The June-July, 1926

RADIO HOME

20¢

A HOME Magazine for the Radio Family

...ducted by HENRY M. NEELY

In this issue:

ANNOUNCING

A New DAVEN Discovery!

N. B. Glastor though embodying this vital new principle and though it has cost us thousands of dollars and more than three years of laboratory and field work to develop and perfect, is no higher priced than the old type Daven Resistors.

GLASTOR

THE *TRANSPARENT* RESISTOR

A DISCOVERY that makes for greater accuracy, for absolute permanence, and for the abolishment of receiving set noises.

In Glastor we have entirely eliminated the use of impregnated fibre, paper or similar substances for the resistance unit. We have replaced it with an entirely new Daven discovery—

DAVEN PROCESSED GLASS

The result—a resistor that will carry the highest current known in the field of radio resistances.

A resistor whose resistance can be accurately fixed and which *does not change*—even with rough handling.

Radio engineers have tested Glastor for resistance—then abused it, shaken it. In testing again, they find the *resistance unchanged.*

Glastor comes in a complete range of resistances, .0025 to 10. megohms. Try it in your own set. You'll notice the difference. Leading Radio Dealers are now selling Glastor.

THE DAVEN FAMILY OF RADIO ACCESSORIES

DAVEN SUPER AMPLIFIER
Revolutionizes Reception

DAVEN LEAKANDENSER
Grid Resistor and Condenser in One

DAVEN RESISTOR MOUNT
Bakelite. For all Types of Sets

DAVEN D R F COILS
For the Daven "Bass Note" and other Tuned Radio Frequency Circuits

DAVEN AMPLIFIER KIT
Complete set Daven Resistance Coupling Units

DAVEN BALLAST RESISTOR
Eliminates Rheostat, Needless Controls, etc.

DAVEN TUBES
MU-6 and MU-20, for Clear, True Tone

DAVEN RESISTO-COUPLERS
Unit Mounting for Limited Space

DAVEN CONDENSER
Type A. Space Saving. Moisture-Proof

FOLDER FREE
This Folder tells in detail what Glastor is and what it will do for your radio set. Write for a copy today. It is Free.

The Sine of Merit

DAVEN RADIO CORPORATION

TRADE MARK *Resistor Specialists* Reg. U.S. Pat. Off.

158 Summit St., Newark, N. J.

RESISTOR MANUAL
A complete authoritative Handbook on Daven Amplification. 25c at Dealers. Or sent by mail for 30c.

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

THE RADIO HOME,
Produce Exchange Building,
Third and Walnut Sts., Philadelphia.

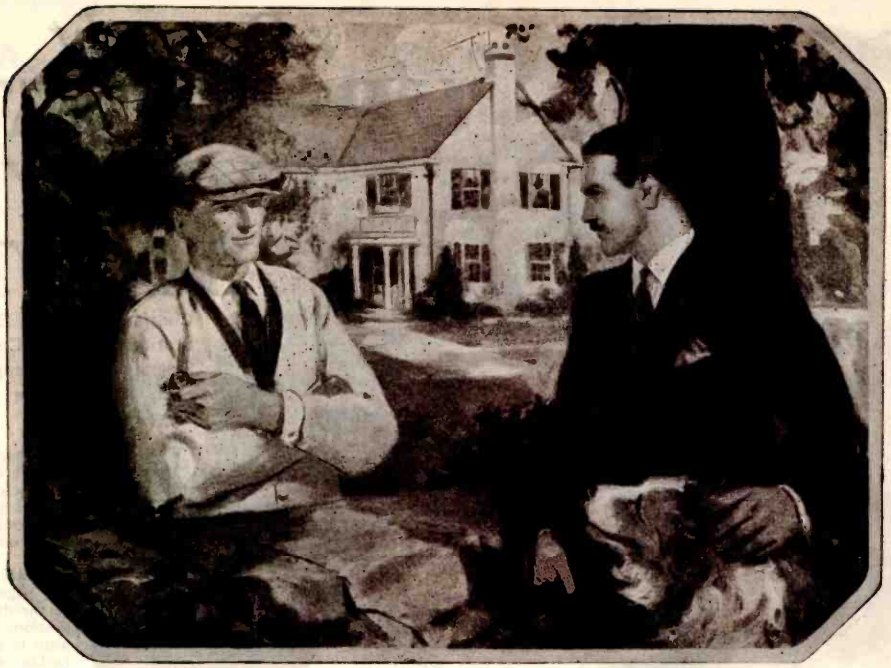
You bet I want that revised station list every month for one year along with THE RADIO HOME. *Here's my* $.....

