactory to apply alternating current to the filament of a tube and since it may be of interest to know why, the reasons follow:

When alternating current is applied to a filament there is a variation of temperature. Alternating current starts from zero, rises to a positive value, falls through zero to a negative value and back to zero again. Such reversals naturally affect the temperature of the filament.

The temperature of the filament in turn controls the number of electrons given off (see Nakken's articles) which affects the current in the plate circuit and consequently variations in the plate circuit give the hum depending on the frequency of the alternating current flowing in the filament.

There is also a magnetic field surrounding the filament when there is current flowing. If direct current is employed this field is fixed and although it deflects some of the electrons leaving the filament and forces them to travel much longer paths than others, it is seldom noticeable.

However, in the case of AC this magnetic field will be periodically reversed and if the field changes, the paths of the electrons will be changed with the frequency of the AC and this will result in fluctuations in the plate current with the consequent hum. The equi-potential cathode tends to overcome such difficulties and Figure 3 shows a form of this cathode used by Dr. H. J. Morecroft in the course of experiments.

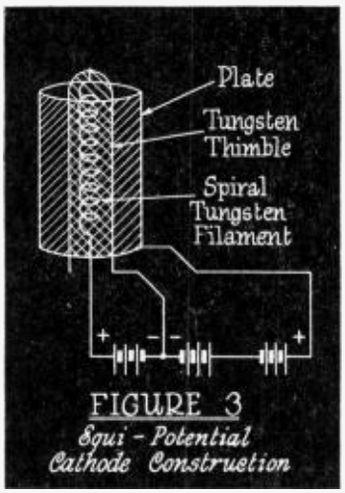


FIGURE 3
Equi-Potential Cathode Construction

The cathode was built in order to obtain experimental tube data which would conform with theory, because with the ordinary filament, measurements do not exactly agree with theory. With the cathode in Figure 3 the potential difference found in Figure 2 does not exist.

The thimble cathode of Figure 3 was of tungsten, the same as the filament and some difficulty was experienced in obtaining a copious supply of electrons because the construction did not permit the cathode to get as hot as the inside filament.

As suggested before, why not coat the outside of a thimble with an electron-emitting substance? In 1915 a patent on such a cathode was granted to A. M. Nicolson for the use of an oxide coated quartz rod.

As yet we have not started on the alternating current tube but frankly the above introduction is necessary to give the desired background.

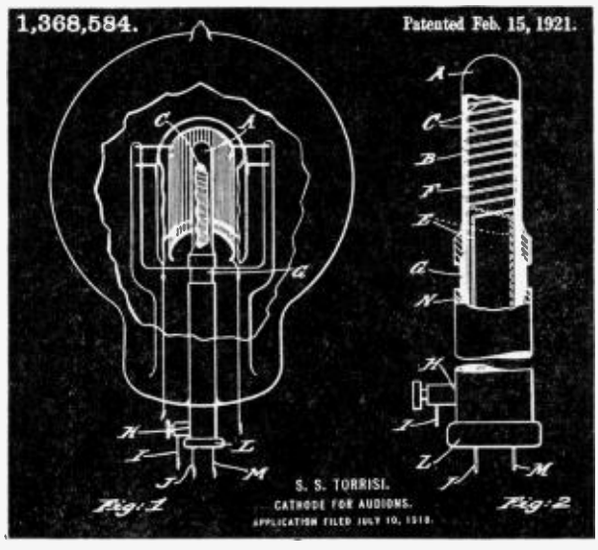
In the Electric Journal of December, 1922, an article by H. M. Freeman, describes what he calls "the first truly practical tube for alternating current operation." Freeman found that heating a cathode by radiation as shown in Figure 3 was not as good as indirect heating. Accordingly he made a cylinder cathode of nickel coated on the outside with barium and strontium oxide. A V-shaped filament wire was then placed inside of the cathode but it was insulated from the inner walls of the cathode. All the elements were sealed inside the "vacuum" portion of the tube.

While considering Freeman's tube we must not forget the McCullough AC tube which has now been placed on the market in improved form and is dealt with in Mr. Biles' article on Page 64.

This tube requires a "B" supply and has its heater connected through a step-down transformer to the alternating current mains. This tube is familiar to radio fans and hence needs no further introduction.

Another feature which engineers have been working on is the renewable heater which tends to lengthen the life of the tube. If the electron emission from the cathode can be maintained by the use of a correct coating of oxide, then the only part to go wrong is the heater and if the heater is renewable it makes little difference if it burns out after a short or long period.

In patent 1,368,584 granted in February of 1921 to Samuel S. Torrisi the renewable heater feature is incorporated. It is shown at the left.



According to the specifications thimble cathode A is coated with platinum and the portion of A exposed to the vacuum is coated with oxide. Running through the length of this tube is a rod of mica, porcelain or any other heat-resisting composition, F, wound on its tip with the heating coil, C, with leads, E, running down this rod to the outside of the tube making two connections, J and M. The rod, F, has a covering of thin mica sheet, B and N, to prevent the wires of the heat coil from coming into contact with the inner walls of A. The heater is not in the vacuum portion of the tube and hence can be taken out when desired.

However, in the laboratory, other working models with renewable heaters have put in appearance. One of these has been developed by Dr. A. N. Lucian of the University of Pennsylvania.

The New HAMMARLUND-ROBERTS

Here, For the First Time, Is a Magazine Article That Has Been Fully Checked Over and Approved By the Designers of a Circuit and a Kit That Are Winning Increasing Popularity.

This outfit, when properly put together, results in a set that compares favorably in appearance with standard factory products.

By the 3XP STAFF

A FEW years ago there appeared among a host of other new circuits a little three tube reflex that became known as "The Roberts." It exhibited many advantages over most of the then popular sets and at once became the favorite hook-up of many set builders. It was economical in the use of tubes, which then cost $5.00 to $6.00 each, and batteries; it gave good volume and was a fair distance getter.

There were however many disadvantages and it took another year's work in the laboratory to develop the next model which had evolved into a four tube reflex set. This model was very much better than its predecessors, but still had disadvantages.

Its superiority in other ways was so evident however that Mr. Roberts determined to improve the circuit still further and to design a set for the home builder, each part of which would be the most efficient in its particular place, be easy for the inexperienced builder to put together, a good distance getter, capable of giving true reproduction, and the finished job must be as fine in appearance as a high priced factory built set.

This was no small order for one man, but circumstances were in Mr. Roberts' favor and he was able to call to his assistance a number of well-known engineers in the radio field. Each of these men was a specialist in some particular line—resistors, condensers, coils, transformers, etc. Each of them was familiar with the various types of apparatus offered in his line and knew which one of them could be depended upon to give the best results in this circuit.

After months of patient testing and planning, all of the obstacles were overcome and a set was produced which was not the idea of one man but the combined thought and effort of ten individual engineers unconnected with each other except in the development of this set. And in the end they found they have done a better job than they expected. This then is the story of the origin of the new Hammarlund-Roberts.

Contrary to the general idea, the building of radio sets at home is not merely satisfying a desire to tinker. It is the deep seated craving to investigate—invent—to find out why a thing happens. De Forest, Armstrong, Tesla, Marconi were all moved by this desire and without it would never have risen above the average run of mankind.

There is too a real economic reason for this home set building. Due to the keen competition among manufacturers of radio receivers, many of them are forced, against their will, to use parts for their particular receiver that will effect a saving of money rather than improve the performance of the instrument. This necessary evil does not worry the man who "rolls his own"; he chooses the units which he is convinced are the best and then, guided by his own ideas, or the experience of others, assembles a set which he is positive is the best that can be produced.

Of course he may lack the experience or the ability to make these fine units synchronize, nor does he want to spend the money and time in finding out how to do so. In this case he follows the step-by-step instructions of the men who designed the set with the assurance that the finished product will be something that he can very well be proud of.

Certain circuits lend themselves more readily to home construction than others and this explains the popularity of the Hammarlund-Roberts. Due to the great simplicity and adaptability of its design there are few chances of mistakes in the assembly and it is a rare occurrence for a home builder to find that he has put together a set that is unsatisfactory. In the majority of cases the set "perks" the first time it is hooked up and if instructions have been carefully followed little or no trouble is encountered in its operation.

Theory: In theory the circuit of the Hammarlund-Roberts is best described

The Radio Home,
3rd & Walnut Sts.,
Philadelphia, Pa.

Attention: Mr. H. W. Neely.

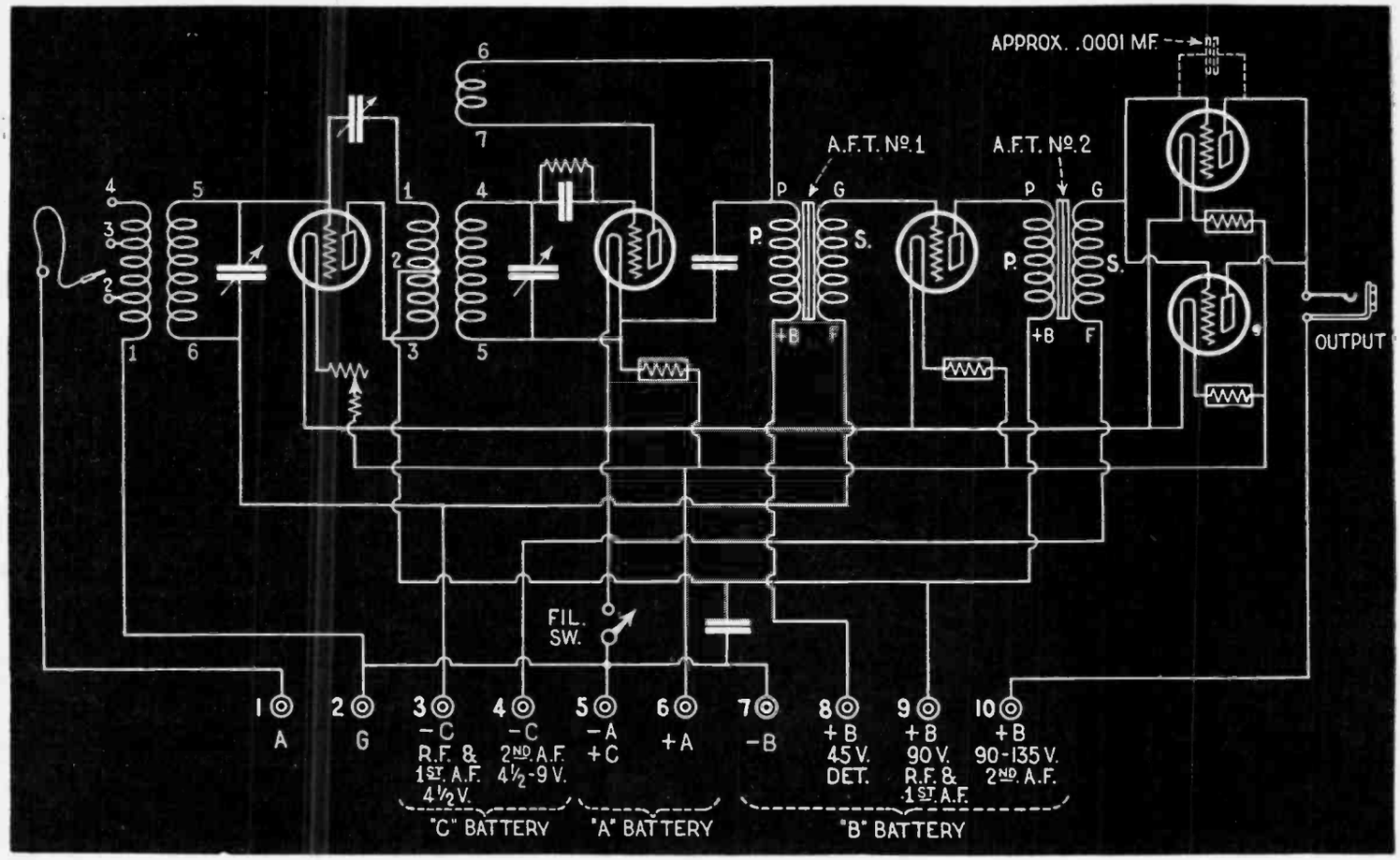
Dear Sir:

I have carefully examined and checked the proofs of the article with its diagrams and illustrations and am pleased to inform you that your article is the only absolutely correct magazine article I have seen in which the new Hammarlund-Roberts receiver has been covered in every detail.

Considering the care evidenced in the preparation of this article and the clear way in which every step in constructing the receiver is discussed, it is hard to conceive of anyone being unable to secure absolutely perfect results from a set built using your article for guidance.

Cordially yours,

O. A. Hammarlund



by tracing the path of the currents through the receiver. A stage of radio frequency amplification is used to increase the signal received in the antenna. This tube is neutralized to prevent radiation and annoying your neighbors.

After amplification in the radio frequency stage, the signal is passed on to a regenerative detector where it is further amplified and rectified. From the detector the signal passes into an audio amplification system which is unique in many ways. The first tube is a stage of straight transformer coupled audio. The second stage is two tubes in tandem and a single audio transformer. This method of handling the second audio stage is used to insure purity of reproduction and to enable the tubes to handle very great volume without distortion.

Controls have been reduced to a minimum. Two straight frequency line condensers are used as the major controls for tuning. Straight frequency line condensers were chosen on account of the ease with which they may be logged and the method of logging them will be given later in this article.

Two minor controls, one for sensitivity and one for volume, are provided and these with two major controls make the set so flexible in tuning as to meet every possible condition.

All tubes excepting the radio frequency tube are automatically kept at their best operating point by the use of the automatic filament controls and provision for proper "C" battery connections. The radio frequency tube is controlled by a rheostat which acts as a volume control. The coils used are of extremely high efficiency and the unpleasant detuning effects due to movements of the tickler are avoided by a new coil design.

Here is the diagram in the usual schematic form.

To assure the best operation of the various parts of the receiver it was found necessary to give considerable attention to their relative positions in the set, therefore the tubes in the Hammarlund-Roberts are not laid out as in the usual set, that is, first a radio frequency tube, then a detector, followed by the audio frequency tubes. In this set the first tube on the left is the first audio frequency tube, the second one is the radio frequency tube, the third one is the detector and the fourth and fifth are audio frequency tubes in parallel.

The diagram on this page shows the schematic of the circuit in which the tubes are placed in the order of the path of signals through the receiver and not in the order of their position in the set.

To make it easy for the home builder to establish the proper relative positions of the apparatus, to relieve him of a lot of hard and unprofitable labor in laying out and drilling the panels and to give the completed receiver the appearance of a high priced factory built set the engineers decided to design a complete set of panels, panel supports and incidental hardware and to make this specially designed apparatus available to the set builder. Of course the Hammarlund-Roberts may be built on any kind or size of panel and adapted for any size or shape of cabinet and the use of the specially designed panels is not necessary if instructions are carefully followed.

In the experimental sets built, the parts listed below were used and the panels provided are drilled to fit those parts, furthermore the location of each part in the set has been determined by actual experiment and any change in their relative position may effect the operation of the set. Other parts may be substituted for those recommended but great care should be used in doing so in order to avoid reducing the efficiency of the set.

List of Parts Used

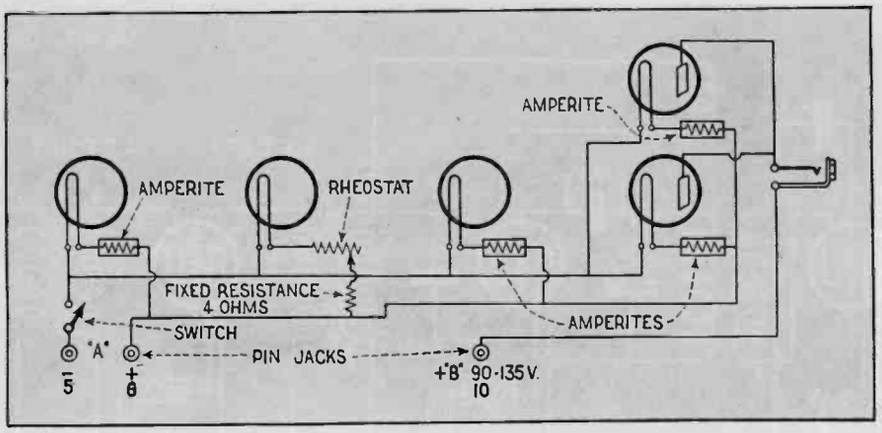
1 Rauland - Lyric Transformers
2 Hammarlund-.0005 mfd. Model "C" or S. L. F. Condensers
1 Hammarlund "Midget" variable Condenser of five plates.
1 Set Hammarlund-Roberts Coils
2 Na-Ald "Super De-Luxe" 4-in. Bakelite Dials
5 Na-Ald "DeLuxe" Sockets
1 Na-Ald K3844 — 1¾ in. Dial
1 Carter 25-ohm "Imp" Rheostat
1 Carter Single Circuit No. 101 "Hold-Tite" Jack
1 Carter "Imp" Battery Switch
1 Durham Metallized Resistor
4 Amperites No. 1-A
1 Dubilier Type 640-G .00025 mfd. Grid Condenser.
1 Dubilier Type 640 .002 mfd. Fixed Condenser
1 Dubilier Type 640 .006 mfd. Fixed Condenser
5 Prs. Union Phone Tip Jacks.
1 Hammarlund-Roberts Foundation Unit

The "foundation unit" which is the backbone of the set contains the following items:

1 Drilled and engraved front panel
1 Drilled sub-panel
1 Right hand bracket
1 Left hand bracket
1 Coil plate
2 Grid condenser mounting posts
1 Coil wire
1 Fixed resistance

Since it is impossible for us to know the

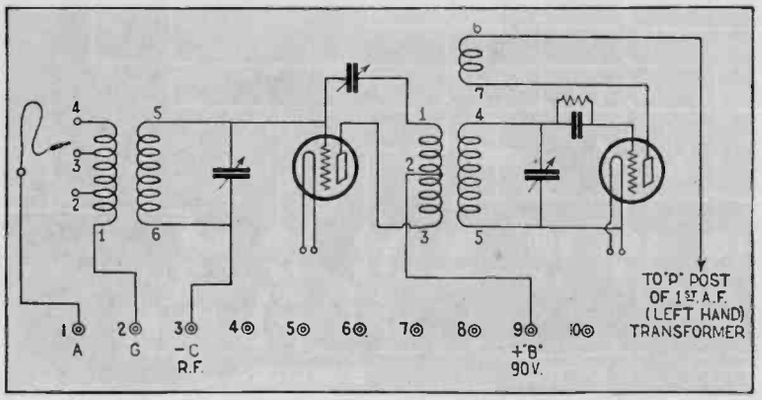
stages that the individual builder may want to make in his set, we will describe the assembly of the Hammarlund-Roberts using the parts specified and the foundation unit. The assembly is described step by step, each paragraph giving the next operation in the order in which it should be performed. Check the paragraph as you complete it and at the end it will be easy to find an error. The absence of a check mark will indicate work not done.



This diagram shows the complete wiring of the filament circuit.

Before proceeding with the assembly of the set it is always well to test the parts for open or short circuits. They are all tested before leaving the factory but much may happen to them in either shipment or handling.

Construction: On the sub-panel will be seen two holes at one end, about 1½" apart. The base panel will be top up when these two holes are to the left and the ten 1¼" holes along one edge, to the back.



The wiring of the radio frequency and the detector circuits.

1. Mount the phone tip jacks in the ¼" holes at the back of the sub-panel. Do not pull them up any tighter than necessary to hold the jacks in place.

2. Mount the 5 sockets on the base panel with terminals in position shown in photo.

3. Mount grid condenser in holes between second and third socket using brass posts and screws in foundation unit.

4. Mount the 4 amperite clips on bottom of panel.

5. Mount the midget condenser in the hole to the front of the base panel between the second and third sockets.

6. Using a hack saw or pocket knife cut the line of the arrow on the knob of the midget condenser deep enough to hold the blade of a screw driver.

7. Mount the knob on the midget condenser.

8. Fasten the panel supports to the sub-panel.

9. Connect together the minus terminals of the second, third and fifth sockets by a wire passing through the holes in the sub-panel near these terminals and running along the bottom of the sub-panel.

10. Connect together the minus terminals of the first and second sockets.

11. Connect in the same way the minus terminals of the fourth and fifth socket.

12. Connect all the amperite clips together at the ends nearest the back of the panel.

13. Connect the back terminal of the third amperite clip to the Plus A (sixth) phone tip jack.

14. Connect the other end of clip #1 to the plus post of socket #1.

15. Clip #2 to plus post in socket #3.

16. Clip #3 to plus post in socket #4.

17. Clip #4 to plus post of socket #5.

18. Mount the rheostat in the lower center hole on the front panel.

19. Mount the jack in the lower right hole on the front panel.

20. Mount the filament switch in the lower left hand hole of the front panel.

21. Mount, on the front panel, the condensers and their shields placing the shield between the condenser and the panel.

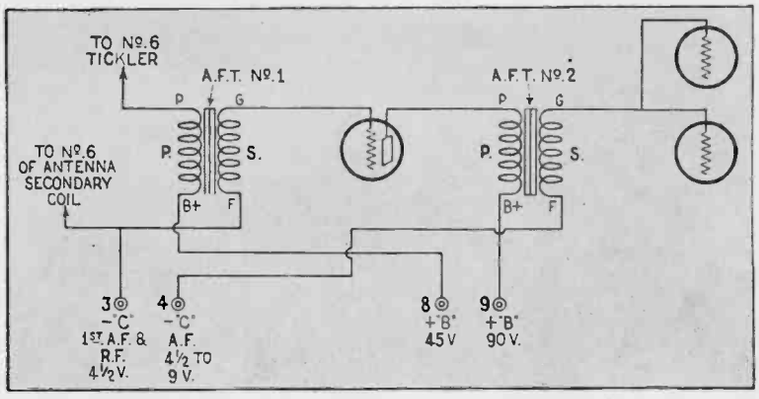
22. Place front panel in position on panel supports which are already mounted on base panel.

23. Connect a wire from the minus A fifth phone tip jack to the screw holding the left hand bracket to the back edge of the sub-panel.

24. Connect a wire from the screw holding the left hand bracket to the front panel to one of the filament switch terminals.

25. Connect the other side of the filament switch to the minus terminal of the first socket.

26. Connect the plus terminal of the second socket to one of the rheostat terminals.



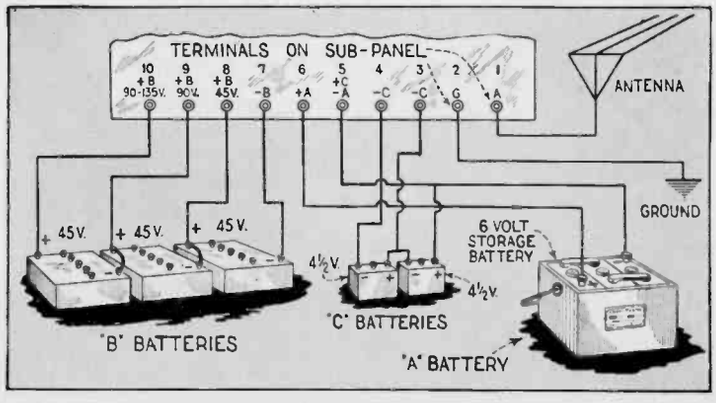
Completed wiring of the audio frequency amplifier circuit.

27. Connect the other rheostat terminal by a short piece of wire to the small resistance strip supplied in the foundation unit.

28. Connect the end of this resistance strip to the plus A (sixth) phone tip jack.

29. Connect the top blade of the jack to the P post of the fifth socket.

30. Connect the P post of the fourth socket to the P post of the fifth Socket.



Showing all the battery connections.

31. Connect the lower blade of the jack to the 90-135 amplifier (tenth) phone tip jack.

32. Connect together the "G" posts of the fourth and fifth sockets.

33. Mount the antenna tuning coil in position on the left hand bracket using the brass mounting plate and screws provided. the secondary of this coil should be toward the front panel.

34. Mount the radio frequency coupler coil on the front panel with the rotating coil to the left.

35. Adjust the antenna tuning coil until it is exactly at right

angles to the radio frequency tuning coil, then tighten the holding screw in the bottom of the mounting plate.

36. Connect terminal #1 of the antenna tuning coil, the one nearest the front panel, to the mounting screw which fastens the coil block to the mounting strip. Do this by running a wire from the terminal down through the hole in the mounting block at the bottom of the coil.

37. Cut off a piece of flexible wire long enough to reach from the antenna (first) phone tip jack to terminal #2 of the antenna coil.

38. Connect a small spring clip to one end of this wire.

39. Connect the other end of this wire to the antenna (first) phone tip jack.

40. Terminal #5 on the antenna coil which is on the bottom of the coil at the back connects to the nearest terminal on the stator of the first condenser.

41. Connect the other terminal on the stator of the first condenser to the stator terminal of the midget condenser.

42. Connect the stator terminal of the midget condenser to the "G" post of the second socket.

43. Terminal #6 of the antenna coil is at the bottom to the front and connects to the rotor terminal of the first condenser.

44. Connect the rotor terminal of the first condenser to the C-RF (third) phone tip jack.

45. Terminal #4 in the radio frequency coil is in the side opposite the mounting block to the left; it connects to the nearest side of the grid condenser.

46. Connect the next terminal to #4 (#1 in the photo) to one side of a .0001 mfd. fixed condenser. See Paragraph #47.

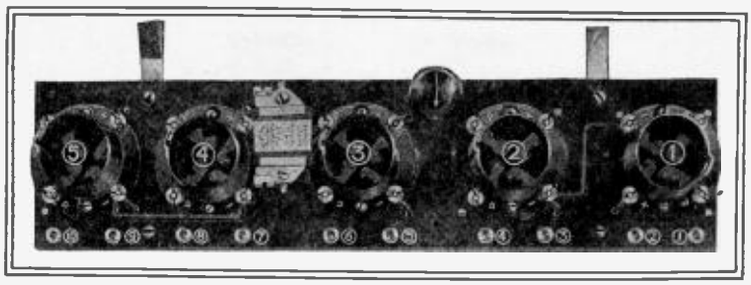
47. Connect the other side of this fixed condenser to the rotor of the midget condenser.

48. Mount audio transformers on screws holding the panel bracket to the base panel, reference to the photographs will show the exact position in which these transformers should be mounted.

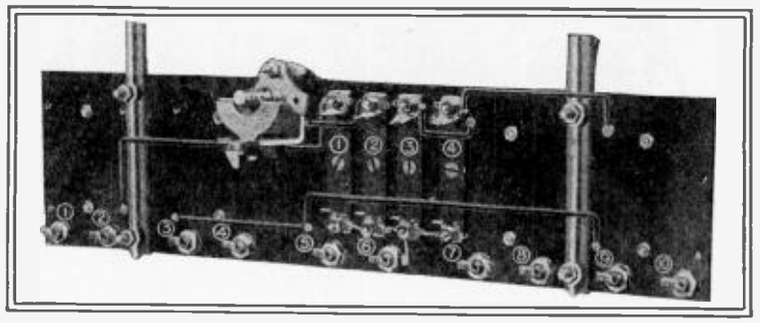
49. Connect terminal #2 on the radio frequency coil to the B terminal of the left hand (second) audio transformer.

50. Terminal #3 on the radio frequency coil to the P post on the second socket.

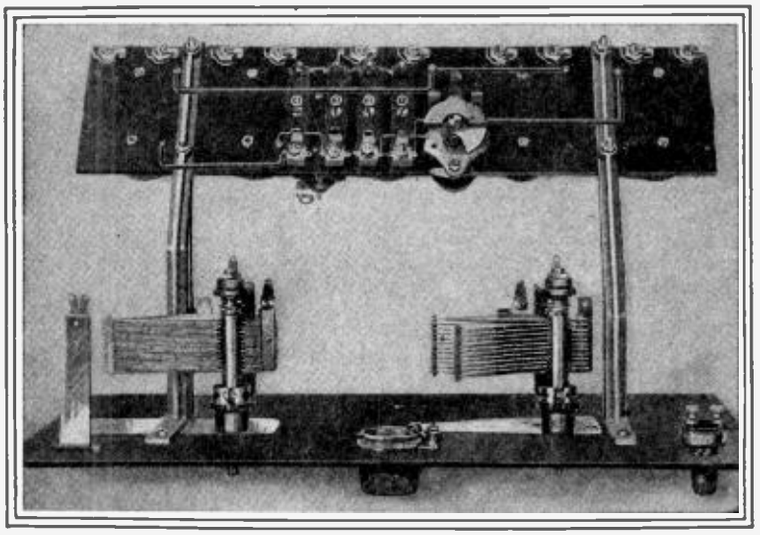
51. Terminal #5 to the rotor terminal of the second condenser.



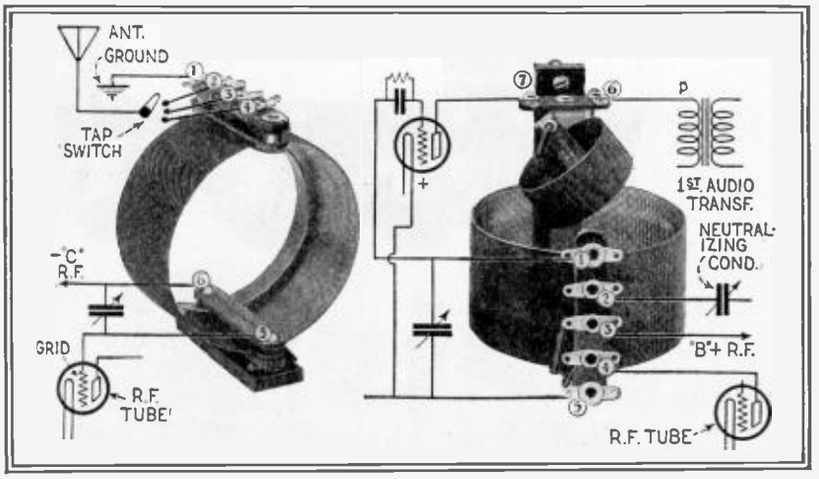
Showing correct assembly of sub-panel unit.



Bottom view of sub-panel illustrating correct wiring.



Front panel and sub-panel assembled.



Showing correct connections to coils.

52. Terminal #7 is the top connection in the tickler coil and connects to the P post of the third socket.

53. Terminal #6 on the bottom of the tickler connects to the P post in the left hand audio frequency transformer.

54. Connect the front terminal of the second amperite clip to the screw holding the bracket and audio transformers to the front of the base panel.

55. Connect the stationary plates of the second condenser to terminal #4 of the radio frequency coil.

56. Connect the G post of the third socket to the near side of the grid condenser.

57. Connect the F post of the first audio transformers to the -C R F and first A F (third) phone tip jack.

58. Connect the F post of the second transformer to the -C second A F (fourth) phone tip jack.

59. Connect the G post of the first transformer to the G terminal of the first socket.

60. Connect the G post of the second transformer to the G terminal of the fifth socket.

61. Connect the B post of the second transformer to the B 90 R F and A F (ninth) phone tip jack.

62. Connect the B post of the first transformer to the "B 45 Det" (eighth) phone tip jack.

63. Connect the P post of the second transformer to the P terminal of the first socket.

64. Connect one side of the .006 mfd. fixed condenser to the B terminal of the second transformer.

65. Connect the other side of this .006 mfd. fixed condenser to the B minus (seventh) phone tip jack.

66. Connect the minus B (seventh) phone tip jack to the minus A battery (fifth) phone tip jack.

67. Connect the "minus A" (fifth) phone tip jack to the "ground" (second) phone tip jack.

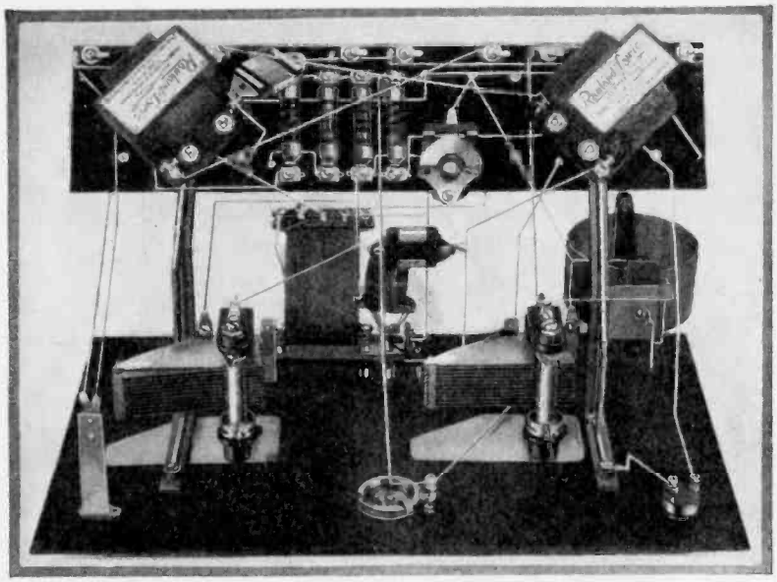
68. Connect one side of the .002 mfd. fixed condenser to the positive terminal of the Detector (third) socket.

69. Connect the other side of the .002 mfd. fixed condenser to the lead running between the P post of the first transformer and terminal #6 of the tickler coil.

70. Connect a small fixed condenser not over .00025 between the G & P terminals of the last socket.

71. Mount the second condenser dial locating it far enough from the panel to prevent scraping and having the zero graduation coincide with the pointer on the panel when the plates of the condenser are entirely out of mesh.

72. Mount the first condenser dial in the same way.



Completely wired receiver, view from bottom.

73. Mount the pointer dial on the coil shaft so that the pointer coincides with the pointer on the panel when the shaft is turned as far to the left as it will go.

74. Mount the knob on the rheostat.

75. Mount the knob on the battery switch.

76. Take six pieces of wire long enough to reach from the phone tip jack on the receiver to the point where you want to keep the batteries, solder phone tip to one end of each of them and tin about 1 inch of the opposite ends.

77. Make 3 pieces of wire long enough to reach from the set to the "C" batteries treating them in the same way as the battery leads.

78. Connect one side of the "A" 6 volt battery to the "B" minus (seventh) phone tip jack.

79. Connect the other side of the "A" battery to the "B" 45 Det eighth phone tip jack.

80. Put all 5 tubes in their sockets and turn on the filament switch. *No tube should light.*

81. Disconnect the wire in the "B 45 Det" eighth phone tip jack and put it in the "B 90V" (ninth) phone tip jack then in the "B 90-135 V" tenth phone tip jack. No tube should light under these conditions. Paragraphs 78-79-80 and 81 provide a test against the possibility of the B battery being shorted to the filament circuit and prevents burning out tubes.

82. Disconnect the A Battery lead from the B battery phone tip jack and connect the negative A Battery lead to the -A (fifth) phone tip jack.

83. Connects the positive A Battery lead to the plus A (sixth) phone tip jack.

84. Turn on filament switch and all tubes should light. If they do light, the filament switch may be turned off and the tubes removed from their sockets.

85. Connect the negative side of the first 45 volt B battery to positive side of the second 45 volt B battery.

86. Connect the negative side of the second 45 volt B battery to the positive side of the third B battery.

87. Connect the positive side of the first 45 volt B Battery to the "B 90-135 V" (tenth) phone tip jack, using one of the long battery leads you have made.

88. Connect the positive side of the second B Battery to the "B 90 V" (ninth) phone tip jack.

89. Connect the negative side of the third B Battery to the -B (seventh) phone tip jack. While making these connections note whether a spark occurs, if it does it is a sure indication of a wrong connection in the set and no further connections should be made until the trouble is remedied.

90. Connect the positive side of the first "C" Battery to the negative side of the second C Battery.

91. Connect the negative side of the first "C" Battery to the -C (fourth) phone tip jack.

92. Connect the negative side of the second "C" Battery (which is already connected to the positive of the first "C" Battery) to the -C (third) phone tip jack.

93. Connect the positive of the second "C" battery to the "C-A" (fifth) phone tip jack or it may be connected to the positive side of the "A" battery depending on the location of the batteries. If a spark occurs while making any of these connections it indicates a wrong connection and the trouble should be found before proceeding further.

94. Connect the Antenna to the A (first) phone tip jack.

95. Connect the ground to the "G" (second) phone tip jack.

96. Place a tube in the second socket, turn on the filament switch and turn the rheostat to the right. The tube should light up to normal brilliancy when the rheostat is as far to the right as it will go.

97. If no trouble is found the rest of the tubes may be placed in their sockets.

98. Plug in loud speaker or phones in jack on front panel.

99. Connect antenna to middle top of coil with the flexible wire and clip.

100. Turn both condenser dials to zero.

101. Turn sensitivity dial as far to right as it will go.

102. Using both hands, turn the condenser dials to the left keeping them about even; at some point in the scale a squeal will be heard if there are any stations transmitting. Tune in this squeal, by small movements of the condensers, as loud as you can get it.

103. Turn the sensitivity control to the left until the signal comes in pure and undistorted.

104. Retune the two condensers until the signal is at its loudest.

105. Turn out the radio frequency tube by turning the rheostat as far to the left as possible.

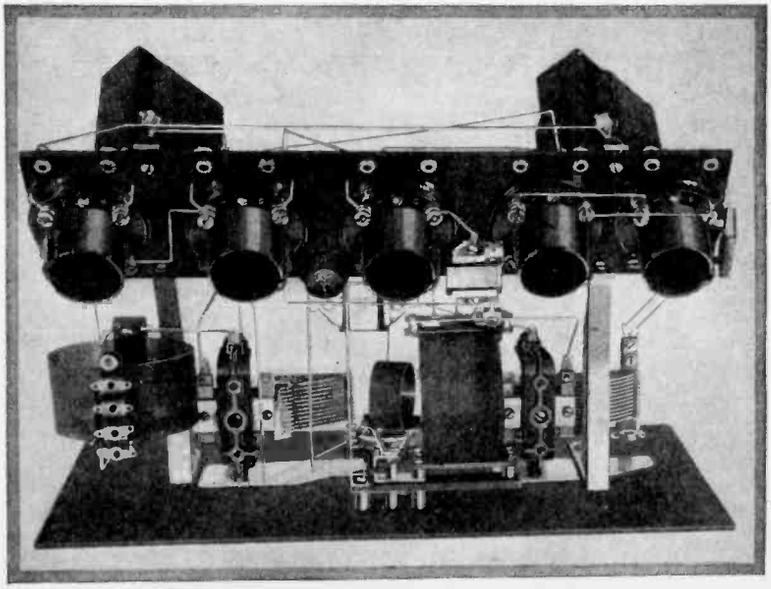
106. The signal should now be heard faintly in the head phones, or loud speaker. With a long screw driver turn the midget condenser using the slot which you have sawed in it to hold the screw driver. Vary the position of this condenser until the signal is not heard or is at a minimum.

107. Light the radio frequency tube to full brilliancy and retune the condensers until the signal is again at a maximum.

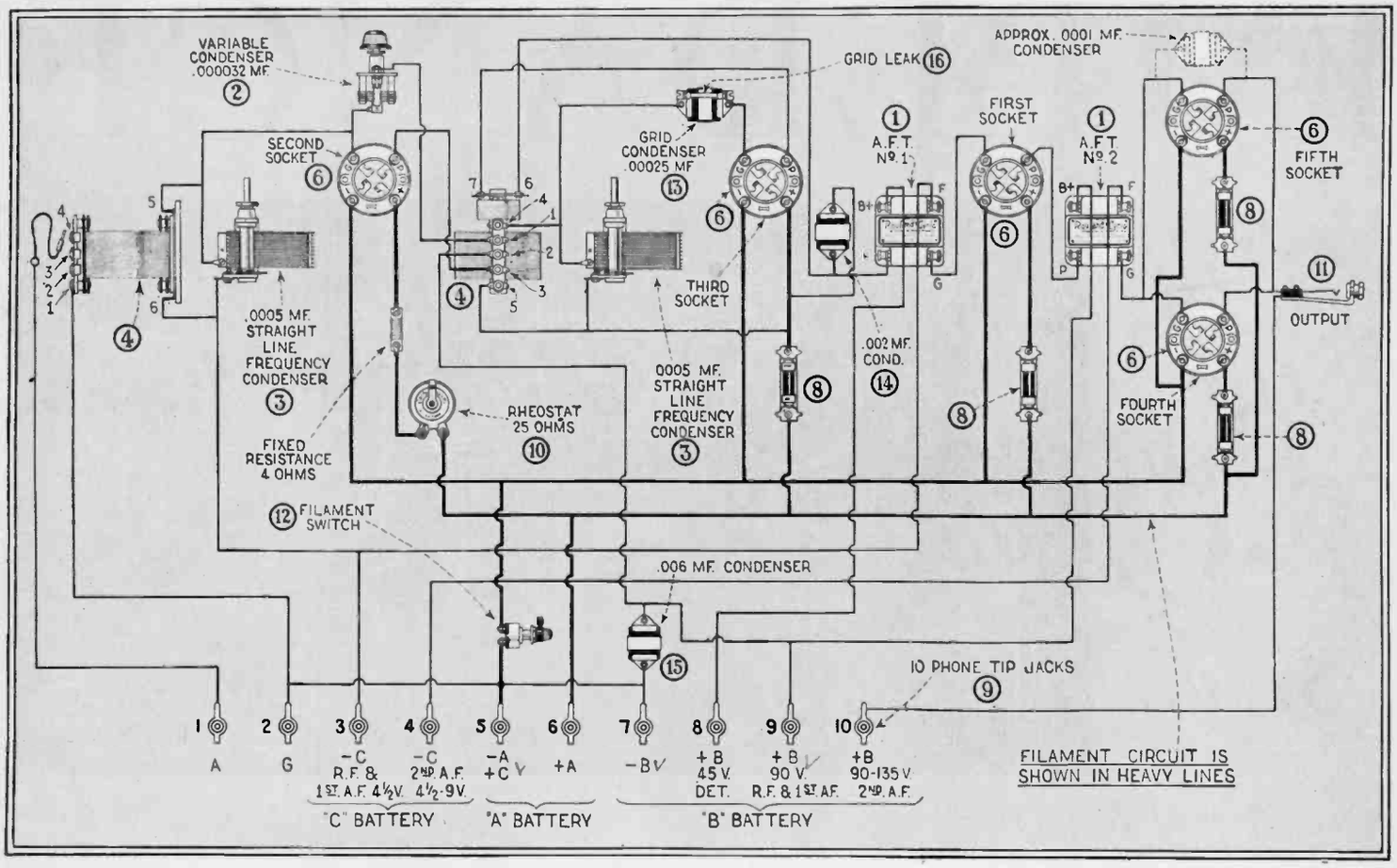
108. Turn out the radio frequency tube and readjust the midget condenser for minimum signal. The set is now neutralized and ready for operation.

Logging the Set: The use of straight frequency line condensers in the Hammarlund-Roberts makes the set very easy to log. These condensers are so designed that a movement of one division on the dial results in a change of 10 Kc. in frequency. Most radio programs give both the wave length in meters and the frequency in kilocycles for all the stations. Find the frequency of any station and the point at which that station is received the best on the right hand dial. Now find the frequency of the station you want to receive, divide the difference by 10 and the result will be the number of points change required on the dial.

Keep in mind the fact that the higher the frequency the lower the wave length and hence the lower the dial reading. As an example Station KDKA transmits at a frequency of 970 Kc. while station WSAI transmits at a frequency of 920 Kc. a higher wave length than KDKA and a difference of 50 Kc. Dividing this by 10 gives 5 which tells us that if we have received KDKA at 52 on the dial we should find WSAI at 57. In logging the Hammarlund-Roberts it is not necessary to log the left hand dial as it should read about the same as the right hand



View looking from the rear showing receiver completely wired.



This diagram shows the wiring in the picture form.

dial and is subject to some change depending on type of antenna and which tap in the coil is used.

If a mild but persistent singing noise should occur, try reversing the primary ends to the transformer.

If regeneration does not occur, try reversing the connections to terminal No. 6 and No. 7 of the tickler coil.

Poor signals may indicate that (a) the antenna or ground is not perfect, (b) that the radio frequency stage is not producing any gain, (c) that a tube or tubes are defective, (d) that the audio frequency transformers are not amplifying, (e) that something may be wrong with the loud speaker.

A pair of phones placed in B battery lead will tell whether the trouble is before or after the detector. If signals are heard in the detector circuit but none in the loud speaker, it is certain that the trouble is in the audio amplifier.

If no signals are heard in the detector circuit, and if the tube sounds "alive," that is, if a click is heard when the tube is turned off or on, or when the G post of the detector tube socket is touched, or when the B battery lead is disconnected, it is possible that the tube does not oscillate, or that there is some trouble in the radio frequency amplifier.

To test the detector, remove the radio frequency amplifier tube from its socket. Advance the sensitivity control and ascertain if the detector oscillates. If it does, all that is necessary is to get the amplifier working. If the detector does not oscillate, try reversing the tickler connections or increasing the B battery voltage.

Place the antenna wire on the P post of the second socket. The receiver is then working as a three circuit tuner and signals should be heard. If the tube does not oscillate under this condition, loosen the coupling of the antenna to the circuit by placing a small condenser in series with the antenna and P post of the second socket.

If signals are heard, remove the antenna wire and place it on the grid post of the same socket. (The tube should be replaced in its socket and lighted.)

Signals should now be somewhat louder due to the amplification of the tube itself. Then place the antenna in its regular position and retune both detector and amplifier circuits.

Operation: The reception of both local and distant signals with the Hammarlund-Roberts is directly dependent on the efficiency of the antenna and ground circuit used. The better the antenna, the better the results and the more easily they are obtained. The set is designed to operate very efficiently on rather poor antennae and local signals may be received with great volume using only about 15 ft. of wire around the room as an antenna and a radiator as a ground.

With the antenna, ground and loud speaker connected to the set, turn the volume control on full and advance the sensitivity dial to its maximum position. Both knobs should be turned to the right to increase and to the left to decrease. Now, by simultaneously rotating the two tuning dials at approximately the same settings, a squeal should be heard in the loud speaker, provided any stations are "on the air." Adjust the dials for maximum squeal and then reduce the setting of the sensitivity dial. This will eliminate the squeal and result in reception of music or whatever is being broadcast at the time.

On local stations, the advancement of the volume control to its limit may produce distorted reception because of tubes overloading. If this happens it is only necessary to reduce on the setting of the volume control, or else reduce the amount of B battery voltage applied to the last audio amplifier tubes.

Regeneration should be obtained smoothly by advancing the sensitivity control, that is the tube should go in and out of oscillation quite evenly and slowly. If this is not the case reduce on the detector B voltage applied to the B-45 jack.

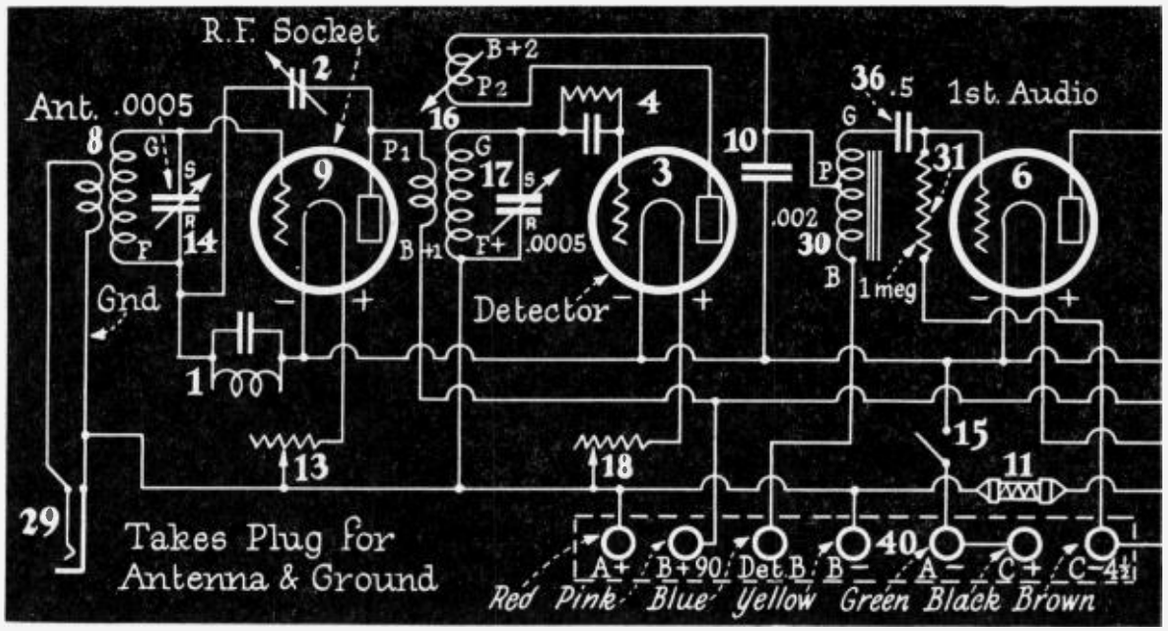
The volume control, which is a filament rheostat in the radio frequency amplifier tube, should never be turned up any higher than necessary so as to prolong the life of the tube. It is impossible to harm the filament of this tube by burning the tube at full brilliancy because of a safety fixed resistance of 4 ohms which is placed in series with the rheostat.

The antenna taps on the first coil are for adjusting the receiver to the particular antenna used with the receiver. When the correct tap is found the tuning of the two condensers will be practically alike, and to tune in one station after the other it is only necessary to rotate both condensers at the same time. It will not be necessary to have the detector oscillate to pick up stations if it is operating within 200 miles of moderately powerful stations.

Using the greater part of the antenna coil increases the signal strength to some extent but broadens the tuning, especially if used with a long antenna.

IMPEDANCE

With the T-C *Circuit*



This is the usual schematic diagram for the Samson T-C

By G. P. ALLEN

THE article on the T-C in the April issue started off, (if I remember correctly) with the account of a scrap that we had at Station 3XP before we built the set. That was a Peace Conference beside the one we had before building the set in this issue!

I lost this time! In order to get a smooth control of volume with the impedance coupled amplifier it is necessary to use one of the Bremer Tully, or Centralab non-inductive high resistances in the place of a grid leak in the second audio stage. That means adding one instrument to the panel that you now have. That is, you have it, if you have built the T-C in the last two issues.

To my mind, it made the panel look like the power board in an electric light sub-station. I wanted to eliminate the rheostat on the detector tube, and put the resistance in the place occupied by it. The detector was to be placed on an automatic filament control. As soon as I made a remark to this effect to the lab staff in general, H.M.N., and Turner, landed on me with both feet. They admitted that the automatic control might be as efficient as a rheostat,—BUT! There were more buts flying around than there are in a goat.

Now that the set is done, I am inclined to agree with them. Nevertheless, I have submitted my minority report.

In building the T-C this month we have gone back to the baseboard type of assembly used in the March issue. Here's hoping that you still have that piece of baseboard, and did not use it for something else!

We wanted to use a sub-panel for this on account of yours truly developing the sub-panel complex last month. Because of the dimensions of the Autoformer, we had to pass up the sub-panel job since it involved the use of odd shaped brackets that would be difficult to secure.

In giving you the list of parts this month we will continue the practice used in the April issue, and give the parts the same numbers that they have had in previous issues. By doing this you will have no trouble identifying the parts that have been used before, and will be able to decide quickly what parts are new.

Thus, when you come to part No. 5 in the list of parts you will see the statement "This No. not used." Now, we said the same thing in the April issue. No. 5 was a transformer used in the T-C in the March issue. It has not been used since, but we are still carrying the number in the list so that you will not be confused by its omission.

If you built the T-C with resistance coupling and want to build the impedance coupled amplifier for it, we are telling you what parts of your former hook-up may be used, wherever it is possible to do so.

Let's place the base in front of us on the work bench. Mark the end away from you "Back," and the end towards you, "Front." Call in your mother, or your wife, and get her to tell you which is your right hand, and which is your left. Then mark your baseboard accordingly. Yes! It sounds like a lot of bunk! But would you believe it possible that some of our readers got all balled up in building the set in the March issue because they didn't know which was their right hand and which was their left? They probably built it on Sunday after they heard the minister read "Let not your right hand know what your left hand doeth!"

Arrange the apparatus in the same form that it is in the photograph in Fig. 1. Before fastening the parts permanently to the baseboard, put lugs under the screws of the Autoformers and tin them. Solder a wire onto one side of the grid leak and condenser No. 4, so that you can fasten it to socket No. 3. Tin the other side of the condenser so that soldering will be easier later.

This time we have mounted the condenser in a vertical position as it seemed to fit in with the arrangement of parts better. When you are sure that you have the parts located to the best advantage, and that none of the parts that you have mounted on the baseboard are going to interfere with parts on the panel, we are ready to fasten them in permanently. Our remarks in the March issue concerning the location of apparatus, and the drawing of the "Danger Line" still hold good.

Figure 2. Connecting the Filament Wires.

Connect the F minus on sockets Nos. 9, 3, 6, 12, 28 to a single wire. If you use bell wire, the one length will do. If you are using the buss bar wiring, put lugs under the socket terminals and solder the one wire to the lugs.

Connect the plus filament terminal of socket No. 6 to the plus filament of socket No. 12; and from there to the plus filament of socket No. 28.

Connect F plus of socket No. 28 to the front of No. 11. (If you are using the Amperite instead of the Brach, or Daven unit for filament control you will need two additional mounts which do not show on the diagram. In that event your connections will run as follows: Instead of joining the three positive filament terminals of sockets Nos. 6, 12, and 28 by a common wire, run a wire that connects the two Amperite mounts for tubes Nos. 6 and 12. The end of this should be con-

Amplification

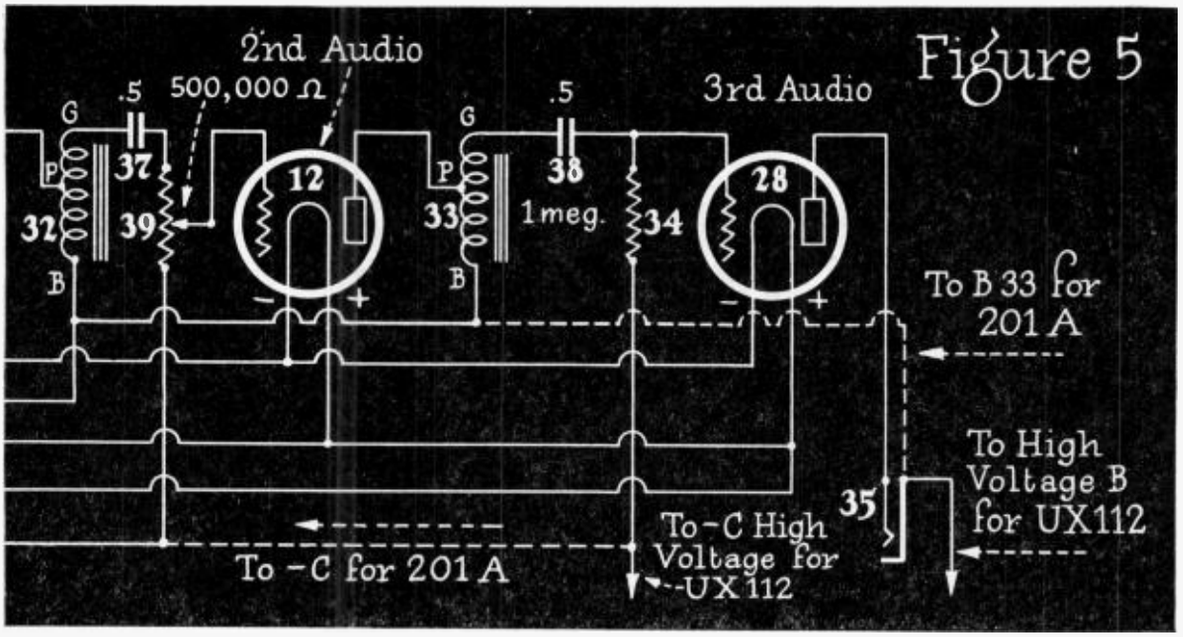


Figure 5

Here is Another Method of Audio Coupling That is An Attempt to Secure Better Musical Quality

with impedance coupled audio amplification.

nected to the rear of No. 11 and the front of No. 11 should be connected to the plus filament of socket No. 28. The unconnected side of the other two Amperites should be connected to the plus filament connections of tubes Nos. 6 and 12.

Now, whether you are using Amperites, Brach, or Daven filament control, connect a wire from the rear of No. 11, to the red connection on the Jones cable mount which is numbered 40 in the diagrams. This is the plus filament connection.

From the left side of No. 1 to the F minus on socket No. 9.

From the bottom of jack No. 29 (ground connection), to the wire that joins No. 40 red and No. 11 rear.

From the yellow connection on No. 40 (B minus) to the red connection on No. 40, or to the line going to the red connection from the bottom of 29.

Figure 3. Grid Leads.

From the bottom, or rear of grid condenser and leak No. 4 to G of No. 3. If you have done as suggested a few paragraphs back, this wire is already in place and ready for you to fasten.

From right side of No. 1 to front of No. 2.

From P30 to the rear of No. 10.

From the other side of No. 10 to the line joining the minus filaments of the tube sockets.

From G30 to the front of No. 36.

From the rear of No. 36 to G6.

From G6 to front of No. 31.

From the blue connection on No. 40 (detector B plus) to 30B.

Wire from 6P to 32P.

32G to 37 front.

B32 to B33.

A wire from this last wire to the pink on No. 40 (90 volt B-plus).

12P to 33P.

33G to 38 front.

38 rear to 28G.

28G to 34 front.

28P to 35 blade.

31 rear to 40 brown. This is the 4½ volt C minus. It does not come into the cable but is one of the two wires outside. These two wires were intended for the antenna and ground connection. If possible, locate the C battery inside the cabinet of your set and cut off this wire when the set is completed so that the brown wire attached to the plug will be as short as possible. This is part of the grid circuit of your set and should be no longer than is absolutely necessary.

From 40 green to 40 black. The black wire is the plus C battery connection. The same remarks apply to it that have just been made in regard to the brown wire.

From 9P to 2 rear.

A loose wire that will be long enough to reach your high voltage B should be attached to the bottom of No. 35 if you are going to use the UX112 tube. If you are not going to do this, and are going to use the regular 201A type connect the bottom of No. 35 to the wire connecting B33 and B32.

A loose wire from the rear of No. 34 that is to be long enough to reach the C battery. This is to be the high negative if you are using the UX112 tube. If you are not, it is to be joined to brown on No. 40.

Figure 4. Panel Connections.

If you followed the advice given earlier in the article, the instruments are mounted on the panel, and you are sure that none of the parts that are located on either the baseboard, or the panel, are going to interfere with the proper operation of each other.

In this section of the hook-up directions we are going to do the same as we have done in the two previous issues, and refer at various places to a "loose wire." These remarks have nothing to do with the moral character of the wire, but refer to a piece of wire that is left with one end unconnected, and which is joined to its proper connection when the base and the panel are connected.

Lay the panel on the table before you with the back of the panel upwards. The edge that is to be at the top should be nearest you, and the edge that is to be the bottom should be away from you.

Loose wire from 13, bottom to be connected to F plus on No. 9.

Loose wire from 18 top for plus F on No. 3.

13 top to 18 bottom.

Loose wire from No. 15 bottom to go to green on 40. (This is the minus A connection.)

From the top of No. 15, a loose wire to be connected to any point on the line joining the minus connections on the tube sockets.

By the way, are you putting a slip of paper, or a tag, over these "immoral" wires so that you will know where they go when you get done? If you are in doubt as to how to do this, see the photograph at the bottom of Page 20 in the March, 1926, issue of this magazine.

Connect 8G to 14S.

8F to 14R.

16G to 17S.

16F to 17R.

From any point on the wire from 8G to 14S attach a wire to be connected later to 9G.

A loose wire from any point on the line connecting 8F and 14R to be connected to the right side of No. 1. Don't get excited and forget to put a tag on it!

From B plus 1 on No. 16 a loose wire is to go to the wire that joins B32 and B33.

From B plus 2 on 16 a loose wire goes to 30P.

From P1 on 16, loose wire to 9P.

From P2 on 16, a loose wire goes to P3.

From the wire which joins 16G and 17S a loose wire goes to top of No. 4.

Wire from the one joining 16F and 17R to 18 bottom.

A loose wire from the bottom of No. 18 that is to be connected to 40 red.

From 39 right to be connected to 40 brown. This is the minus C4½.

Loose wire from 39 center to 12G.

Loose wire from 39 left to 37 rear.

From antenna post on No. 8, loose wire to the blade of jack No. 29.

From the ground connection of No. 8 to the frame on No. 29.

If you have tagged the wires on the panel as we have suggested it is now only necessary for you to fasten the panel to the baseboard and make the connections indicated.

Here endeth the lesson. We will now get the dust pan and brush and clean up the mess that we have made in the kitchen. At this point, it is also wise to turn off the juice in the electric soldering iron, if you use one. You remember the remarks that were made the last time the electric iron was left turned on?

Since we have already explained the neutralization and operation of the set in the March and April issues, we have only to caution you to remember that the All-American condensers require a 360 degree dial. Don't do as I did,—put on a 180 degree dial, and yell to Turner for help because the set wouldn't tune above 300 meters.

Once more, you are referred to H. M. N.'s remarks on Page 17 of the March issue. We still have all three sets on the test table and we still are not willing to tell you which is the "best set."

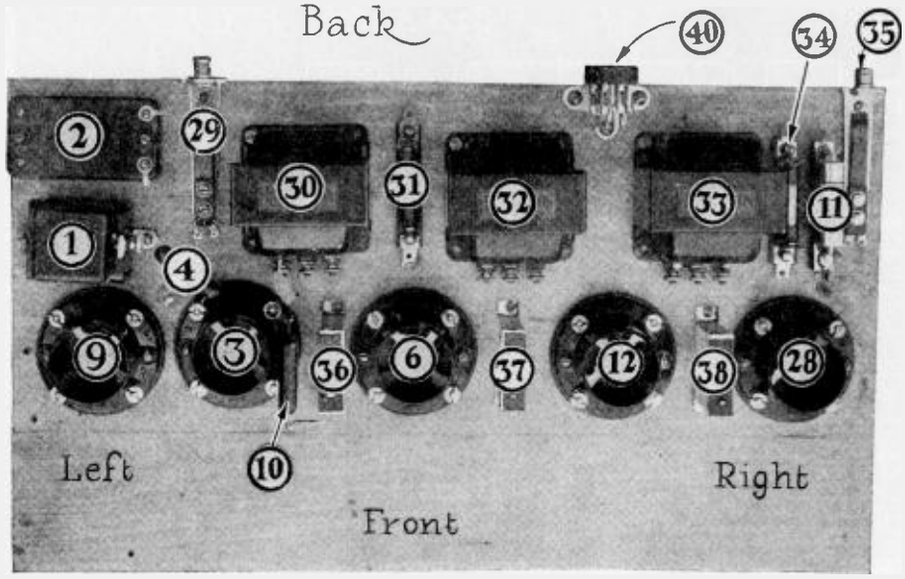


Figure 1. Layout of parts on the baseboard.

At any rate, you can be sure if you build this one that you will not be greeted by the remark, "Aw, that's no better than any of the other sets that you have built!"

Before closing, we want to print a letter which will be of value to readers who built the T-C set with resistance coupling. The writer is Arthur Lynch, formerly editor of Radio Broadcast. He says:

"I read with a great deal of interest your editorial note accompanying the description of the T-C set with resistance coupling by Mr. G. P. Allen in the April issue.

"If the receiver used at your laboratory employs the circuit pictured on Page 42, I don't wonder that there is still some doubt in your mind as to the advantages of resistance over other types of audio frequency amplifications.

"You will notice that the first two audio frequency tubes are supplied by 90 volts. That is, 90 volts is applied to the plates through the coupling resistor; actually the plates have imposed upon them about 45 volts. Forty-five volts in an audio frequency amplifier with a negative bias of 4.5 volts, is not liable to produce too great tone quality or very much volume.

"Another thing which seems to me to be a little out of order is the use of a ballast resistor for controlling the filament of the last three tubes. If two 201 'A's' or high mu 20 tubes are used in the first two stages of the resistance amplifier, they should. under ordinary conditions, operate at ¼ of an ampere. The last tube, whether it be a mu 6 or the Radio Corporation UX-112, requires for its best operation .5 ampere. How can these filaments be operated from the same ballast resistor and all of them be operated correctly?

"A thorough test of the receiver using 90 volts on the radio frequency tube with the

LIST OF PARTS SHOWN ON BASEBOARD OF FIG. 1

1. *Samson choke coil with .00025 fixed condenser.*
2. *Samson Neutralizing condenser.*
3. *Detector tube socket. This time we used Na-ald sockets.*
4. *Grid leak and condenser, .00025 mfd. and 3 meg. In this assembly the combination condenser mount is used. We used the Micamold unit, but if you have built the other two sets you can stick to the same mount that you have been using. Simply allow a little more space between sockets 3 and 9 to permit it to fit in.*
5. *This number not used.*
6. *First audio socket*
7. *This number not used.*
8. *Samson antenna coil.*
9. *Radio frequency tube socket.*
10. *.002 mfd. bypass condenser.*
11. *Brach mount, Micamold mount, or Daven mount for filament ballast for three tubes. If you are using the UX-112 this should be for 1 amp. of current. If you are using the 201A type this should be for ¾ amp. See discussion in April's issue.*
12. *Second audio tube socket.*
13. *Radio frequency tube rheostat, 30 ohms. This time we used the Centralab.*
14. *.0005 mfd. variable condenser. This time we used All-American Type C-50.*
15. *Filament switch.*
16. *Two rotor coil.*
17. *.0005 mfd.; Type C-50, All-American variable condenser.*
18. *Detector tube rheostat, 30 ohms Centralab.*

Nos. 19 to 27 inclusive are not used in this hookup.

28. *Third audio tube socket.*
29. *Single open circuit jack to take plug for antenna and ground wires.*
30. *Thordarsen Autoformer.*
31. *Resistance mount with .1 meg leak, Micamold. If you built the subpanel job last month and want to tear it down you can use part number 19 here, only don't forget to call it by the new number.*
32. *Thordarsen autoformer.*
33. *Thordarsen autoformer.*
34. *Resistance mount with .1 meg leak, Micamold. You can use number 22 of last month here.*
35. *Single open circuit jack to take plug for loud speaker.*
36. 37. 38. *Micamold .5 mfd. bypass condensers.*
39. *Bremer Tully, or Centralab "Modulator." BT. number VC-500. This is a non-inductive resistance of 500,000 ohms in the form of a potentiometer. It is used as a volume control.*
40. *Jones multi-plug type B-M.*

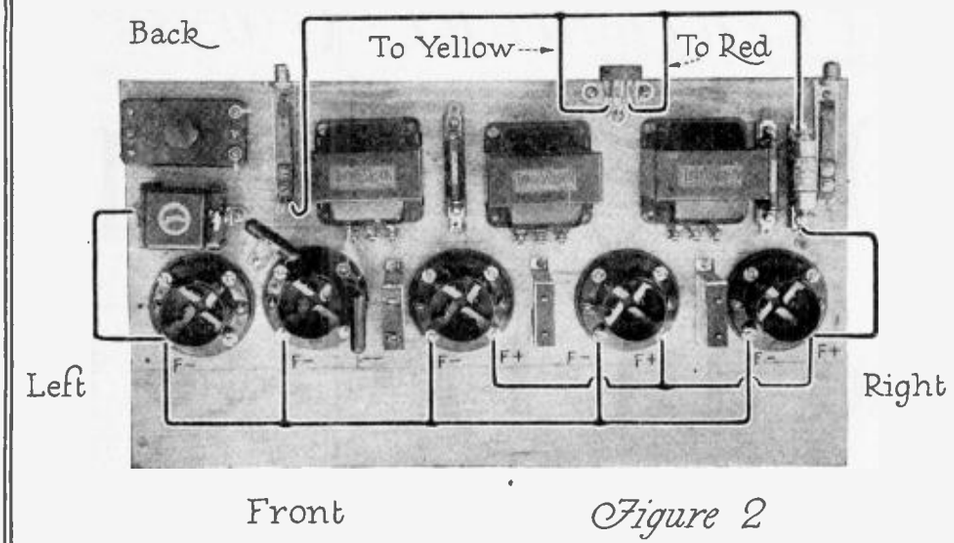


Figure 2

proper grid bias, would, I feel sure, disclose a very much more satisfactory proposition than 60 volts with no negative bias, although I will agree that the latter is slightly simpler to construct."

NEXT season promises an interesting contest among the adherents of the different forms of audio amplification.

Transformer coupling is the system which gave most of us our introduction to loud speaker reception and a great many still like it better than resistance or impedance. Resistance coupling, however, made great strides forward last season and gave transformer coupling quite a battle.

Now comes a growing interest in impedance coupling and this system is also finding its champions.

Just after I wrote this article, a prominent manufacturer brought to our laboratory a set constructed on a principle which he calls "dual impedance." As soon as we get the apparatus and all the dope on it, we will give it to you and that will introduce a fourth element into this fight for music without distortion.

The fifth element will be the power plant which H. M. N. speaks about in his editorial on Page 37 and with these five contestants in the field, the coming season bids fair to be an audio year.

We are glad of this at Station 3XP. Long ago we stopped trying to get any more DX because we cannot stand the strain of dragging in all the fireworks in the world to spoil our signals.

What we have been striving for and what we will continue to strive for is a genuinely natural reproduction of the music and speech transmitted by radio.

We don't care which of the systems we use. We aren't manufacturing anything except a public demand for quality reception.

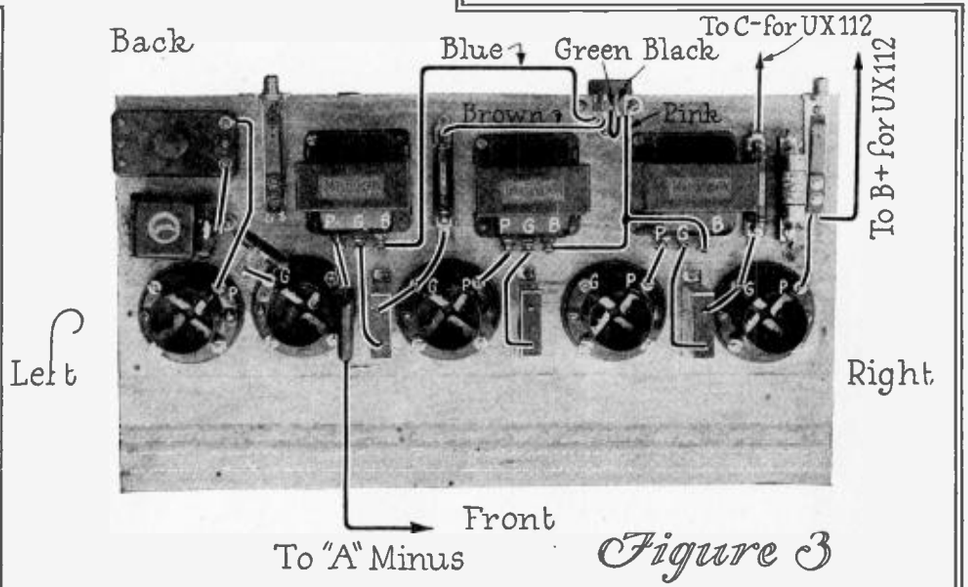


Figure 3

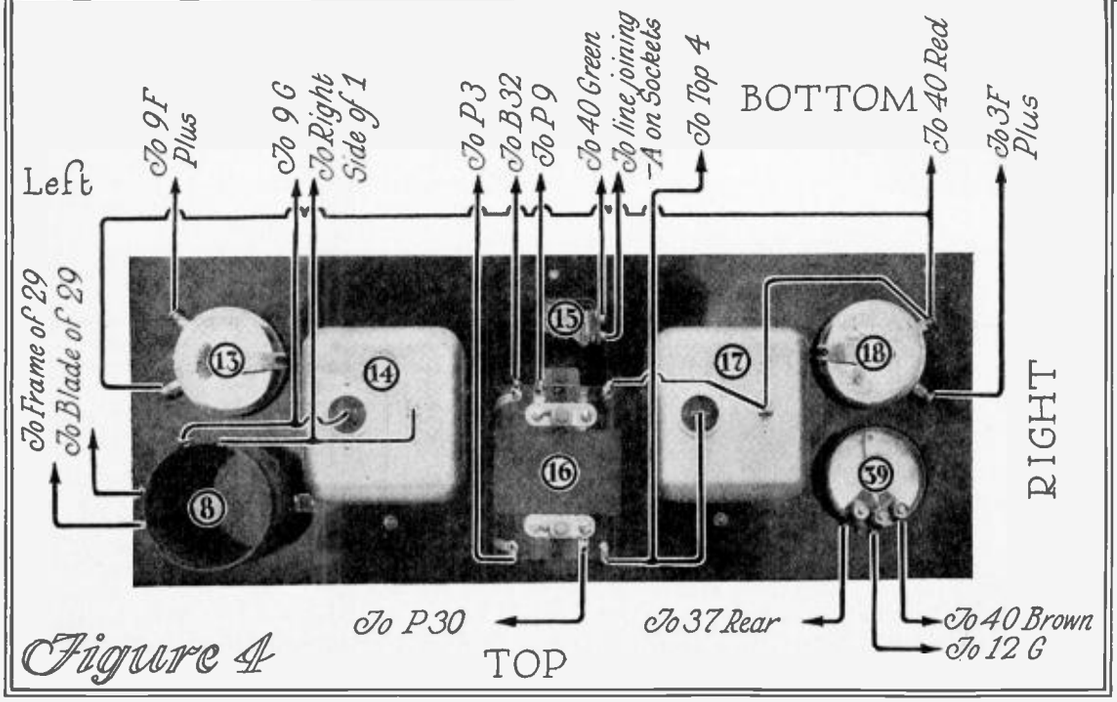


Figure 4

The upper left shows the wiring of the filament leads.

The center shows the grid and plate leads on the baseboard.

The lower left shows the connections on the back of the panel.

Is Your Entertainment Costly?

RADIO Costs Only 6⅓c an HOUR

Here is an Interesting and Surprising Analysis That Shows What a Wonderful Public Benefactor This New Science is, Even on a Financial Basis

You can get an evening of dance music by the best orchestras in the United States for thirty-five cents.

By K. B. HUMPHREY

Drawings by RUSSELL H. EDWARDS

HOW much does an hour of opera cost? What does that dance program come to? Would you give three cents to hear the Happiness Boys?

Most of the broadcast listeners have an idea that a radio receiver does not cost a great deal to operate, but very few probably have any idea as to what the actual cost is. It is an interesting question so let us get out our paper and pencil and see what it comes to in dollars and cents per hour of entertainment received over the radio.

An actual example is probably the best way to get at the problem. To make it more nearly universally applicable, however, average figures will be used throughout in the calculations. If the figures for an individual case are wanted it will be comparatively easy for the reader, by following the method outlined. to figure his own costs for himself.

The average receiver is of the five tube type using two stages of radio frequency, detector, and two steps of audio frequency, uses a storage battery, for lighting the tubes, a dry cell B battery for the plate current, operates a speaker, and uses an outside antenna. It is assumed that the cost of the receiver alone is $80.00 which is not far from being the average.

The accessories to go with the above receiver such as storage battery, B batteries, vacuum tubes, loud speaker, and aerial equipment will cost approximately $50.00 making the total cost come up to $130.00. This price varies to a great extent with the purchaser and may in certain cases run well over $200.00 and in others well under $100.000 completely installed. However, we are talking in averages and it is thought that $130.00 will about cover the cost of the receiver used in the medium class home. Chargers for the storage battery and B eliminators have not been figured in as they are not universally used at the present time.

Now that we have decided on a definite cost upon which to base our calculations, we can go a little further.

The average life of a receiver due to obsolescence is about four years. That is, it would have to be replaced every fourth year to get the best results. Radio is so young that definite figures cannot be obtained on this point but in comparison with other electrical machinery and in studying what has gone before it is thought that this is a fair figure.

Some of the accessories which include B batteries and tubes do not last this long and the cost of these will amount to about $20.00 at the present day prices. Subtracting this amount ($20.00) from the total cost of $130.00 leaves a balance of $110.00.

This amount spread over a period of four years gives a cost of $27.50 a year. Interest charges are not taken into account as they do not amount to any great sum and accuracy of the calculations do not warrant it.

The B batteries, say on the average, cost about $3.00 each and last approximately six months. Two of them are used and would be replaced twice a year making the total cost of this item $12.00.

This does not mean that a B battery will only last six months. Cases have been known where they have given much better service than this, and also much less at any given time.

The storage battery costs, on the average, for recharging in the metropolitan district fifty cents. The times that it is charged would average close to once every four weeks throughout the year thus making 13 recharges. Thirteen charges at the rate of fifty cents each would bring the cost up to $6.50 a year.

The battery is of the 100 ampere hour type and is used as the basis of the conclusions following: The storage battery tube takes .25 of an ampere to light it properly, and the total amperage taken by the five tubes would then be 1.25 amperes. At this rate of discharge, the battery being replenished every four weeks means that the receiver has been in operation somewhere around 80 hours or on the average of 2.85 hours a day, or in other words 2 hours and 51 minutes.

This figure may seem low to some operators and high to others depending a great deal on the degree of interest. What we are getting at is the figure which shows how much the receiver is operated during the year. A yearly figure would be 80 times 13 (the number of charges per year) or 1040 hours.

The ordinary vacuum tube is supposed to give about 1000 hours of first class service, but due to the process used for reviving tubes the actual hours of useful service is much greater. However, to take care of the possibility of a shortened life due to accidents or other causes, the best way to figure is that the tubes will last for one year. A new set of tubes will cost approximately $14.00 and can be considered to be the yearly charge for this item.

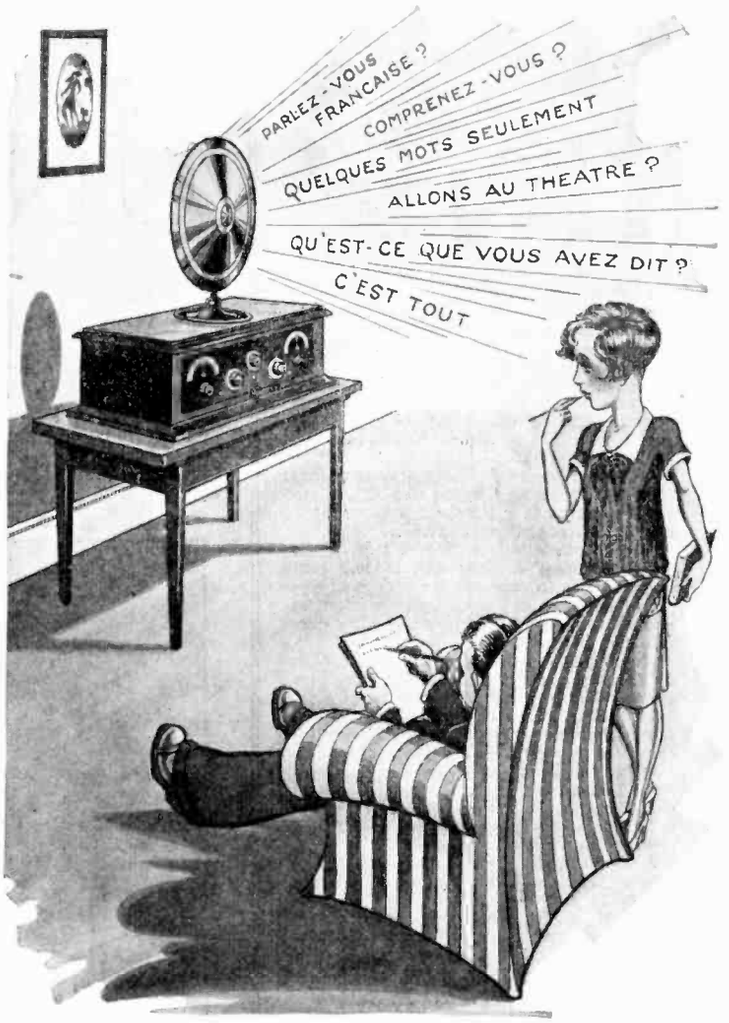
The service on the modern day receiver can be figured at about six dollars a year, allowing two calls at a minimum rate of three dollars each.

The summation of all these various charges is as follows:

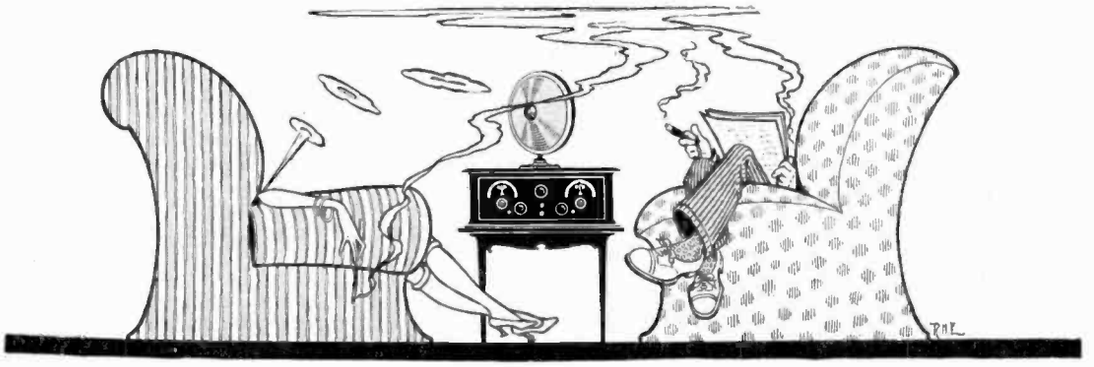
Cost of receiver per year..	$27.50
Cost of B batteries per year	12.00
Cost of storage battery charging	$ 6.50
Cost of vacuum tubes per year	14.00
Cost of service per year...	6.00
Total	$66.00

Sixty-six dollars looks like quite a bit of money but if it is figured on the basis of actual hours used the figure is $66.00 divided by 1040 hours or an actual cost of $.063 or a little over *six cents* on hour. Think what this means; a complete opera program for about *nineteen* cents. An evening of dance music by the best orchestras in the United States for *thirty-five* cents. A half hour with the Happiness Boys or other entertainers for about *three* cents. A lesson in French for *three* cents, and so on down the many varied programs as broadcast today.

As a form of entertainment at a very reasonable cost it would be hard to beat in this era of high prices and high living.



A lesson in French is obtainable for as little as three cents.



What Nakken Has in Store for You

My dear Mr. Neely:

The next article which I am preparing now will deal with regenerative receivers and how they work. In this article I intend laying great stress upon the undesirability of the use of this kind of receiver, unless radiation is completely prevented.

I am building at this time a regenerative receiver, in such a form that you can make a beautiful series of photographs of it. Regeneration takes place in a separate circuit, to which the antenna tuning coils are attached in the fashion of a Wheatstone bridge arrangement. This receiver is very sensitive indeed and completely prevents radiation, while it is as sensitive as any ordinary regenerator.

On this receiver I am preparing a construction article and would like you to reserve space for it in the same issue with the article on regenerative receivers.

The fourth article will deal with audio frequency amplification: and so will give me a chance to compare the merits of different systems, as transformers, resistances and choke coils. This article will carry over into the fifth one.

Radio frequency amplification will then be taken up, and I can promise you there another feature article on a system of radio amplification which will possess the following advantages: Absolute neutralization of the tube capacity, full voltage amplification per tube, the use of high Mu tubes for the R.F. stages and the application of C-battery to the R.F. tubes. This system will, I believe, surpass any five or six tube receiver on the market.

Following this I will deal with superheterodynes, and there again can promise you a few surprises. Again I want then to give you a feature article describing a superheterodyne which will enable the user to reduce static to the signal level.

Yours very truly,
Theodore H. Nakken.

How to UNDERSTAND

PART TWO
How the Signals Are Sent and Received

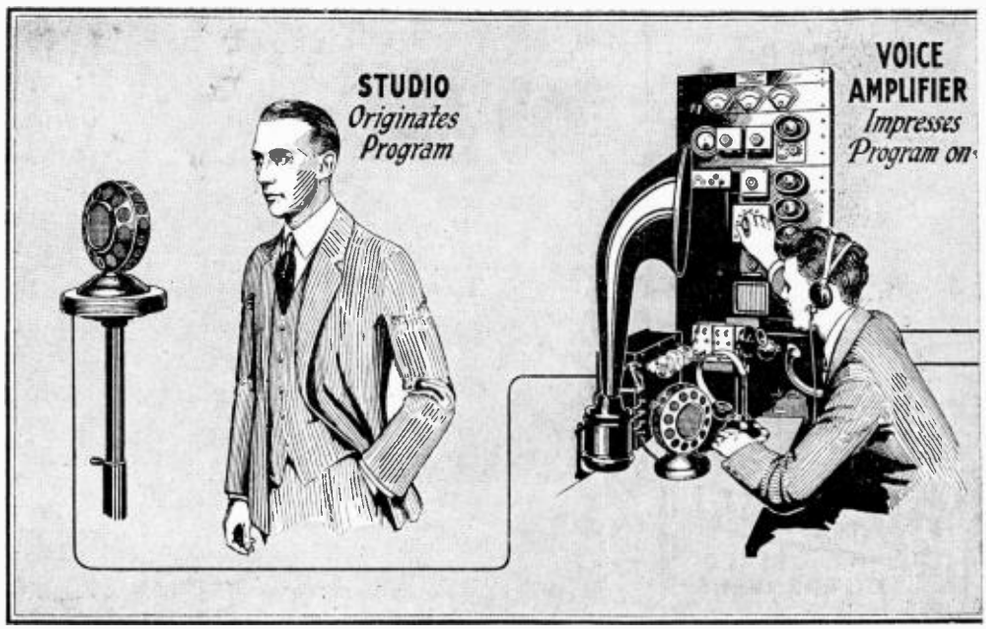
IN THE previous chapter of this series, we stated that the vacuum tube is the real heart of the modern radio receiver, and explained its action in some detail. It should be understood that not even half of the subject was touched upon, and that it will be necessary later to refer several times to the vacuum tube and its characteristics.

Actually we have only explained that the vacuum tube is a device which enables us to control electric currents by means of potentials, and that these potentials are applied between grid and filament, without any energy consumption by the vacuum tube itself.

We stated then that if we could only dispose of very small energies we might employ any and all means to convert this available energy into the largest potential difference possible, then to apply such potentials between grid and filament. It seems therefore that we now should consider in what form we receive the energy which will be used in our radio receiver to actuate the vacuum tube and how we will convert such energies into potential differences to be applied to filament and grid.

We are all familiar with the fact that in the radio transmitting station energy is radiated into space. This radiant energy, as it is called, is what actuates our receiver. And we must know how it can do so.

In the transmitting station, then, we find two very distinct parts in the equipment. The first is the apparatus which delivers energy in such a form that it can be radiated successfully into space; the second is that part of the apparatus controlling the radiated energy is such a manner that the latter is the electrical reproduction of the matter we want to radiate.



This shows the course the signal takes from the voice in the

The first part consists of the so-called oscillator and the transmitting antenna; the second is called the modulating equipment. In both sections, the vacuum tube plays an all-important part. In fact it may be stated that without vacuum tubes our modern broadcasting would be well nigh an impossibility.

The oscillator, then, consists of one or more vacuum tubes, which have been arranged in such a way that the tubes convert a direct current into alternating current of any desired frequency. How this is done we will see in a subsequent article, which will explain in detail how broadcasting is actually accomplished. The modulator impresses the program to be transmitted upon the alternating current delivered by the oscillator and causes this current to vary in its characteristics and thus makes it represent the program in an electrical sense.

This impressing or super-imposing of a program upon a high frequency current is called modulation.

To understand how the alternating current delivered by the oscillator can be radiated from the antenna, one must realize that when an electric current flows in a wire, this wire is surrounded by a so-called magnetic field. This field is established as soon as the current begins to flow, and disappears, or collapses, as soon as the current ceases. We will refer to the properties of such magnetic fields very often, as they are almost wholly responsible for the function of all parts of our radio receiving equipment, with the exception of the vacuum tube.

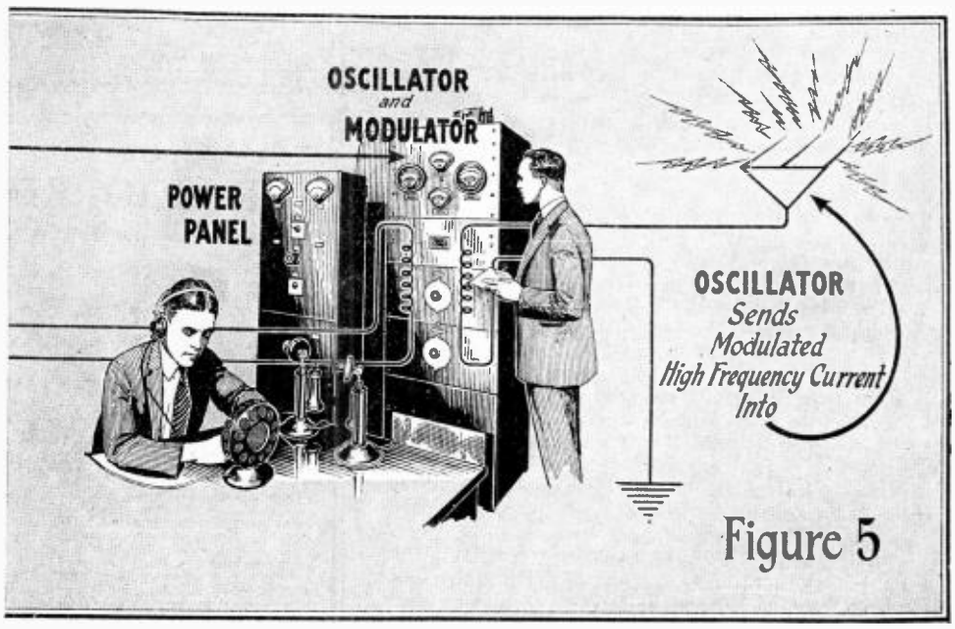
When we have a circuit in which a direct current is flowing, we will have a magnetic field surrounding this wire. When we break the current, that field will collapse. When we send an *alternating* current through the same circuit, it can be clearly seen that we will have a constant succession of magnetic fields, which are set up and collapse every time the current changes direction.

Such fields are never in rest, but are constantly moving, because alternating currents are such that they start from a zero value, gradually reach a maximum, then decrease, till they fall to zero, after which a current with the same characteristics begins flowing in the opposite direction. Now the magnetic field is at all times proportional to the current flow, so that the field also increases,

RADIO

By

THEODORE H. NAKKEN



studio to the ether waves radiating from the broadcasting antenna.

reaches a maximum, then decreases to zero, after which the same process is repeated.

When a conductor—that is, for instance, a metal wire—is located in a place where such a varying magnetic field is present, a current flow will be caused in the conductor by the action of that field. And this current will be an exact replica of the one which originally created the magnetic field in the first place. This phenomenon is called electromagnetic induction, and is the principle upon which all transformers are based.

If therefore a receiving instrument were placed in the immediate vicinity of a transmitting station, every one would realize that the varying magnetic field around the transmitting antenna would induce currents in the receiving antenna and its related circuits. But now the question arises: How can a receiving antenna, thousands of miles from the transmitter, be affected at all? Certainly not through pure induction such as we were talking about.

We will try to see the matter in a very simple way. It was stated that when an alternating current flows through a conductor, a field is gradually set up, till the current reaches a maximum, after which the field gradually collapses as the current decreases.

This holds true only to a certain extent: it is true when the number of current reversals is comparatively low, or, to state it in technical words, when the *frequency* of the alternating current is low.

As we increase the frequency of our alternating current, however, it seems that the fields created by the successive currents no longer have the time to collapse: they behave as if they were detached from the antenna and start to travel away from the latter: so that it seems as if the high frequency currents have given rise to free magnetic fields, which have nothing whatsoever to do with their origin any more. Of course, these magnetic fields represent energy, and retain their original property, i.e., when they pass a conductor, they induce an alternating current therein.

Now this is exactly what happens at a transmitting station: There we create by means of the oscillator alternating currents, which we cause to flow in the antenna: And we make the frequency of these currents so high, that their associated fields no longer collapse, but detach themselves from the antenna and travel away, radiate, into space.

In this manner, then, the broadcasting station radiates energy, and, as we said before, the currents flowing in the antenna were modulated in such a way that the high frequency currents represented the program to be transmitted. It follows then that the radiated magnetic fields, which travel outwards from the antenna, represent the program in their intensity, because the magnetic field created is at all times proportional to the current which created it.

Such a radiated magnetic field now travels with a terrific speed through space: it covers about 18,000 miles or 300,000,000 meters per second. Now, if the station works with an alternating current of a frequency of one million variations, or cycles, a second, it will send out that same number of individual magnetic fields a second. Between every field then lies a space of 300 meters, the distance traveled by the first field before the second has been created.

We see thus, that the *wave length*, as it is called, depends on the frequency of the alternating current creating the successive magnetic fields. If for example the frequency of a station is 500,000 a second, its wavelength is 600 meters: The product of frequency and wave length in meters must always be 300,000,000.

As these fields completely surround the antenna, and always travel away from it, it is clear that the radiation will take place in all directions. And this then means, that these radiated magnetic fields will reach almost any spot around the transmitting station, even if such a spot is thousands of miles away. Even then they will be only passing by, to go on into infinity, no one knows when to cease. As they spread out their sphere all the time, the intensity decreases all the time, but never disappears completely. And always these fields retain their inherent property, that they can induce a current in a conductor which they happen to pass.

Therefore, if we erect a metallic conductor say in Australia, and we start sending out our magnetic fields, or waves, as we will now call them, from some part of the United States, these waves will reach the conductor in Australia: they will induce alternating currents in that conductor, which of course are exceedingly feeble, but still represent accurately the alternating currents which were used to create the traveling wave. And thus it should be possible to use these currents in the conductor to recreate the program which was used to modulate the alternating currents at the transmitting station.

But, as stated, these currents are so feeble, that there never was any instrument in the history of science which would be able to respond to such currents. Only the discovery of the three element tube was able to put these small currents to practical use: it made long-distance reception a common thing.

In view of the fact that these currents are so minute, it appears necessary to take all possible precautions to retain them without any losses that can be avoided by proper precautions. We will, therefore, try to keep the actual resistance of our metallic conductor at the receiving station, the receiving antenna, as low as possible, because, if we made this antenna out of material of high resistance, most of the current which in itself is already so extremely small would be lost by conversion into heat, due to another effect of electric currents—their property to heat up conductors through which they are flowing. The higher the resistance of a conductor, the more current is converted into heat, and as far as radio reception is concerned, heat is a total loss. We will therefore make our receiving antenna from a metal with low resistance, and the logical metal is copper.

Of course the currents induced in the receiving antenna are alternating currents of

the same frequency as those at the transmitting station and they are called radio frequency currents.

These currents, when travelling over a wire, show a peculiarity, in that they travel largely over the *surface* of the wire, instead of *through* it, as one would expect. This property is called the "skin effect": and we will preferably take this property into account when choosing antenna wire.

If the antenna is meant as an outdoor antenna and therefore expose to wind and weather one may expect that it will be covered in a very short time by a thin layer of corrosion, and this consists largely of copper oxide, which is a bad conductor. This causes an excessive surface resistance, even if the antenna is made of best possible material.

It is for this reason that enameled wire is generally recommended for use as antenna wire, because under the protecting coat of enamel the copper has little chance of corroding, and the enamel is an insulator, so that our currents have no tendency to travel therein.

But not only should the receiving antenna be constructed of low resistance material. Because the currents travel over the surface of the wire, it is advisable to give the antenna wire as large a surface as possible, in order to reduce the effective resistance of the antenna, and thus to enable the current to be fully utilized. It is with this fact in mind that nowadays the recommended antenna material is braided enameled wire, because such a wire has more surface than a single round wire of the same thickness and strength. Many other kinds of special antenna materials are put on the market, but it is very doubtful whether these give any special benefits.

We will now consider the so-called tuning of the apparatus attached to this antenna. In doing so, we must remember that mostly there is not only one transmitting station which radiates energy, but that there are a multitude of stations which are working at the same time. And we must therefore have some means to choose between these stations at will.

When describing the transmitter we stated that the latter consists of an oscillator and a modulating system. We also know that the oscillator is nothing but a generator of high frequency alternating current, which current causes radiant energy to travel into space, and we mentioned the terms "frequency" and "wave length" in connection with the radiated magnetic fields. This frequency can be regulated at will, and is what enables us to select any one particular station with the exclusion of all other ones. We will make an endeavor to explain why this is possible.

We will for this purpose compare these electric waves with a sort of waves which are known to all of us—the everyday sound waves. It is generally known that when a string of a certain length, thickness and tension is agitated, it will invariably give the same tone; in other words it will vibrate at a rate or frequency, which is governed by the three factors named: length, tension and thickness.

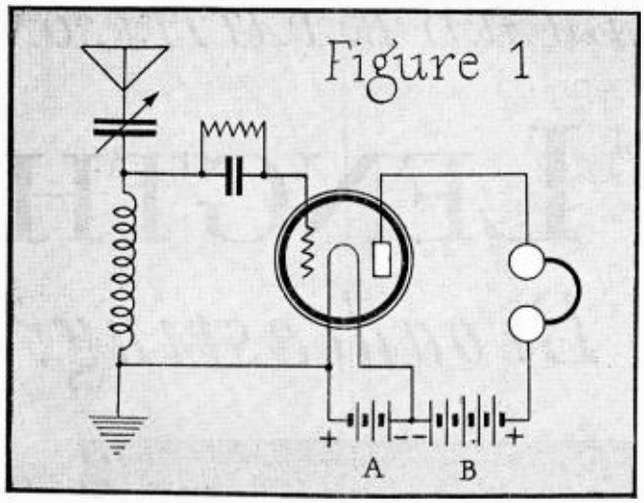
Not only this, but such a string has another peculiarity: When it is in rest, the same tone which it would normally emit when agitated, when sung or played on another instrument, will cause it to commence to vibrate in unison with the sound vibration. This is due to the fact that the surrounding air vibrates at that frequency, and therefore agitates the string in a series of extremely small impulses, but these impulses are so timed that each impulse reenforces the effect of the previous one. And when then suddenly the original tone ceases, the string will continue in its vibrations and act as a sort of echo. Any one can prove this by singing to a tuned violin: It will sing when one of its fundamental notes is sung to it. With a piano, with its many strings, it is even possible to make a great many strings vibrate by singing into its case while the loud pedal is held down. When one sings different vowels, the piano will answer, and the sound it emits will sound like the vowel that was sung.

In the same manner one can excite columns of air and these will, when agitated, vibrate at a definite rate and emit a certain tone. But also they will respond when the same note is sung into them. One could give many more examples of such sympathetic vibrations, and it has been stated that, if in complete silence, a certain tone should be played in the vicinity of a large building, such a building would start vibrating in sympathy at the same frequency and at last would sway so violently that it would fall to earth.

Such phenomena of ready response to certain frequencies are generally called "resonance phenomena," and we find many applications in electrical apparatus. But most of all do we find them in applications of high frequency alternating currents, or radio frequencies, as they are generally called. We are able to design circuits that will respond to or be resonant to certain frequencies.

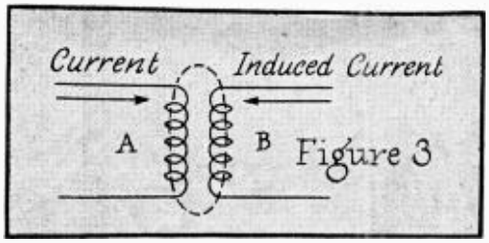
In such electrically resonant circuits we will find invariably a combination of two electrical characteristics: Inductance and capacity.

In radio instruments, the inductance of a circuit is present in the form of a coil of wire, the capacity being a condenser. The various coils in such instruments have in general a fixed number of turns, while the condenser can be changed at will: It consists of two sets of plates, of which one



set can be rotated and meshed with a fixed set of plates without touching. Now, when two electrical conductors are placed in each other's vicinity, they have what is called a certain *capacity*, which means that a certain amount of energy can be "stored" in them, when one is charged positively, the other negatively. The capacity of two conductors then is dependent upon the total area and the distance between them, and also on the kind of material which separates them.

When, therefore, the two sets of plates are completely meshed, the capacity of a variable condenser will be largest, but when we rotate the movable plates of the condenser in such a way that the plates do not mesh at all,



its capacity is at a minimum because the total area enclosed between the plates is at a minimum.

It is almost impossible at this point to analyze fully why a combination of an inductance and a capacity should resonate or respond to a certain frequency, because this would lead us into an involved mathematical treatise, which we wish to avoid as much as possible. We will therefore try to explain the matter by simply stating that when alternating currents flow over an inductance, this inductance has an effect upon the passage of current which is exactly the opposite of the effect a capacity would have.

This then means that if we start out with an alternating current of a certain frequency, a given inductance will exert a definite influence upon the passage of that current. If, however, we also put a condenser in the circuit which we can vary at will, we can always find a value of capacity which will offset the effect of the inductance: and which only offsets this effect at the one frequency. The combination of inductance and capacity behaves then at this frequency as if it showed preference, because for all other frequencies, the combination of the circuit is not in resonance, as it is called: coil and condenser do not offset each other.

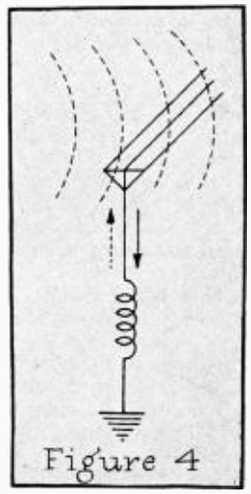
The variation of the condenser to the value of capacity at which the circuit will be resonant to a certain frequency, to a certain radio signal in a receiver, is called *tuning*. It would be equally possible to use a fixed value of capacity, and a variable inductance —as in the variometer— but for practical reasons the most common form of tuning element is a variable condenser.

When such a circuit is tuned to a certain frequency, and currents of that frequency are introduced into that circuit, we will see that these currents can pass very easily. At the same time there are caused large differences in potential, or voltage, across the coil and the condenser, due to the action of the circuit.

Now it was stated in the beginning of this chapter that we might employ any and all means for converting our very small energies into the largest possible potential differences and then apply these potentials between grid and filament of a vacuum tube.

This is exactly what we are striving to accomplish when we tune a receiver. We make use of the infinitesimally small currents generated in our receiving antenna by the passing waves from the distant transmitting station, and we tune the antenna to the particular frequency of these waves, so that their passage shall be as easy as possible. They will then flow without any appreciable resistance in the antenna circuit and therefore generate the largest possible potential differences across coil and condenser, and these differences are then applied to the vacuum tube.

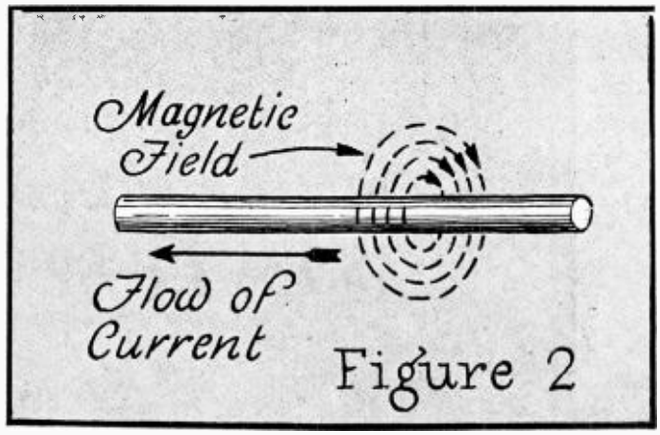
When we only tune the antenna, by inserting in it a coil and a variable condenser, we can easily construct an extremely simple radio receiver: Such an instrument is shown diagrammatically in Figure 1, complete with the vacuum tube and its related circuits and the head phones.



This circuit is about the simplest possible form of vacuum tube receiver, and in view of its extreme simplicity delivers remarkable results. It will receive signals over more than 100 miles and gives remarkably clear reception in the head phones. Nobody, however, would think of using it, as the one tube can be made to deliver much better results, as will be shown in the next article.

The circuit contains two instruments or devices that have not been dealt with as yet, and the function of which will be explained later. These are the grid leak and grid condenser.

It must be remembered that the signal wave —and thus the current which this passing wave creates in the antenna—has an extremely high frequency: a wave length of 300 meters means that the current has a frequency of one million complete reversals or cycles per second. Now it would be absolutely impossible for the human ear to hear such a high frequency; in fact most of us can-



not hear frequencies above 10,000 to 20,000. Also it is impossible for the diaphragm of the telephone, which must be set in motion by the current variations in the plate circuit of the vacuum tube, to vibrate at such a high speed. And it is the vibrations of this diaphragm that convert a received signal, which represents electrical energy, into sound.

Anyway, what we want to hear is not the high frequencies themselves. As was explained, we only utilize these to superimpose the actual program upon them, because they are capable of being radiated into space. As soon as they have served their purpose they are of no further use to us, and should be separated from the matter we desire to receive.

The process of discarding the "carrier wave" (a high frequency) and reducing the received signal currents to such a form that they can actuate the telephones and can be observed by the ear is called "detection."

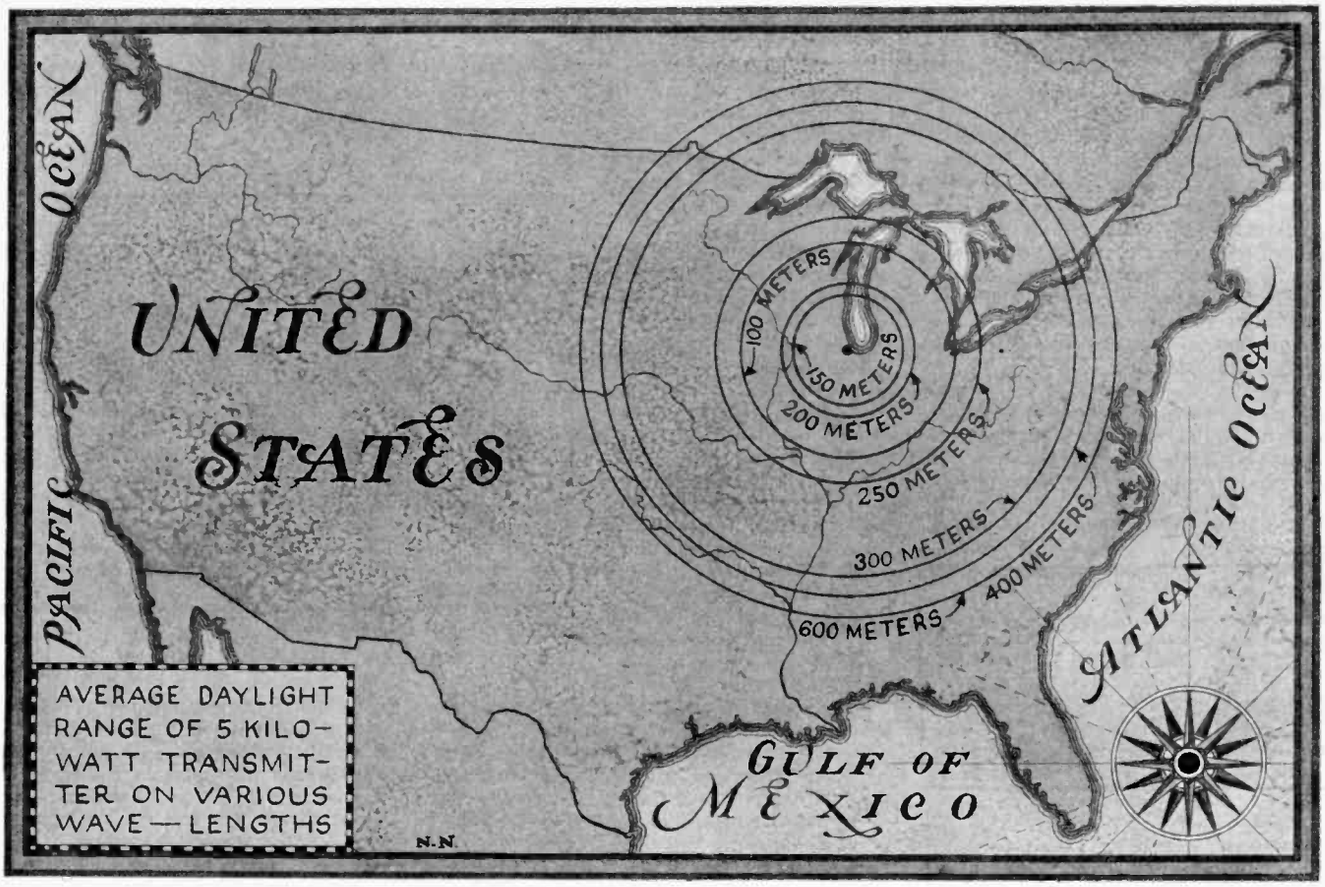
This in itself is an interesting subject and all radio fans are fully aware of the past difficulties experienced in securing a special tube that would prove a good "detector" and the development work that is now going on in this line.

The next article will deal with this subject, and will also explain in detail how the amplification of the signal by the tube can be boosted enormously by the use of so-called *regeneration*, whereby the signal is amplified in the receiving tube many times over.

What is the BEST WAVE LENGTH *for Broadcasting?*

By EDWARD B. PATTERSON

New Theory Shows Station on 400 Meters Will Be About Twelve Times as Efficient as It Would Be on 200 Meters



For the purpose of comparing the ranges of the station on various wave lengths, Chicago has been taken as the center. The 200 meter wave appears to be a poor one for daylight transmission.

DID you ever sit before your trusty receiver and wonder why distance did not come in as it should and why some stations faded? There probably isn't a radio fan in the country who, at some time, has not asked these questions which are as old as radio itself.

Scientists have been trying to solve just such problems ever since radio was shown to be a practical form of communication. The title of this interesting study is known as "Radio Wave propagation."

It is remarkable how much and also how little is really known about the propagation of radio waves and how they journey from the transmitting station to the receiver. If you are mathematically inclined you will find a most attractive field when you begin to investigate the idiosyncrasies of radio waves.

However, it is not the purpose of this article to delve into a deep analysis of the behavior of the waves, as such technical treatment of the subject can be found in the standard works and the highly technical journals. Since many do not have the knack of absorbing such material, a brief and simplified outline of what is known about radio wave propagation may be appropriate at this time for recently a new theory has been advanced which appears to answer questions raised about propagation.

This latest theory has a distinct bearing on the present day broadcasting and shows that some of the wave lengths included in the broadcast band are the most inefficient ones in the entire spectrum.

The new information recently available based on daylight ranges indicates that a broadcasting station on a wave length of 400 meters has an opportunity approximately twelve times greater of reaching the public than a station on a wave of 200 meters.

But before starting on this theory we should review some of the important contributions to our knowledge of the subject from the early times to the present.

Back in 1873 Clerk Maxwell, the great English mathematician, developed a theory which showed that light and radiant heat were electro-magnetic and that they travelled through the ether at a definite velocity which was known to be about 300,000 kilometers or 186,000 miles per second.

Heinrich Hertz, the German physicist, published around 1887 and later, the results of his experiments with electro-magnetic waves which substantiated Maxwell's theory. Hertz had produced electro-magnetic (radio) waves, or ether waves as they were called, about 60 centimeters long by an electrical mechanism. These waves, although many, many times longer than light waves, nevertheless obeyed the same laws.

In his experiments, Hertz employed an oscillator which consisted of a spark gap, each side of which was connected to copper rods thirty centimeters long extending outward in a straight line. On the free or outside ends of the rods, round or square plates were attached. The spark gap was connected to an induction coil to give the desired sparking action.

Every radio fan is familiar with the fact that when sparking occurs, an ether disturbance is the result. When you turn an electric light off and on in the vicinity of your receiver you often hear in your loud speaker the click of the tiny spark which takes place at the switch.

You also have observed other manifestations of sparking and the consequent noises. Of course, this is old stuff to you but just remember that Hertz did not have an easy time in detecting such ether disturbances.

How did he find that an ether disturbance was caused? He fashioned a loop from a rod and brought the free ends very close together to form a spark gap. By placing the loop at various distances and in various positions with respect to his oscillator or sending rods, a spark appeared in the little loop gap. In other words a spark occurring at the transmitter caused a spark to take place at the receiver.

We can readily imagine his delight in observing the phenomenon. To be sure he had a crude detector in his receiving apparatus but the little spark ignited the scientific world and made radio broadcasting possible for us today, instead of for our grandchildren.

Rather than illustrate Hertz's famous experiment with diagrams which may be confusing, let us turn to the time honored analogy of the water waves. A stone dropped in a pool causes water waves which spread out in ever increasing circles. In a somewhat similiar manner radio waves swing out from the radio transmitter.

Any substance placed in the path of the waves and having a period of vibration like those of the waves will be set oscillating by them.

The plane in which the oscillator is placed of course controls the plane in which the waves leave the transmitter. It is not necessary for the waves to swing up and down vertically as in a pond because in radio we also have the condition where the pond can be visualized as extending in a vertical position, in which case the wave motion would be horizontal.

Following Hertz's foot-steps many investigators turned their attention to the study of the new ether waves. It seems that the scientists wanted still shorter waves approaching those of light and heat and it is recorded that one professor produced waves having a length of six tenths of a centimeter.

It was in 1895 that the young Italian, Marconi, put in an appearance and in 1901 we hear of him transmitting a message 200 miles with aerials at the sending and receiving station only 300 feet high. But he had sent waves around the curvature of the earth! The curvature of the earth was no barrier to wireless waves!

Later he signalled across the Atlantic Ocean which was further proof that the bulge of the earth did not interfere with long distance transmission.

Such a feat was rather startling to those who had been thinking of radio in terms of light. Lord Rayleigh, it is recorded, asked how these ether waves could go around the earth. To be sure the waves used by Marconi were fairly long but that did not lessen the importance of the new problem.

As Marconi experimented he found some unusual conditions. At a distance of 500 miles from his transmitting station there was a marked difference between the strength of the day and night signals. Signals were inaudible at 800 miles away during the day time, while at night signals from the same station were clearly heard 2000 miles away.

Such a phenomenon was disconcerting to those who had worked out the laws for these waves from data obtained on transmissions as great as 50 miles. The law clearly stated that the signals would decrease inversely as the square of the distance. (Such is the case for light waves.) In other words if a signal had the strength of one unit at the transmitting station, then the signal at a distance of four unit lengths from the station would have one-sixteenth of its strength, etc.

But Marconi found the law was a fizzle. Then observers discovered the day time signals fell off more rapidly that the inverse square law and that the night time signals were too variable to be measured with any degree of accuracy.

Opinions were advanced that diffraction of the waves would account for the transmissions over the bulge of the earth. We know how sound bends due to diffraction and the same is also true of light to a small extent. Even this could not account entirely for the whole phenomenon.

In 1902 published reports of Kennelly in this country and Heaviside in England suggested the existence of a "ceiling" above the earth which by its reflecting properties would act somewhat like a whispering gallery. This layer or "radio roof" (which by the way bears their names) would act as a shell and keep the waves on the track, so to speak, and make transmissions around the world possible.

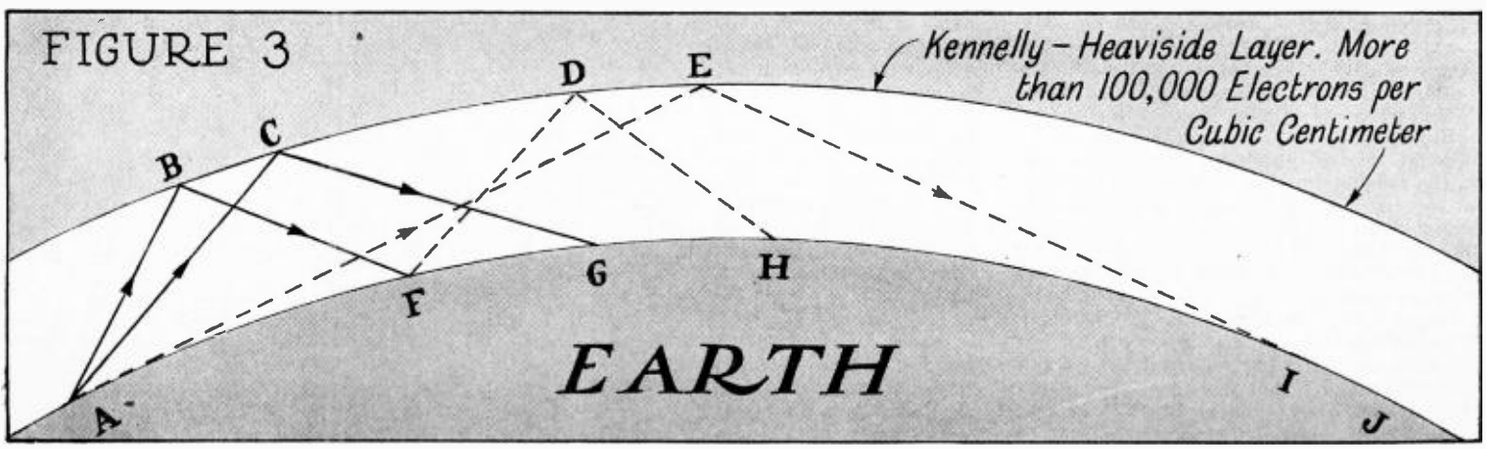
It was believed that this roof was caused by electrons or ions in the upper atmosphere produced by the action of the sun's rays on molecules. A molecule consists of positive and negative electrical charges perfectly balanced. However, the ultra-violet light from the sun and electrons from sun spots striking the molecules cause them to break up into positive and negative portions. The negative portion is the small electron and the other is the heavier positive part.

Such an ionized (from the Greek word ion meaning wanderer) layer would explain why radio waves pass around the bulge of the earth.

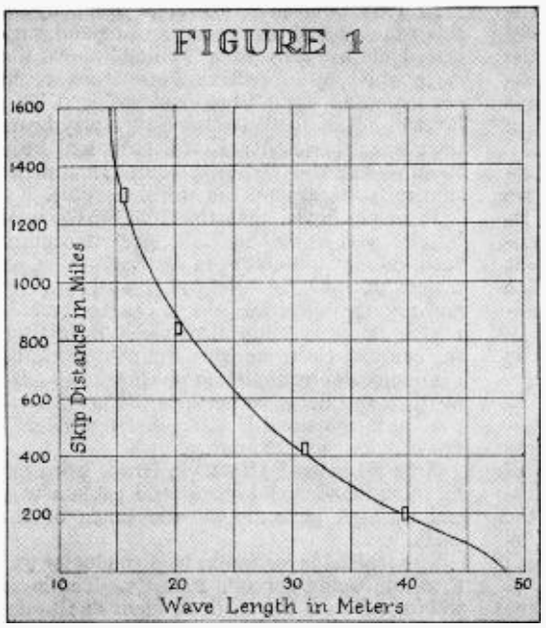
The ionized layer would be a conductor and therefore would act as a reflector. The layer would rise from the earth at night due to deionization or reuniting of the positive and negative portions of the molecules because of the withdrawal of the sun's rays. During the day the layer would come closer to the earth because of the sun. Even when it is dark, however, a certain portion of the upper layer never is deionized because of the rarified atmosphere. The layer is always present, although at different heights.

Due to this shifting of the height of the layer and also to a probable rough surface at times, it allowed a number of explanations of fading to be made and in part maintained. Irregularities in the "roof" and a possible difference in the paths of the waves would produce interference or beating of the various parts of the waves with one another in such a manner as to give neutralization of the energy with the consequent fading.

In 1910 Sommerfeld in his theory of wave propagation suggested that a wave from a transmitter at the earth's surface might be conceived of as consisting of two component parts, one of which would have the nature of a space wave and the other a surface wave. He also thought it was possible that the surface wave might be tilted forward in its journey due to the retarding action of the ground. Zenneck showed that the ground wave rapidly decreased in strength as the distance from the transmitter was increased.



Based on the reflection theory the rays from the transmitter at point A are shown reflected downward by the radio roof and upward by the ground. The skipped distances are indicated.



Poincare, Nicholson and H. W. March came to the conclusion a year or so later that the energy propagation along the curved surface was different than along a plane or level surface and also that the radiated energy did not entirely follow the course of the earth's curvature and that radiation or straying of energy into space away from the earth's surface might actually take place.

Eccles showed the bending of waves was due to ions in the upper atmosphere which became more numerous with increasing heights.

Extensive experiments were made by the U. S. Navy for a number of years starting back in 1910. Austin and Cohen as a result of the experiments finally developed a formula which would permit the calculation of the intensity of a signal at various distances from the transmitter. Since Marconi had found the inverse square law did not hold, these two scientists set out to find a formula that would. They found the energy density in the field of the waves fell off *as the sixth power of the distance.*

Larmor in 1924 advanced his theory of wave propagation which showed bending of waves without absorption. He noted that the bending increased as the square of the wave length which made it small for short waves.

In February of 1925, Appleton of England suggested that the earth's magnetic field might have an influence on the propagation of waves. While this suggestion had the appearance of being made in an off-hand manner, it nevertheless was of great importance.

In April of the same year, Nichols and Schelling, noting the erratic behavior of waves in the neighborhood of two hundred meters, set out to find the reason. There seemed to be something in the nature of the earth's surface or atmosphere which was responsible for the vagaries in the transmission of this band of wave lengths.

By means of a mathematical treatment, these engineers found that a wave length of 214 meters was readily absorbed by the ionized "radio roof." The fact that their mathematics so closely coincided with actual measurements showed their line of attack to be correct.

In considering the presence of the earth's magnetic field, they believed it possible that long waves might be propagated with less attenuation (reduction of strength) along the magnetic field (North and South) than waves travelling from East to West

During the course of experiments conducted with trans-Atlantic reception they did not find magnetic storms greatly influencing fading.

These engineers called attention to an important source of fading. Suppose that a radio wave strikes irregularities in the atmosphere. The front of the wave becomes "crinkled" and portions of it become concave and convex. On reaching a point near the receiver the wave may assume a distorted shape somewhat like water waves striking obstructions on a sandy beach. The form of the radio wave will be sensitive to fluctuations in the atmosphere and since the atmosphere does change with various periods of time we hence have the reason for fading. (In this article we are only considering general fading and not the fading due to distortion of waves by buildings and earth contour.)

The last and most important contribution to our knowledge of wave propagation comes from Dr. O. E. Hulbert of the Naval Research Laboratory at Washington, D. C., who recently lectured before the Franklin Institute on the "Kennelly-Heaviside Layer and Radio Wave Propagation."

Dr. Hulbert and Dr. A. H. Taylor of the Laboratory, working together and taking all the available material in hand, have made a distinct advance in this field. Extensive measurements made by Dr. G. W. Pickard and other scientists as well as those made by such amateurs as John Reinartz and others throughout the world have been considered and it appears that an adequate explanation of the vagaries of the waves has been discovered.

The new theory modifies Larmor's which was found incorrect on the short waves. While Larmor was correct on the high waves his theory did not hold for the entire spectrum. The new theory, however, overcomes these defects.

Dr. Hulbert's presentation of the theory before the Institute was highly technical and hence only a simplified outline of it will be given.

He stated that successful radio transmission to distances as great as half-way around the earth with waves below 90 meters proves attenuation (reduction of strength) is small, no matter to what cause it is attributed, and this combined with the pronounced earth absorption for the shorter waves leads forcibly to the conclusion that *waves must travel in the upper atmosphere and that absorption in these regions is slight.*

Experiments conducted by Dr. Taylor showed that for waves shorter than 50 meters the intensity of received signals decreased as the distance from the transmitter increased, reaching a value too low to be observed at the distance of 100 miles or so. On the other hand, with further increases in distance *the signals became readable again.*

A "skip zone" had been observed!

This skipping of radio waves is shown in one of the accompanying diagrams (Figure 1) which Dr. Hulbert used in his lecture before the Institute. It indicates that a wave length of 16 meters jumps approximately 1300 miles, 21 meters skips 700 miles, 40 meters skips 175 miles, etc. The skipping is not noticed above 50 meters as indicated in Figure 1.

This clearly proves predictions previously mentioned that a transmitted wave consists of two main parts, one of which clings to the earth, decreases in intensity and is lost while the other one returns to earth after refraction from the "radio roof."

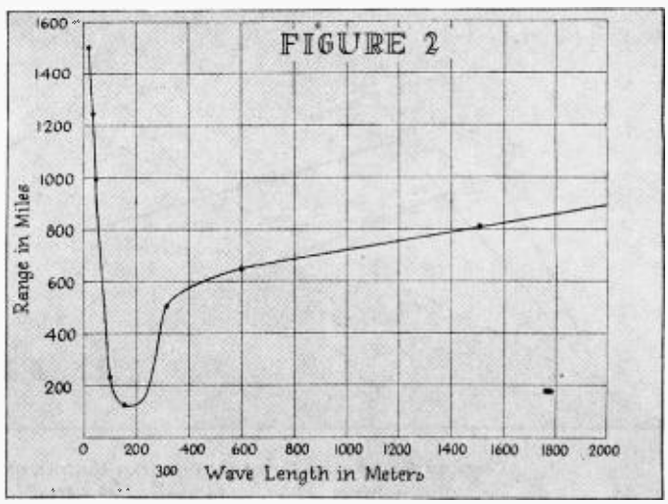
Of great importance was the second curve shown in Figure 2 which gives the daylight ranges averaged throughout a period of a year for a 5 kilowatt transmitter. It appears that ranges of more than one station may modify these results.

The minimum transmission falls in the zone around 200 meters and suggests there is a critical region of absorption. These actual measurements coincide with the theoretical minimum or critical wave length of dispersion or absorption at 214 meters.

The height of the radio roof responsible for the skip distance was calculated from the various constants available. Because of its physical appeal, it was assumed the layer consists of an ionized section of the atmosphere which is sharply defined and that the radio waves would travel in straight lines to the layer and be reflected back in the same manner. Actually, however, the wave is refracted along a curved surface.

You may wonder why some frequencies are reflected at different angles from others. This is because the bending depends in part upon frequency. Different radio frequencies from the transmitter therefore control the amount of skip distance.

In considering the radio roof and the atmosphere near the earth we must think of them in the same manner as though we were living under water with the air (representing the radio roof) above us. Suppose we had a flashlight under the water. Rays from it in a vertical direction would pass from the water out into the air. On the other hand at a certain angle between the vertical and horizontal we would find a point where the light



would neither go out into the air nor come back into the water again. It would be absorbed. At an angle more to the horizontal, the rays of light would not pass out into the air but would come back into the water again.

Now by placing an observer under the water at different position from us and by pointing the light at this angle of total internal reflection, the rays would go up to the surface and then be reflected back. Therefore, the observer at a distance from us would see the rays coming down at an angle from above.

The same action is true of radio waves. As previously noted, the higher the frequency, the flatter will be the angle of reflection and hence the greater the skipped distance.

Now suppose we and the observer sink down below the surface still further and repeat the experiment. The skip will be greater still. This is equivalent to night time transmission while the other experiment was like that occuring during the day.

If the surface of the water is rough there will be a distortion of the light rays which may result in the observation of fading by our friend who is receiving the light impulses.

The discovery of the skipped distance and of the fact that waves were propagated by refraction in the layer and reflection at the ground enabled a determination of the height of the radio roof to be made. Mathematics soon revealed the layer was approximately 150 miles high from a reflection standpoint. The skip distance is proportional to the layer height. Therefore, as the skipped distance at night is three times the day value, hence the layer at night is proportionally higher than during the day.

In Figure 1 it can be seen that for waves shorter than 10 or 14 meters the bulge of the earth prevents them from being used efficiently for communication over the earth although it is expected that certain freak conditions may allow some long distance communication at times. This if done at all will be exceptional according to the theory. The ground wave of course dies out and cannot be depended upon. On the other hand, if practice shows the very short waves are efficient, the theory must be modified.

Figure 3 serves to illustrate the skipping of the waves. The transmitter is at point A and the layer is 150 miles above the earth. For simplicity the waves will be shown reflected. Assuming the waves from A are confined to the space BAC, then the upper ray AB comes down at F, is reflected back to D down to H, etc. The distance AF is the first skipped section.

The lower limiting ray is assumed to be AE and from the drawing it will be seen there is a second skipped distance GH. Other skipped sections can be found with increases in distance but generally they are not well defined and very small.

It will be noted that the region IJ can be reached only with at least one ground reflection and two layer reflections. The distance AI is 2000 miles with the layer 150 miles high. The section FI is reached by one layer reflection and no ground reflection. Since the ground reflections vary in different parts of the country it is to be expected that the section FI will be easier to reach than IJ, disregarding the actual distance. This distinction for sections greater and less than 2,000 miles appears valid for all wave lengths which do not depend upon the ground wave.

It was pointed out that *a forest 2,500 miles away might be responsible for poor reception 5,000 miles away.*

Dr. Hulbert outlined conceptions of slow and rapid fading. For waves longer than 800 meters the high speed fading rarely occurs. From 300 to 600 meters it is noticeable only at intermediate distances and at night from 100 to 1,000 miles from the transmitter. From 60 to 100 meters the high speed fading is violent at night from 5 to 300 miles.

Slow fading is due to the distortion of the wave front by motion of the radio roof and corresponds somewhat to the twinkling of the stars we so often observe.

Audio or high speed fading is due to shifting interference patterns. What it is realized that a wave has four possible courses before reaching the receiver we know the waves from these different paths will interfere and neutralize or partly neutralize one another.

Dr. Hulbert showed that three overhead waves are possible, due either to the condition of the radio roof or to the rotation of the plane of polarization of the wave.

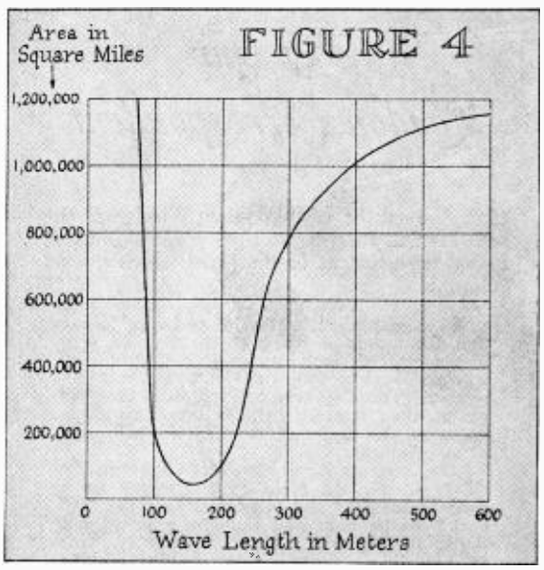


FIGURE 4

This beating of the waves with each other can be visualized by imagining two forces pulling on a rope in opposite directions. When the energy expended by both of them is equal, no work is done. However, if both forces go in the same direction considerable work can be done. A number of combinations are possible, which fact accounts for peculiar forms of fading.

Whenever fading occurs you can always be sure that the overhead waves are responsible for it.

At the beginning of this article it was mentioned that a station on the long broadcasting waves had a greater opportunity of reaching the public than those on the shorter waves. This statement was based on the experiments with a 5 kilowatt transmitter during the daylight hours. The ranges of this transmitter at various wave lengths are shown in Figure 2.

We can assume that a broadcasting station reaches out equally well in all directions. Hence to find the area which a station will cover, all we have to do is to get the square of the range or radius and multiply it by *pi* or 3.1416.

Accordingly, the ranges of Figure 2 have been used to give the areas in square miles which the transmitter employed in the test would cover at different wave lengths. The result is shown in Figure 4. It must be remembered that the graph is approximate and is only given to show the remarkable differences in the efficiencies of the wave lengths included in the broadcasting band.

It should be noted that the areas are only for daylight transmission. For those who do not read graphs, the ranges with Chicago as the center are shown on the accompanying map.

Immediately some fan will question the accuracy of the chart and map. How is it that he can hear a low wave broadcaster several thousand miles at night? Because it is night and the range increases and transmission becomes erratic.

It may also be noted that 214 meters found by mathematics to be the worst wave length to use is not at the lowest point on the chart. This is a slight discrepancy between the theoretical and actual values. The variation, however, is so small that it may be neglected. As the experiments were conducted over a period of a year and the ranges averaged, it should be realized that at times the daylight ranges will be greater or less than those shown on the chart. The chart in Figure 4 is certainly food for thought in more ways than one.

This latest radio theory will come somewhat as a relief to those who have ambitions to talk to Mars and other heavenly bodies. Since the waves shorter than 10 meters cannot be used successfully over the earth, why not try them for interplanetary communication as they seem capable of piercing our atmosphere as well as that of other planets?

The probable course of the interplanetary wave was suggested. On leaving the earth it would be influenced by the electrons from the sun and would be diverted toward the sun. Then it might pass beyond the influence of the sun after a small deflection or it might spiral towards the sun until it reached that electron density necessary for total reflection whereupon it would pursue an enlarging spiral until free again. The route would be complicated.

In conclusion it should be noted that the theory here presented appears to adequately answer the important radio transmission questions of the day and it is expected to withstand all attacks. However, time will tell.

The following texts have been freely consulted in preparing this article and radio fans interested in further details on radio wave propagation are referred to these publications:

Zenneck—Wireless Telegraph
Fleming—Electric Wave Telegraphy and Telephony
Glazebrook—Dictionary of Applied Physics
Stanley—Wireless Telegraphy
Bell System Technical Journal (Apr. 1925)
Proceedings of Institute of Radio Engineers (Dec. 1925)
Physical Review (Feb. 1926)
Journal of Franklin Institute (May 1926)
QST (Oct. 1925)

Other sources will be found in Principles Underlying Radio Communication (Morecroft), U S. Naval Manual, issues of the Proceedings of the Institute of Radio Engineers, QST, Proceedings of the Royal Society, Philosophical Magazine, Proceedings of the Physical Society of London, etc.

Sir Oliver Lodge's NEW "N" CIRCUIT

Famous Scientist Devises System to Prevent Your Receiver Sending Out Squeals and Howls to Annoy Your Neighbors.

By Our London Correspondent

THE recent announcement in the newspapers of Sir Oliver Lodge's "N" circuit which could be attached to any receiver and would eliminate the tweets and chirps of the squealing sets, naturally aroused our curiosity. Accordingly we cabled our London correspondent to find out what it was all about.

Our correspondent is in very close touch with radio affairs in England and in his reply set forth the claims and possibilities of the "N" circuit exactly as made by Sir Oliver.

Frankly, we expected a different circuit.

There are several points in the article on which we cannot agree. However, rather than intersperse the article with editorial comments, it is being presented "as is" for the benefit of our advanced readers who may wish to try and judge the "N" circuit for themselves. The treatment of the circuit is along general lines and hence gives the experimenter a chance to test the various combinations said to be possible.

In defense of the circuit it should be noted that it possesses possibilities of considerable selectivity. Loose coupling is one of the features. If the circuit appears to be hooked-up by only one lead, it does not mean the circuit is not complete. Capacitive coupling to ground exists, even though it is not indicated by wiring.

On inspection it will be seen that no special parts are required. To cover the range of wave lengths used by stations in this country the regular coils and condensers found around the workshop or laboratory will be satisfactory.

For instance in Figure 2 the usual variometer can be used for circuit 19, a tapped vario-coupler for 15, etc. Although the diagrams indicate tapped inductances for the "N" circuit, they will not be found necessary as the ordinary coils (honeycomb, etc.) when shunted with suitable capacities give the desired tuning range. It is believed a high inductance is desirable and hence the capacity required will be low.

H. M. N.

LONDON—MARCH 26th.

CONSIDERABLE interest has been aroused in this country this week by a press announcement headed as follows:

"GREAT NEW WIRELESS INVENTION"

"SIR OLIVER LODGE'S SECRET"

My American readers will appreciate the effect of this "streamer" on wireless amateurs in this country, and before I go into any details regarding Sir Oliver Lodge's new invention, it might be interesting to give a few non-technical details about the way in which this story "broke" in the London press.

Two days ago a London evening newspaper came out with the heading I have quoted above, and later on that evening the editor of "Popular Wireless," the well-known British weekly wireless journal, issued a statement to the press which ran as follows:

> "I am authorised by Sir Oliver Lodge to say that the statement which appeared in an evening newspaper tonight regarding a great new wireless discovery by Sir Oliver Lodge, was premature. The discovery referred to is the "N" circuit, about which Sir Oliver does not wish to authorise any technical details for publication at the moment.
>
> "Arrangements have been made between Sir Oliver Lodge, Mr. Melinsky and myself for a special model of a set incorporating the "N" circuit to be built and thoroughly tested out during the course of the next week or so. Not until this has been done does Sir Oliver wish to authorise any statement to be made for publication regarding his invention, nor has he authorised any statements which have been made hitherto."
>
> (Signed) NORMAN EDWARDS.
> Editor,
> "Popular Wireless."

Now, behind this statement I find an interesting story. It appears that for some months Sir Oliver Lodge and Mr. Melinsky have been working together on a new circuit *which will eliminate the possibility of reradiation from an aerial;* the circuit making no use of magnetic reaction (regeneration) coupling.

But some enterprising journalist got hold of this story before Sir Oliver Lodge was ready to make known the result of his researches and, I understand, he was exceedingly annoyed at these premature press disclosures; so much so that he issued the following notice to the press, which I quote verbatim:

> "Reports about an "N" circuit, which have appeared in the press, are premature and unauthorised. As a matter of fact several sets have been on practical trial for some time and the method is now being submitted to independent test. Until the experts have reported I do not wish to enter into details, except to admit that one object of the system is the elimination of reradiation from a valve receiver without loss of efficiency.
>
> "In all probability the circuit can be adopted by existing sets. In due course I shall explain the system in 'Popular Wireless'."
>
> (Signed) OLIVER LODGE.

Nevertheless, it became quite evident that although Sir Oliver deprecated what he considered to be premature disclosures in the press, he had, in partnership with Mr. Melinsky (who happened to be working on the same lines as himself), devised a circuit of great interest to all wireless amateurs.

It so happened that Sir Oliver has taken out a full patent for this circuit; the application date is June 20th, 1923, and the complete patent was accepted by the British Patent Office, on October 20th, 1924.

I have a copy of this patent specification before me as I write and I propose, before disclosing the results of certain tests with this "N" circuit, to outline briefly the nature of Sir Oliver Lodge's latest invention.

It will be remembered that radio science is indebted to Sir Oliver Lodge for the principle of electric tuning in which, by a skillful balancing of capacity and inductance, currents of different frequencies can be more or less separated, or segregated, one from another.

In the pioneer days of wireless this conception, although commonplace now-a-days to every tyro in the art, was of outstanding importance. Without it, in fact, the modern complex work of wireless communication could not have been developed. It is peculiarly interesting, therefore, that Sir Oliver's latest contribution to radio progress should lie in a refinement of the tuning principle, in which the rapid building up of small impulses into currents of large amplitude by a resonance effect is utilized as

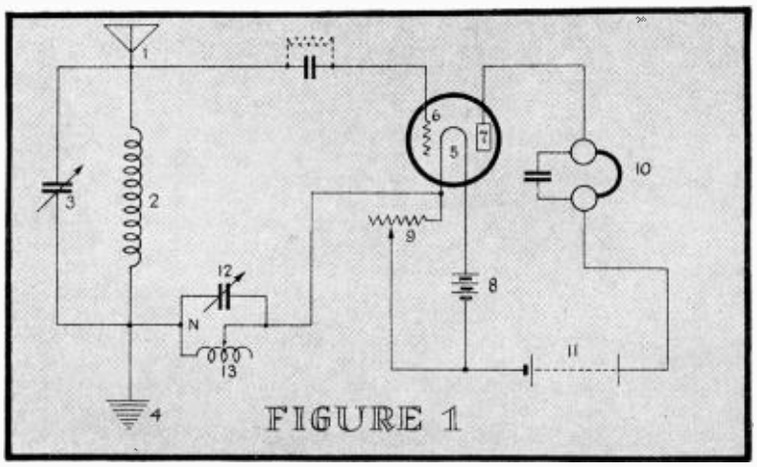
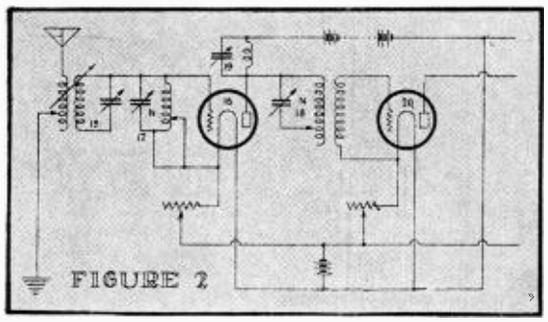


FIGURE 1



a means of separating or disassociating the receiving set proper—i.e., the tube amplifier—from the collecting system, or aerial; thus preventing the comparatively powerful currents flowing in the tube circuits from energizing the aerial and so forming a source of local reradiation or disturbance.

Stated briefly, the "N" circuit consists of a free uncoupled low resistance "loop" (circuit) capable of exact tuning, and inserted between a one point tapping to the aerial and the grid of the receiving tube. Such a circuit, when stimulated by small voltage impulses derived say, from an undamped aerial, will respond in the same way as the balance spring of a watch. Provided the tuning is sufficiently sensitive, the minute impulses tapped off from the aerial will build up into current of considerable magnitude, thus creating large voltages which, when applied to the grid of a tube, produce a corresponding response in the plate circuit.

In this connection it must be remembered that the tube is itself a voltage-operated device which responds to a very minute energy input, provided this is presented to it in the best form, which in this case is essentially a voltage variation.

Incidentally it will be seen that the resonant loop, or "N" circuit, not only provides a one-way passage from the aerial to the grid of the amplifier, incapable of passing energy in the opposite direction, i.e., from the tube back to the aerial; but also that it functions as a highly selective threshold to the receiving apparatus. Only those special frequencies to which the "N" circuit is tuned can gain effective foothold to the sensitive grid, the "N" loop operating as a blocking or rejector circuit to all other frequencies.

It is possible, therefore, that the new arrangement will go a long way towards solving an insistent demand of the wireless public for a receiving set that is at the same time selective as regards range, and really selective in its power of discriminating between broadcast frequencies transmitted on neighboring wave lengths.

By way of example, Sir Oliver, in his patent, gives instances of the application of the invention to wireless receiving apparatus. In Figure 1 is shown a diagram of connections of a receiver employing a thermionic tube as a detector; and in Figure 2 in shown a diagram of connections giving an alternative method of connecting the oscillator to an amplifier or detector. Figure 3 is a simplified receiver embodying the N circuit.

In Figure 1 again, the aerial 1, inductance 2, condenser 3, and earth connection 4 are the aerial connections in an aerial circuit, while 5 is the filament, 6 the grid, and 7 the plate of an ordinary 3-electrode tube. The filament of the tube is supplied with current from a battery 8, through a resistance 9, while a pair of telephones 10, shunted by H. T. (B) battery 11, complete the plate circuit.

(NOTE—In England, the B battery is called the H. T., or high tension, battery.—H. M. N.)

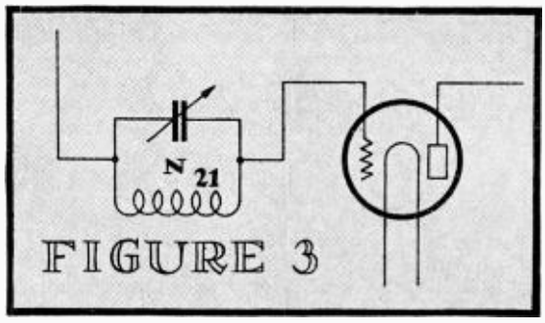
Connection is made from the aerial circuit to the grid of the tube in the usual way. In the connection between the aerial circuit and the filament there is interposed an oscillatory circuit marked "N," which consists of control 12, an inductance 13, one or both of which may be variable.

The invention lies in the provision of the oscillator "N." (Here it may be remarked that it is also satisfactory to insert the oscillator "N" in the connections to the grid of the tube instead of the connection to the filament, and it must not be confused with the well-known rejector circuit with which my readers are no doubt familiar.)

To get the best out of this circuit it must be wired up so that any accidental coupling between the source of oscillation and the "N" circuit is quite eliminated.

Figure 2 shows in usual form a receiving circuit consisting of a closed oscillator circuit 15, tuned and coupled to the open aerial circuit.

Sir Oliver insists that the invention is quite independent of this part of the system as it may be applied to any usual receiving system, such as a frame (loop aerial) and even allows the use of a special untuned aerial wire, without earth connection, as the sole stimulator. This diagram illustrates the 3-electrode tube 16 used without H. F. (radio frequency) oscillation. Its grid and filament are joined across the circuit 17, which corresponds with the "N" in Figure 1. One point of this oscillator is joined to a point in the stimulating circuit.



The connector used for this purpose may be quite long, provided the capacity between it and neighboring bodies is kept small. The single connection is enough to set up oscillations which build up by resonance and they must not be upset by other association with the stimulating circuit, or this is likely to spoil the effect: accidental coupling must be avoided.

Figure 2 also illustrates a mode of using the invention to convey impulses from one valve (tube) circuit to another. The oscillator 18, which again corresponds with "N" in Figure 1, has a single connection to the plate circuit of tube 16. This circuit is shown as including besides a high tension (B) battery an oscillatory circuit 19, but other usual forms of plate circuit will serve.

In order to illustrate the different ways of connecting the oscillator "N," the second valve 20 is shown not connected directly across the oscillator 18, but magnetically coupled with it, the inductance of the oscillator forming one winding of a transformer, which may step up the electro-motive force transmitted. The aerial circuit is merely a means of collecting alternating potential from the radiation for application to the oscillator. It is not necessary to have an accurately tuned aerial circuit, nor to have an earth connection to any part of the apparatus.

Figure 3 shows the aerial 21 connected on the one hand to a wire serving as an aerial and on the other hand to the grid of a tube, the anode (plate) and filament circuit of which may be completed or utilized in any usual way.

It is claimed that this circuit eliminates any possibility of reradiation, or, as we say in this country, causing "howling" in circuits of neighboring amateurs.

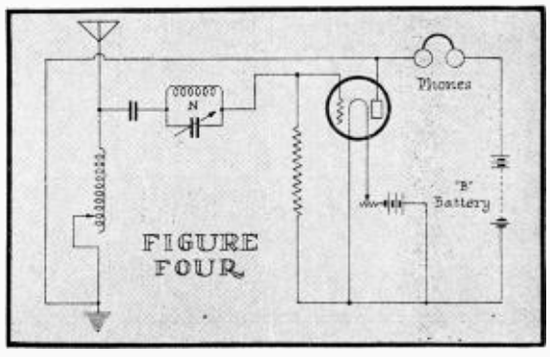
On test I find that this "N" circuit can create a loud howl in the receiving telephones, but can cause no disturbance in neighboring telephones of another circuit. Furthermore, the absence of reaction (regeneration) does not, to any appreciable extent, result in the diminution of signal strength, and excellent loud speaker signals can be obtained. Hand capacity effects, however, are rather prevalent, and for the small variable condenser connected across the "N" circuit (see diagrams) a very long extension handle has to be used. The condenser consists only of three plates and for British broadcasting I have found a coil of 150 turns, basket type, is approximately correct for the aerial I have used when making the test.

A variation on the circuit has been worked out by Mr. Melinsky and he and Sir Oliver Lodge have agreed to pool their patents. Another circuit evolved by Mr. Melinsky is shown in Figure. 4.

It will be seen that Sir Oliver Lodge's invention makes use of the potential gradient—which is inseparable from any current—and taps from a surging current its accompanying surging potentials.

In an open oscillator, like an aerial, there are obvious alternating end-potentials at its capacity terminals, but there is also a varying potential everywhere, except deep in the earth connection: and this side potential, when tapped off, is sufficient to stimulate into oscillation a responsive circuit, consisting of low resistance inductance and concentrated capacity.

From the surgings in this free oscillator the electrostatic potentials at its capacity terminals can be tapped off and utilized as required. Pulses of the right frequency in this way also reinforce—and no others.



This Set NEEDS NO BATTERIES

Quadraformers, With the New McCullough A. C. Tubes, and a Good B Eliminator Give The Answer to the Demand of the Woman Who Wants Radio But Refuses to Tolerate Batteries

By

LESLIE G. BILES

ARE you one of those fellows who persist in operating your radio set three or four hours a day and seven days a week without giving a thought to your batteries, and then wonder why the set fails to function satisfactorily?

Do you forget to give the proper attention to these important units—add water occasionally, clean the terminals, test the "B" batteries—or do you consider the care of your batteries "too much trouble,"—in short, a nuisance?

Oh, well; it doesn't matter. Now you can end all your battery troubles and worries by using the new McCullough AC tubes.

The development and perfection of a tube to work without batteries was inevitable; it is the answer to an insistent demand for a tube which would draw its current from the 110 volt AC house lighting system—a logical source of supply.

Changes and improvements in the design of radio receivers during the past two seasons have been many and varied. During this period of transition the radio set has progressed from the cellar work-bench to the living room and now we find it housed in beautiful cabinets and consoles—some hand-carved, inlaid or exquisitely finished and decorated to harmonize with the other household furnishings.

But we must admit that batteries, chargers and such paraphernalia have no place in the library or living room. There is always the danger of acid dripping from the hydrometer when testing the storage battery and this spells ruin to rugs, clothing or whatever it touches.

In addition, there are many women to whom batteries and chargers are unsightly objects and they simply will not tolerate them in the living room. Yes, I'm married and my batteries are down cellar, and that is where they are going to stay.

Incidently, the cellar is the proper place for batteries and chargers. If you use them, build yourself a substantial shelf to support them and have a battery cable lead up through a small hole in the floor for connection to the receiver. This arrangement avoids any possible damage due to spilled acid and also greatly enhances the beauty of your radio installation.

Just rig up a switching arrangement to throw your batteries from the charger to your set or vice versa, as explained by H. M. N. in the February issue. Such an installation is handy, simple and efficient. It makes a permanent installation of your charger and batteries

About the McCullough Tubes

OVER a year ago there appeared upon the market a new tube designed to work from the house electric lighting circuit by means of a step-down transformer very much like the toy transformer that we have under our Christmas tree. These tubes were known as the McCullough AC tubes.

At that time, this magazine expressed the hope that these tubes would solve the problem of operating radio sets without batteries for, as we said then, there is a very large part of the public unalterably opposed to having storage batteries in their homes.

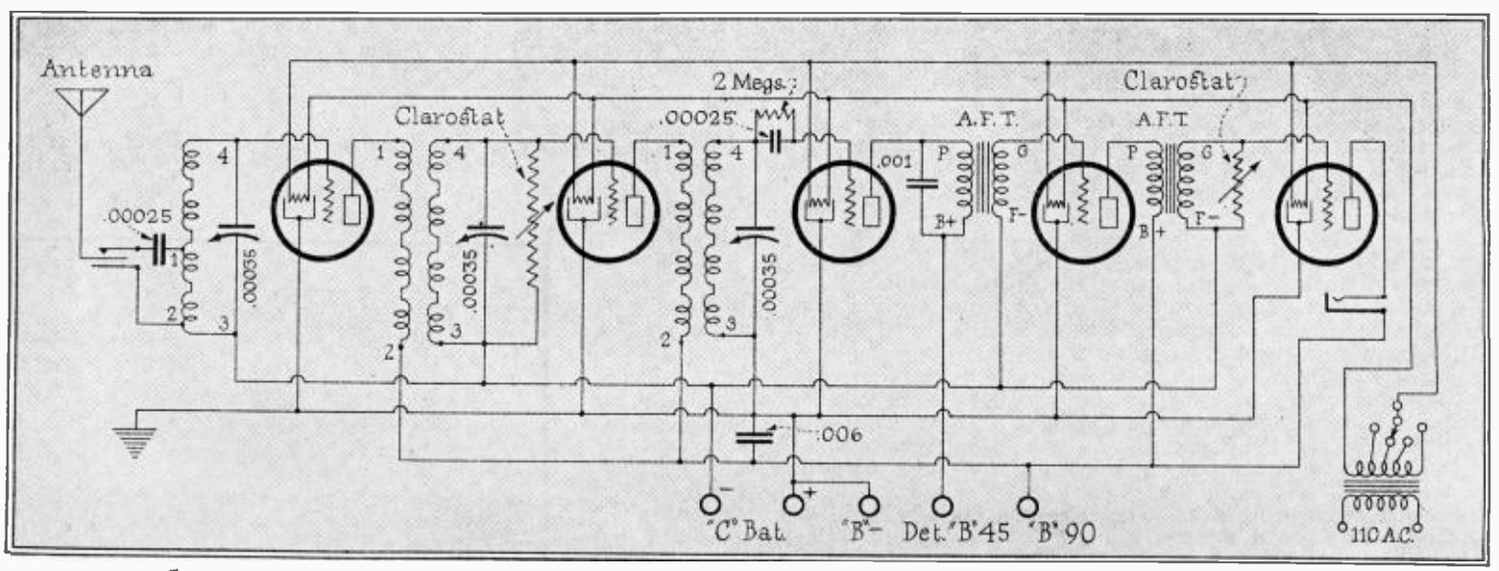
The tubes put out at that time, however, did not seem to meet all of the requirements for general use and we pointed out in an article, which we published in our issue of August, 1925, the shortcomings which we had discovered in very thorough tests which we made in our laboratory and which were reported to us by two independent laboratories.

Those old tubes were withdrawn from the market and the manufacturer has since done a very thorough job of re-designing. Not long ago he sent us some of the new tubes and we have been working with them with very satisfactory results for some time past in the set here described by Mr. Biles.

We plan now to work with these tubes in a number of the hook-ups which have proved most popular with our readers and we will publish such hook-ups from time to time.

I want to emphasize the fact that we are not advocating rebuilding your set for these tubes simply with the hope of getting greater efficiency. In this Quadraformer outfit, we find them just as efficient as the standard tubes with perhaps somewhat more volume. The principle value of the AC tube will be that it will entirely eliminate batteries and these circuits will be given for the benefit of the man or woman to whom this is a major consideration.

H. M. N.

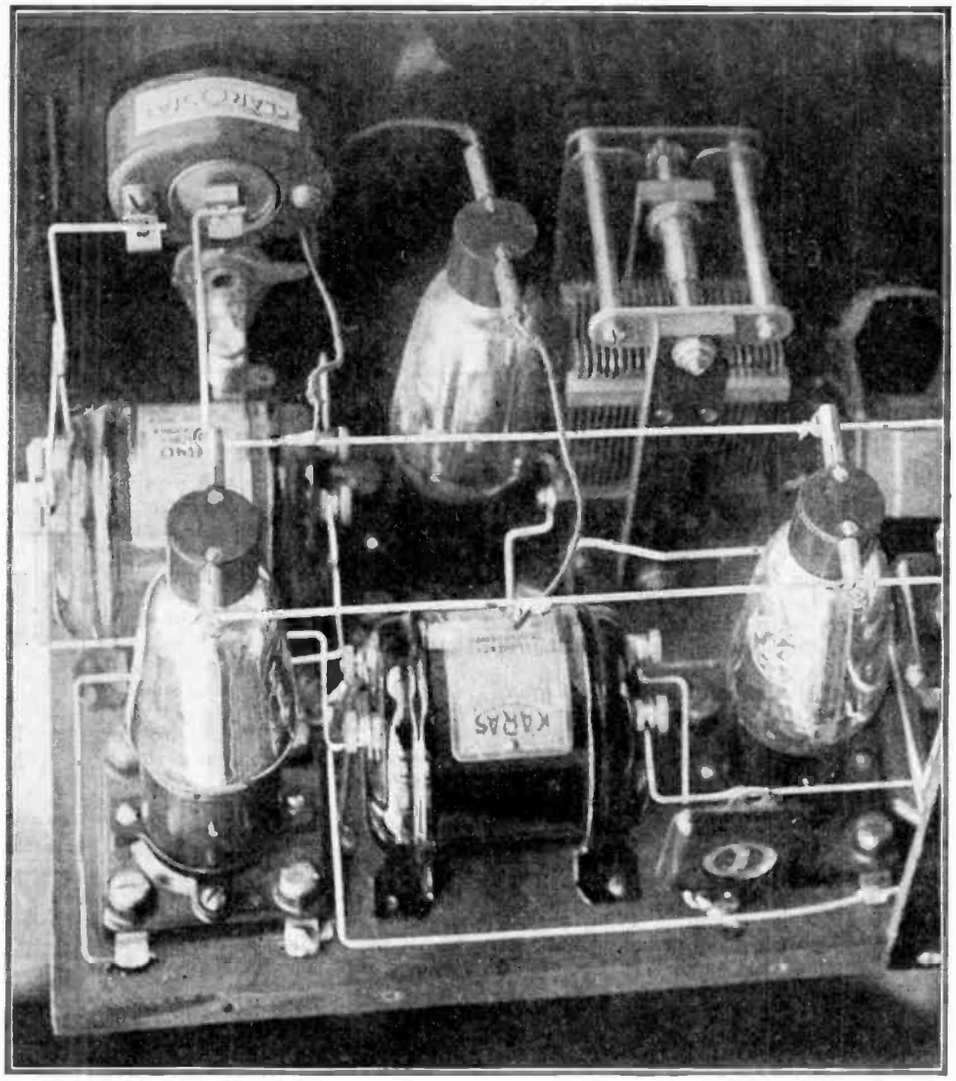


But let's get back to our story. There unquestionably is a great demand for a radio set to operate without batteries, particularly for use in apartment houses, clubs, hotels and other places where it is not possible to install batteries. It is especially for these people that we have assembled the receiver shown in the accompanying illustrations.

In this set, no batteries are used except the little "C" battery and that requires no attention for comparatively long periods of time because the drain is negligible and usually these batteries last a year or longer.

In these McCullough tubes, the "A" current is supplied, through a step-down transformer, direct from the alternating current used for house lighting purposes, and the plate current (ordinarily supplied by high voltage "B" batteries) is taken from the light socket through the medium of a good "B" battery eliminator.

Yes, sir, the operation of this set is just about as simple as turning on the electric light!



The heater connections are made with clips soldered to little wire springs which are, in turn, soldered to long pieces of bus wire. Note that the heater element connections come out at the top of the tubes.

Let me explain right here to you fellows who are using battery operated sets (provided you take care of them) that we are not trying to persuade you to make any changes in your present set just to enable you to use AC tubes. The McCullough tubes will not give you any greater distance; they will not give you any more volume nor will they improve the tone quality. This article is written especially for the man who cannot or who does not want to use batteries, so there would be absolutely no advantage in buying five of these tubes with the expectation of making a tremendous improvement in the operation of your set.

We have here at the laboratory two sets, identical, except for the tubes. One uses UX 201A and the other the McCullough tubes. There is absolutely no difference in their operation.

There is not the slightest trace of a hum or any other extraneous noise when this set is properly assembled and used with a *good* "B" eliminator. The word "good" is used advisedly, for undoubtedly there is a lot of junk on the market masquerading under the nom de plume of "B" battery eliminators. When you are ready to purchase *your* eliminator, have it tested in your own home under actual operating conditions. Do this before you sign on the dotted line or hand out your hard-earned cash. Better be safe than sorry.

We are showing the McCullough tubes in the Quadraformer circuit for the reason that this particular set has proved to be one of the most popular circuits we ever published, and, what is more significant, the circuit with which our readers seem to have had the greatest success with the least amount of trouble. It is extremely simple to assemble and when properly constructed requires no skill or experience to operate. A child can handle it successfully.

In giving details for building this set we are going to assume that this is the first set you have ever assembled. Therefore we shall take you through each operation step by step.

Following is the list of apparatus we used in building the set at Station 3XP:

1 Formica panel, 7 x 24 x $\frac{3}{16}$ inches.

3 Wade Square Law condensers, .00035 mfd. capacity, with dials.

5 McCullough AC tubes.

2 Karas Harmonik audio frequency transformers.

1 set Quadraformers, new type.

5 Eby Cushion sockets.

9 Eby binding posts.

One Yaxley pilot lamp, #310.

One Yaxley switch jack #30.

Two Clarostats.

One Radio Foundation step-down transformer, for use with McCullough tubes.

One Micamold fixed condenser, .001 mfd. capacity.

One Micamold fixed condenser, .00025 mfd. capacity.

One Micamold fixed condenser, .006 mfd. capacity.

One Micamold grid condenser, .00025 mfd. capacity.

One Micamold grid leak, 2.5 megohms.

Any other standard parts may be substituted if you desire.

In addition to the materials mentioned above you will require a few tools; most of which usually can be found around the home. You will need a hand drill and a couple of drills, principally $\frac{1}{8}$ and $\frac{7}{16}$ inches. Then you will need a pair of round nose pliers and a pair of side cutters. A good soldering iron, solder and screw drivers complete the list of essential tools.

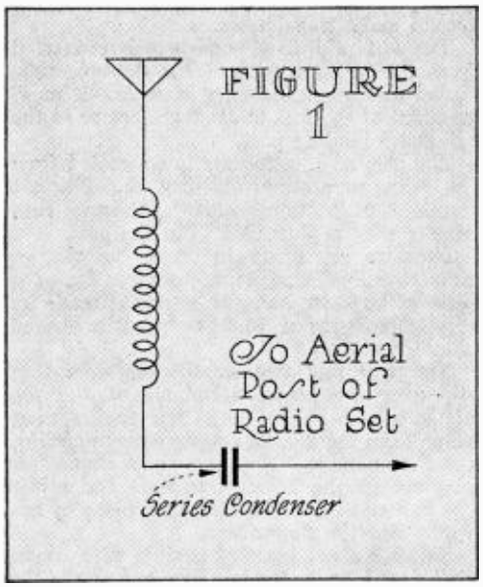
The first job of course is to lay out the panel—that is, get it ready to drill the holes for mounting the condensers and other apparatus. The following measurements will be correct only if you use the same apparatus we did.

With a scriber or some other sharp pointed instrument make a small hole (this is called "spotting") on the front of the panel, four inches from the left hand edge and three and one-half inches from the bottom edge. This mark is the position of the shaft hole for the first variable condenser.

Lay your ruler along the center of the panel, that is, three and one-half inches from the bottom edge, and spot the location of the other two condensers; one seven inches to the right of the first condenser and the other fourteen inches to the right of the first condenser. In other words the condensers should be mounted seven inches between centers.

The antenna tap-switch should be mounted two inches from the left hand end and one and three-quarters from the bottom, so spot this with your scriber.

The exact location of the Clarostats is immaterial so long as you preserve the symmetry of the panel layout and have one Clarostat convenient to the first inter-stage trans-



TROUBLE SHOOTING

in the POWERTONE

By SIDNEY E. FINKELSTEIN

Associate, Institute of Radio Engineers

TROUBLES SOMETIMES ENCOUNTERED

Not enough selectivity.
Can't get DX while the locals are on.
Not enough volume.
Can't tune below 220 meters.
Can't tune above 492 meters.
Can't control oscillations under 273 meters.

THE leading half-dozen complaints, taken from the world at large, whether a set is factory-made or constructed by a radio fan, are shown to the right. And they are all contained in the second grievance—"Can't get DX"—because if you get DX, cutting through locals, your set will pass a life insurance company's medical board; that is, will be quite good enough to get by.

Most fans are not unreasonable. While they yearn to hear 2LO on a 5-tube set, they really don't expect to, except during the fanciful half-fortnight known as International Radio Week. If they cross half the width of the United States under best conditions for reception, they do not complain,—that is, not bitterly. They may yearn in a critical fashion, but it is rather an announcement of an appetite than a kick due to a disappointed promise.

In all receivers there is some room for improvement, even if only a trifle. We will neglect the trifles and consider real trouble. "*Can't get DX.*"

Well, that's a misfortune. Let's seek a cure. Let's apply ourselves to the 5-tube 1-Dial Powertone, described by me in the April issue. With that as the example, let us proceed.

The greatest single obstacle to DX, (by which is meant the reception of programs from distant stations), is an oversized primary, particularly on an interstage coupler (third coil from right in Figure 3, page 59, April issue, same as L3 in Figure 2 this month). The antenna coil, L1, should be moved farther from the secondary to improve selectivity, and primary turns removed therefrom only after this relocation has been done and two or three turns taken off the other primary. Without selectivity we can't expect DX, and the smaller primary aids selectivity, although at a slight volume drop on the higher waves, due to lessened amplification there.

Note, too, that over-oscillation trouble is remedied by removal of turns from interstage coupler primaries. These are always shown in the plate circuit.

A frequent cause of failure to get DX is lack of tuning skill. This applies particularly to three-control sets, but the Powertone has only one tuning control, so this item of difficulty is obviated.

Aside from tuning experience and skill, other considerations which require no structural changes are proper regard for the tubes and the sources that supply them with power. The "A" battery, if of the storage type, should not be allowed to go down further than a condition of half charge. The "B" battery voltage, while an uncertain item so far as any general rule goes, should not be maintained for a long period below 17 volts for a 22½-volt battery and 34 volts for a 45-volt battery. As we are remarking upon distance only, we must require battery conditions in excess of those which would be passable for reception of local stations. The tubes should have a good filament emission and function well as amplifiers in particular, and should be changed about in the sockets until they are so distributed in the receiver that each is in a socket where it works best.

Those people possessing regenerative sets may put tubes to a rather rough but insuring test by placing one after another in the socket where the regenerative tube is to go, and thus find out if perhaps the tube fails to respond to oscillation encouragement. If it is lacking, one need not wonder that DX reception has been curtailed or prevented.

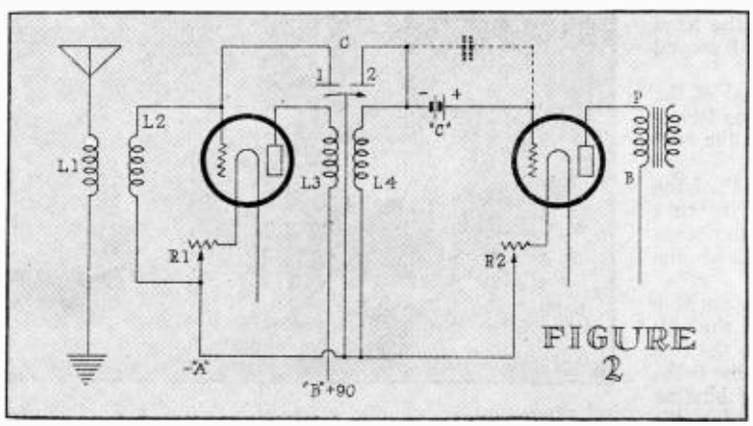
The antenna should be given careful attention.

If your aerial is short and is strung on low masts, or from chimney pot to chimney pot, particularly over a tin roof, you need not be surprised that DX holds aloof. The first requisite is to raise the antenna. That is even more important than lengthening it. Generally, the higher the aerial is from ground potential, the greater its facility for picking up DX.

On the point of lengthening the antenna—and this refers to physical length—a condition soon would be approached when broad tuning would set in, and this would hinder rather than help distance reception where one had to tune through locals to get distance. The drowning effect of the locals would prevent one from "stepping out."

The physical length of the aerial and its electrical length are two different things, although there exist points of interrelation. The electrical length is represented by the natural period or fundamental wave length of the antenna. Hence, if an outdoor aerial and a ground are used, the antenna system consists of both of these and all wire used as a part thereof. A 100-foot aerial really would mean that the ground lead, aerial proper and lead-in to the very posts of the set, comprise 100 feet, not that the wire alone that stretches between the aerial insulators is 100 feet.

Novel method of obtaining two different biases on respective tubes though their circuits are tuned by the same condenser.



For most broadcast reception 100 feet usually is recommended, and is generally satisfactory, but it is better to have a shorter aerial, say 75 feet, with the antenna wire proper raised higher than it usually is. In that way you get greater "pickup" with less tendency toward broadness in tuning, while the simple extension of the antenna stretch combines the virtue with the disadvantage.

The extension of wire stretched between the insulators makes the antenna proper longer both physically and electrically. Every antenna system has a wave length of its own and that is the one to which it is most responsive, but this should be kept below the lowest broadcast wave length, as the best compromise.

The ground connection should be securely made, preferably with a ground clamp or soldered connection to the cold water pipe. Sometimes conditions are improved by using two grounds, one to the cold water pipe, the other to a radiator. Both are used at the same time. Under some conditions this will bring no improvement, due to added resistance.

Soldering to the cold water pipe is difficult, because the solder cools too quickly. Any attempt to get the proper condition of heat should be accompanied by great caution, as the pipe is lead and you might melt it. These are reasons why the ground clamp is by far the favorite method of attachment. The cold water pipe should be filed until bright, and the same should be done with that part of the ground clamp that is to make contact with it. The lead from the clamp to the set should be soldered to the clamp.

As for the electrical length of the aerial, although this is increased by physically lengthening the stretch between insulators, or the ground wire, or both, the natural period or fundamental wave length may be brought down by inserting a series condenser. (Figure 1.) This is usually placed between the lead-in and the antenna post of the set. It should be of smaller capacity than the capacity of the antenna system. Few radio set users know what is the capacity of their antenna system, but a fair average is .00025 mfd., with occasional tendency toward slightly higher capacity. Hence the series condenser, under such circumstances, may be .0001 mfd. or .00015 mfd.

Due consideration of the characteristics of tube operation is necessary for proper DX results. In amplifying circuits the grid return should be to negative "A." This is the "A" minus lead of the battery, and is not the negative filament post of the socket if the rheostat is in the negative leg, as it should be. The connection for amplifying circuits takes advantage of the voltage drop across the rheostat to give the grid a negative bias equal to that drop. As the rheostat setting is changed, the bias changes. Granting the use of a 6-volt "A" battery, minus "A" represents minus 6, and to this point is connected the grid return side of the coil, while the negative filament is 6 volts minus the drop in the rheostat, say 5 volts, if the drop is 1 volt. As all reckoning is made from the negative filament it can be seen that the grid, due to connection to the coil, is one volt more negative than the negative filament. And that is what the bias means.

The amplifying action of the tube is almost destroyed if the grid return is to positive "A."

Hence in the circuit diagram last month the common rotor of the two-section tuning condenser went to "A" minus. The grid leak went from detector grid to "A" plus, imparting a positive bias here, which is proper for detector action.

Another method of getting different biases, though the double condenser (therefore RF and detector input coils) go to the same rotor, is shown in Figure 2. The "C" battery, inserted as shown, gives a positive grid, but may be reversed, with greater bias, to make the grid highly negative. With increased plate voltage (say 90 on "B" plus detector) from 9 to 12 volts negative bias gives good detector action, louder signals but less sensitivity. The leak-condenser method gives more sensitivity and less volume.

The "C" battery, as shown in Figure 2, need be only a small one, even 3 volts, leaving 1½ volts positive assured (battery bias minus rheostat drop. A by-pass condenser sometimes is desirable across the "C" battery; about .0005 will do nicely).

THE END

NOTES *from the* LAB *at* STATION 3XP

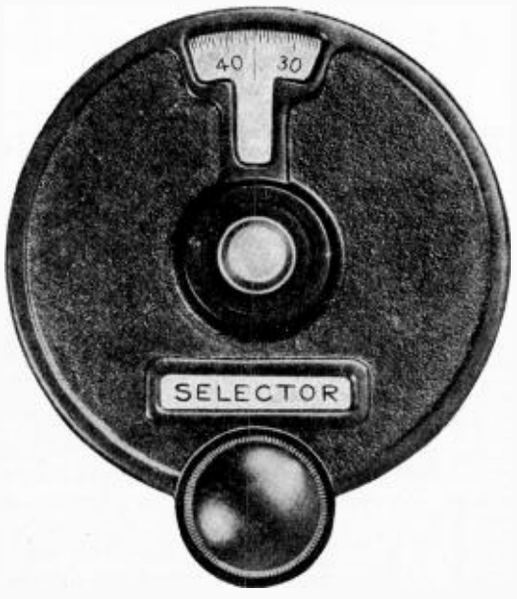
SO MUCH material has been received at Station 3XP recently that we can not use the customary form for the notes from the Laboratory this month. We shall have to give a more informal discussion with whatever photographs the Art Department can find room for. You know we get up a whole flock of stuff out here for you that never gets into print, because the magazine does not have rubber sides, and can not be stretched indefinitely.

Accessories. It is hardly fair to call the Brach Antenna outfit, and the Brach lightning arrestors made in Newark, N. J., accessories. The Brach arrestors now have several new features. The vacuum tube is enclosed in a metal case, and the bottom portion is die cast instead of being molded copper as heretofore.

In the Brach antenna equipment everything is included but the tools, and the will power to get to work.

The Garfield brackets made by the Garfield Radio Corp., 64 Vesey St., N. Y., are of Radion. They make a nice job for sub-panel mounting, and eliminate the danger of shorts through careless wiring.

John J. Mucher, 109 Lafayette St., N. Y., has sent in samples of his Spring Binding Post Strip. No, this does not refer to the season of the year, but to the action of the posts. They are of the Fahnstock clip type, mounted on bakelite. There are soldering terminals underneath for the set wires, and the meaning of the posts is plainly marked in white on the bakelite.



The new Silver-Marshall dial.

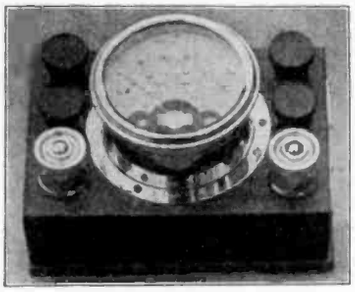
Meters. Among the new meters are the Jewell for super-heterodynes, the Hoyt Rotary Meter, The Sterling R-25-28, and the Weston panel instruments with the Weston Universal Bipolar switch.

The Jewell, Sterling and Weston meters are made in models which plug in on the factory models of the super-heterodynes so that one can tell whether the tubes are being operated at the proper voltage.

The Hoyt Meter is an ingenious device for the fan who does not want to go very heavily into meters but wishes to measure a variety of voltages and currents. By rotating the meter itself it is possible to measure filament voltage, and filament current; plate voltage on the tubes, and in the B batteries, and plate current in milliamperes on small or large sets.

Weston accomplishes the measurement of current values by a mighty clever switch. This switch, with the proper connections to the meters, enables you to measure the amplifier B, detector B, C battery, A battery, and make separate measurements of the first and second audio tubes, the detector, and the radio frequency tubes. There are three different cards come with the switch to take care of all kinds of circuits.

Addresses. Jewell Electrical Instrument



The Hoyt meter measures everything on the set.

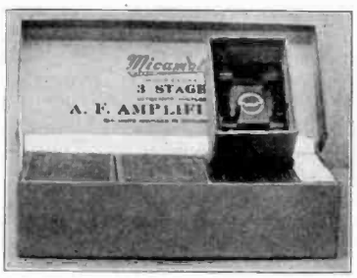
Co., 1650 Walnut St,, Chicago, Ill.;
Sterling Manufacturing Co., 2831 Prospect Ave., Cleveland, Ohio;
Weston Electrical Instrument Co., Newark, New Jersey;
Hoyt Electrical Instrument Works, Penacook, N. H.

Rheostats. The Victoreen Manganin rheostat made by the Victoreen Radio, Inc., of Cleveland, Ohio, is a neat little job. The winding is nicely done, and the whole job has a very attractive appearance. The rheostat takes but a small space on the panel and should be particularly valuable where space is at a premium.

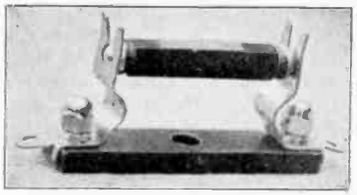
Dials. Bremer-Tully of Chicago, Radiall Co., of New York City; Silver Marshall of Chicago, National Co., of Cambridge, Mass.; All-American of Chicago, and Bruno Radio Company of New York, have sent in dials.

The All-American dial is flat and of metal. It is used in connection with condensers that have a gear vernier inside the condenser itself. It can be used on either the 180 or the 360-degree type.

The new National dial differs very little from its predecessor except in the new lug for fastening



The Micamold resistance-coupled amplifier outfit.



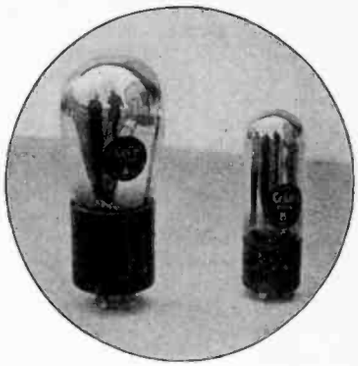
Micamold makes a new resistance.

it to the panel. This new lug is self-centering, and greatly simplifies the mounting. The engraving on the dial has been improved, and the indicator line made finer so that it is possible to log even more sharply than before. The other features of the type B dial remain unchanged.

The Bremer-Tully tuning control gives both clockwise and counterclockwise readings. In addition there is a marker hand on the face of the dial for wave lengths. Once this hand is set at a known wave it is possible to tune to wave lengths instead of having to bother with dial graduations.

The Tunerite dial of the Radiall Co. has an eccentric gear train which enables one to get straight line tuning with the old semi-circular type condenser. The Silver Marshall dial adds a distinctive feature to its vernier action. It is provided with reversible scale for right- and left-hand condensers and is for either the 180-degree, or 360-degree condensers. Space for logging is provided, and indicator cards are furnished to show the use of the dial.

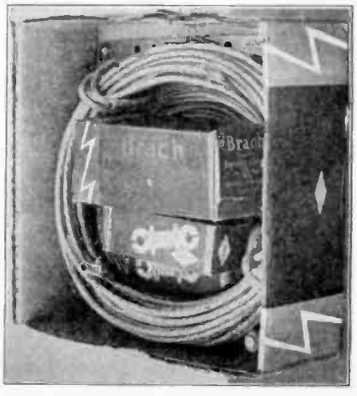
The Bruno dials are made in two models. One is to provide vernier action for the condenser. The other type converts the semi-circular plate type into the straight-line frequency tuning. This action is accomplished by means of a lever device which gives a cam action.



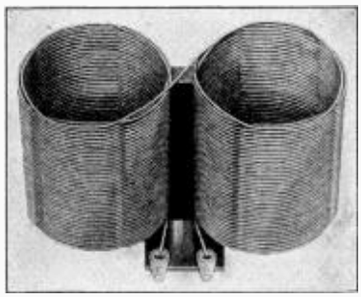
The new CeCo tubes are performing well.

Coils and Kits. The Bremer-Tully Manufacturing Co. of Chicago, Ill., is making a kit called the Counterphase. The instructions that come with it are so complete that one should encounter but little difficulty in assembling it. Colored covered wire is used for leads so that there will be no trouble in making the wiring check with the colored diagrams.

Those who are interested in short waves will find the Aero Coil Short Wave Removable Coil Tuner attractive. It is made by the Aero Products, Inc., Chicago, Ill. The coils are of the plug-in type. Anyone familiar enough with short waves to want to listen to them should have no trouble in building a set from the coils.



Brach offers a complete kit of aerial equipment.



The Bodine Twin-Eight radio frequency transformers.

The National Co., of Cambridge, Mass., have improved their Browning-Drake coils. Their new Equicycle condensers are used. The wire on the coils has been changed from the familiar insulation of green silk to enamelled wire.

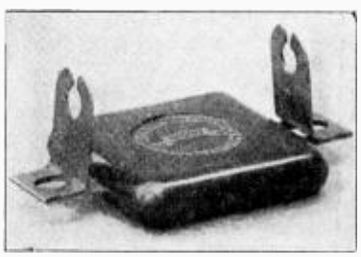
Daven Radio Corporation of Newark, N. J., now manufactures tuned radio coils. They are put up in sets of three. The particular ones sent us are for .00035 condensers. The name, DRF, means Daven Radio Frequency.

A set of three coils of the figure 8 type is made for tuned radio frequency by the Bodine Electric Co., of Chicago, Ill. These coils are air core and are made for the different sizes of condensers.

Condensers. A new type of grid condenser and leak is now on the market. It is made by the Micamold Radio Corporation of Brooklyn, New York. The leak is moulded into the bakelite that forms the protective coating for the mica condenser. The size of the condenser, and the size of the leak are plainly marked on the outside.

The Allen D. Cardwell Mfg. Co., Brooklyn, N. Y., has an original idea in the Type E Variable condenser. Instead of using a peculiar shape to the plates, the semi-circular form is used. The straight-line effect is obtained by changing the thickness of the plates. Each plate is tapered so that looking along the side of the plate, it resembles a wedge in form. The amount of space between the plates, as well as the amount of each plate in mesh, is varied when the condenser is rotated.

Reproducing Units. Radio Foundation, Inc., 25 West Broadway, New York, N. Y., now has a cone speaker. The one sent to the lab is the Junior model. It brings out the low and high notes of an orchestra beautifully, and works particularly well with resistance coupling. It is one of the best speakers we have used.



The Micamold grid condenser with clips for leak.

Audio Amplifiers. The Micamold Radio Corp. makes a very attractive looking resistance coupled amplifier kit. The parts are of brown bakelite. The condenser snaps into place by means of springs so that it is easy to change condensers if you get the bug for experimenting.

The B-T Euphonic audio transformer, made by Bremer-Tully of Chicago, enables you to place your transformer where you wish and avoid crossed leads. The brackets for mounting are reversible so that you can use the transformer for either baseboard or sub-panel work, and still have the terminals in a usable position. The dimensions of the transformer are such that they give a good support to a sub-panel.

The Micamold grid condenser and leak moulded in one unit.

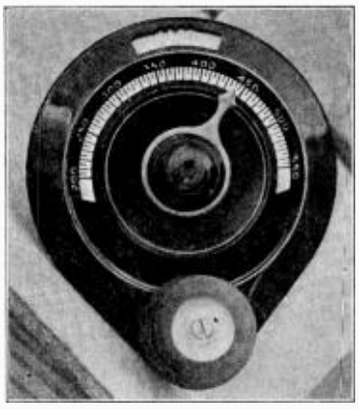
Modern Electric of Toledo, Ohio, has a new model transformer called the "Modern Symphony." This transformer is designed for use in any stage.

The Como Apparatus Co., Manchester, N. H., has a variable ratio transformer which has six binding posts. Two are for the grid and filament. One of the remainder is for the B post. The other posts give ratios of 4 to 1, 6 to 1, and 8 to 1. By changing connections on these posts it is possible to change ratios, and experiment until best results are obtained.

The Pacent Super Audioformer, made by the Pacent Electric Co., 91 7th Ave., N. Y., is a fine example of the large winding transformers which reproduce both the low and high notes.

The A. L. Sealed audio transformer of the Jefferson Electric Mfg. Co. is a distinct departure from the Jefferson transformers with which we are all familiar. It has a large winding to take care of proper reproduction. The connections are at the bottom to insure short leads to the tube sockets.

Sockets. The Bremer-Tully Silent Sockets made by the Bremer-Tully Mfg. Co., of Chicago, are a new method of solving the elimination of the annoyance caused by microphonic tubes. Springs with rubber cushions on them grip the top of the tube firmly on two sides.



The new B-T Tuning Control.

The line of adapters made by the Alden Mfg. Co., of Springfield, Mass., is certainly complete. Had we had these adapters last December it would not have been necessary for us to publish the article in the January issue on connections for the new tubes. All kinds of change-overs in tubes are taken care of by these adapters.

DEALER GIVES HIS SIDE OF "TRIAL" INSTALLATIONS

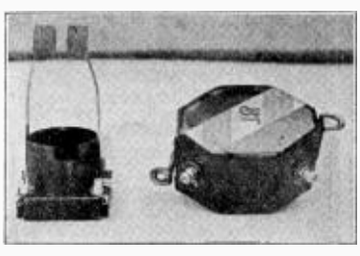
De Smet, S. Dak.,
April 13, 1926.

My dear Mr. Neely:

I cannot but take issue with you for making the remarks you did in your editorial in the last issue of *The Radio Home* relative to the manner in which a first-class radio salesman or shop should conduct itself regarding selling sets.

We have a peculiar territory here—where any one who has made a failure of anything from farming both ways and no matter what education or technical knowledge they may possess, immediately falls to canvassing the country selling radio sets and accessories.

In this locality there were eleven persons selling radios, eight of whom were absolutely unfit to do so as far as previous experience was concerned. The remaining three, two of which were garages, adopted the plan of selling as you suggest and to their very violent disgust.



Bremer-Tully's Silent Socket and Euphonic Audio Transformer.

One garage man who handles a well-known make of machine has five machines out "on trial" at the present time and they have been on trial for the past three or four months.

Three years ago I installed a set for a reputable business man with the above provision and that he was to use it a week and then have it removed or pay for it. During that week he used the set continuously and was very well pleased with it. At the end of the week I had to remove it because he could not pay for it until a period six months later.

That is my first and last experience with the "try it" stunt. I sell my half of all the sets sold by all and sundry and they stay put, but I do not sell on trial. By that I mean, install the set completely without deposit or obligation on the part of the user and then take it out at his discretion.

There are now nine sets in the town alone which are not paid for and their users have no intention of paying for them. One man in fact approached me and asked me when I was going to bring a set around as he had had radio entertainment at the expense of the balance of the salesmen for the entire radio season.

When I approach a prospect I give him a live demonstration and guarantee to duplicate it at his home, but there is a bona fide sale made before the set is installed and I have yet to take one out because of dissatisfaction and naturally none because of non-payment. I also am proud to say that the customer who buys the set is also a customer for his necessary replacements, which is the highest compliment the user of radio can pay the dealer.

I do not mean to say that one must buy "as is" but I do say that you should have written in a few words regarding the payment plan as your paper is read over a great territory. I know what city installations are as I have recently had to contend with that in the installation of a super-heterodyne, which, had the party not moved from his location, I would have had to take back because of poor reception. He could not have used any set there, however.

There is another thing about this "try it" idea and that is—some one is going to get a lot of second-hand tubes and batteries worked off on them as a result of returned sets with their accessories.

I appeal to you to write another article stating some of your ideas with a little fuller explanation as to the conditions governing installation, etc. Few people would go to the expense of buying a complete set of accessories with which to try out the different sets. Per-

sonally I have spent a lot of time and money experimenting with different machines and trying out different types of tubes, batteries and other accessories with the idea in view of getting a quota of equipment with which to complete my sets so that each part will give the best for the money. Possibly there are not many of my standard, but if there are not the standard is lowered by necessity of the dealer to gyp the purchaser in the same manner as some other customer has gypped the dealer. The big idea is to pass the buck and I feel that a number of our larger radio manufacturers are more to blame in this matter than any one else and I do not feel that it is necessary to name any of them to you either.

Very respectfully yours,
N. G. STIMSON.

Bremer-Tully's complete kit for building the famous "Counterphase Six."

GIVES ANOTHER VIEW OF SKALA "WAVE-SPLITTER"

81 Prospect St., Brooklyn, N. Y.
April 30, 1926.

My dear Mr. Neely:

I have just read with interest the article in the current issue of *The Radio Home* describing the so-called "Wave-splitter" invented by Mr. Skala of Chicago. In view of the somewhat vague data given therein, it occurred to me that perhaps Mr. Skala is working along the line of research that was carried on by other engineers and myself in the Allen D. Cardwell Laboratories in New York in 1920.

The tremendous increase in telegraphic and cable traffic due to war-time conditions made it imperative that every possible means should be tried to increase traffic over existing lines and cables. Various multiplex schemes were developed, but even these failed to relieve the congestion, so efforts were directed in other directions.

One of these schemes was based upon the transmission of waves of a particular shape over the line, and their reception by special devices which would handle them to the exclusion of waves of a different shape. Could such a scheme be developed practically, it would permit of messages being multiplexed almost indefinitely—the limit of course being the degree of change in wave shape required to avoid interference between simultaneous messages on the same line.

It is not a particularly difficult problem to produce waves of a characteristic shape in the first place, but the difficulty lies rather in preserving the characteristic shape after propagation. This distortion—or attenuation—presents a serious problem, and it would be rather interesting to know how Mr. Skala takes care of it in his case (assuming that it exists).

Furthermore, any regular wave train, if composed of other than sine waves, can be resolved into a set of sine waves of different frequency and amplitude which in combination form the true wave shape of the original. Should this theory apply to Mr. Skala's scheme, it would appear that several waves of different frequencies would be transmitted: a by no means desirable condition.

It should be said in conclusion that this letter has not been written with the idea of disparaging either Mr. Skala or his work; in fact the writer wishes him every success in these or future efforts. As however difficulties identical with the above were actually encountered by the Cardwell Engineers working along apparently similar lines, I thought these few details might be of interest to you and your readers.

Yours truly,
N. A. WOONCOCK.

WHERE QUALITY is DEMANDED in RADIO

It is safe to assume that quality is demanded in everything else in the home. This magazine was founded on an insistent demand for quality in reproduction, in installation, in program material and in home surroundings.

Our readers share this viewpoint. If they did not, they would read some other magazine with a different editorial message.

Intelligent appreciation of quality, backed by a willingness to spend money for the things that are found worth while, is a characteristic of the 100,000 homes into which this magazine is going each month.

The Radio Home is a Prosperous Home

It can afford to buy anything that makes for the comfort, convenience or culture of the family. It has proved, by a considerable cash investment in radio that it is a modern home and in the market for all that is up to date.

We have an attractive proposition for the advertiser of non-radio products who is seeking such a home market as is reached by our popular broadcasting section. Your inquiry will receive prompt attention. Address our Advertising Department.

Produce Exchange Building *Philadelphia*

POWEL CROSLEY JR.

Radio Manufacturer

Linked with the invention of every valued product is the name of some man or group of men. The basic article is invariably a crude affair. Improvements and refinements follow fast. Then comes another pioneer. The production genius who reduces costs to the level of common means.

Often that man's name outlives the inventor's. He, after all, is the benefactor of the people. Several names so associated with the automobile now live in public consciousness, but who can name the inventor of the motor car?

Such a pioneer is Powel Crosley, Jr. . . . liberator of radio from the grip of prohibitive prices. With his genius for reorganization and his talent for applying mass production methods, he has given to the man of modest means joys of radio in common with those of the millionaire. The desired selectivity, sensitivity, tone, volume and volume control, once exclusive to high priced instruments, are now available in Crosley sets at a fraction of the former price.

A trip through the huge Crosley plant is a revelation. Mere machinery takes on superhuman powers, and human powers are multiplied by machines. Operations that once produced only a few units per day, now turn out thousands. Other phases formerly considered so intricate as to demand hand work, are now accomplished by devices that duplicate the dexterity and shame the speed of hands. Multiple drills make many jobs one. Automatic washers heat, treat and wash the parts, that must be chemically clean, in lightning sequence and with positive results.

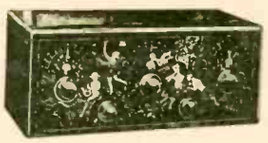
And in the transformation of hand labor to machine performance the unescapable inaccuracies of human error are supplanted by absolute precision. For example, coils must consist of wires of exact length, wound to a certain tension by a certain number of turns. Variation is inevitable when this is done by hand. But Crosley automatic coil winding assures precise results, uniform tension, micrometer measurement, exactly the same number of turns in every case.

A radio manufacturer who is master of mass production! That is the earned title of Powel Crosley, Jr. And that is the gift that has enabled him to give the public the kind of radio instruments they want at the kind of prices they want to pay.

Four New Radios

The Crosley 5-Tube RFL-75

Absolutely balanced radio frequency amplification. Non-oscillating under any handling. Exquisite two-tone mahogany cabinet—satin finish. Decorated panel with rose-gold metal fittings. Cabinet holds necessary dry cells. Price without accessories . . . **$75**



The Crosley 5-Tube RFL-60

Same as RFL-75 but in compact cabinet only 17⅝ inches long. Truly marvelous selectivity, sensitivity and purity of tone. Art panel—solid mahogany cabinet—rose gold fittings. Price without accessories . . . **$60**

The Crosley 5-Tube 5-38

All the volume, selectivity, sensitivity and fine tone in the best 5 tube set you've heard—plus the CRESCENDON. Two toned mahogany finished cabinet—daintily striped in gold. Price without accessories **$38**

The Crosley 4-Tube 4-29

A beautifully designed set—both to ear and eye. Crescendon equivalent to one or more additional tubes of radio frequency amplification. Two toned mahogany finished cabinet. Price without accessories . . . **$29**

Prices slightly higher west of the Rockies

"If inexperienced in radio, be sure your first set is a Crosley"

It takes neither practice nor mechanical skill to tune in stations all over the country. Children and old people operate Crosley radios easily. They are fool proof.

They are inexpensive. They don't tie up a lot of money.

They have proven their efficiency over a period of years. Thousands of letters report remarkable demonstrations. Hundreds of thousands of sets sold substantiate all claims to excellence.

They are made by a reliable, well known and financially strong concern, that guarantees them absolutely.

The easy operation, tone and volume of these four new Crosley sets delight, not only the expectant beginner; they arouse the most confirmed radio lover to realization that Powel Crosley, Jr., has again made an improvement in radio no less revolutionary than the Musicone ($14.75), now the world's largest selling loud speaker.

And the RFL sets possess *true* cascade amplification. For Crosley has utilized an entirely new patented circuit which achieves cumulative amplification, actually approaching the theoretical maximum efficiency per tube.

The Crescendon

In the 4-29 and the 5-38, the introduction of the Crescendon enables these two highly efficient radios to give almost unbelievable results and has lifted them away and beyond all competition.

The Crescendon is an exclusive Crosley device for increasing the weak signals of distant stations to full volume tones without distortion. Yet with these sets, loud nearby stations can always be softened practically to whispers.

Their striking beauty will please your eye, and your ear will introduce to you new qualities in radio, which you are sure to pronounce a revelation.

Write Dept. 60 for complete details of Powel Crosley, Jr.'s latest and greatest triumph of the Crosley dealer franchise.

Crosley manufactures radio receiving sets which are licensed under Armstrong U. S. Patent No. 1,113,140, or under patent applications of Radio Frequency Laboratories, Inc.

THE CROSLEY RADIO CORPORATION
Powel Crosley, Jr., President
CINCINNATI, OHIO

Owning and Operating WLW, first remote control super-power broadcasting station in America

CROSLEY RADIO

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