(Name) .....

.....

.....

Note:—If you are a new subscriber, enclose $2.00. If you are at present a subscriber, enclose $1.00 and we will extend your present subscription three months and send you the Station List for one year.



"We give our sets about the same amount of use, but your 'B' batteries always last longer than mine. What's your secret?"

"WHY, there's really no deep, dark secret about it. It's simply knowing what are the right size batteries to buy for your set."

"Yes, but what do you mean by *right* size?"

"The right size depends on the number of tubes in your set. The more tubes you have, the bigger the 'B' battery you need to give you long, economical service. Just follow the rules laid down by Eveready and you can't make a mistake."

These are the rules and the results:

On all but single tube sets—Connect a "C" Battery. The length of service given below is based on its use.*

On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes—Use the Heavy-Duty "B" Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or 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.

LEFT—No. 486, for 4, 5 or more tubes. $5.50.

RIGHT—Eveready Dry Cell Radio "A" Battery, 1½ volts.

EVEREADY
Radio Batteries
—they last longer

These rules will give you the maximum of "B" battery life and economy. Of course, if you listen in more than 2 hours a day, which is the universal year-round average, your "B" batteries will not last quite so long, and if you listen less they will last longer. Eveready "B" Batteries give a pure, steady, noiseless current, the kind of current that is absolutely essential if you prize pure tone.

Send for booklet, "Choosing and Using the Right Radio Batteries," sent free on request. There is an Eveready dealer nearby.

Manufactured and guaranteed by

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

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WTAG—*Worcester* WTAM—*Cleveland*
WFI—*Philadelphia* WWJ—*Detroit* KSD—*St. Louis*

VOL. V NO. I
JUNE-JULY, 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).

Editorial & Business Offices—Produce Exchange Building, N. E. Cor. Third & Walnut Sts., Phila., Pa.

Printed on the presses of The Haddon Craftsmen, Camden, N. J. Entered as second class matter at the Postoffice, Philadelphia, Pa., under the act of March 3, 1879.

THE RADIO HOME is a member of the Audit Bureau of Circulation.

THE RADIO HOME is sold at 20 cents a copy at all newsstands, radio shops and bookstores. Subscription rates, in the United States, $2.00 a year; Canada, $2.50; foreign, $3.00.

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

SUMMER time radio enthusiasts who remain faithful to their sets throughout the hot weather very naturally have a most friendly feeling toward the broadcasting organizations which continue to furnish them with the best possible entertainment in spite of anything that the thermometer or calendar may say. That's one reason why the Ipana Troubadors are making such a hit with an audience that can safely be numbered by the millions even in these summer days of outdoor life. One of our staff writers tells you about them in our next issue.

Miss Betty Crocker has gone on a vacation for a time but she will be with all of the women fans again soon and meanwhile we have secured from her probably the most interesting material which her admirers can imagine. It is a collection of the recipes which she has given by radio from the many stations all over the country which broadcast her talks and this collection has been made up of the ones which her letters proved to have been most popular with her radio pupils.

There will be a lot of other articles in our next issue that will be of great interest to the person who likes to listen-in but doesn't give a darn what is on the inside of his or her set.

FOR the fellow who cares more about the inside of his set than he does about the programs which the set brings him, our Technical Section will be a hum-dinger. We have been stressing the question of tubes a good deal lately but the next issue will contain even more interesting material because it deals not so much with the kind of tubes that are being developed in the laboratory as with the tubes which are actually now on the market and which have not yet been fully mastered by the fan.

Our laboratory staff will also be in with some mighty valuable notes which they have collected while building all sorts of battery eliminators and these notes will point out the solution of some of the difficulties which any novice is likely to experience.

We also have received from our London correspondent the first article which has been given by M. Lucien Levy, the famous French scientist, on his new method of shooting "death rays" through the atmosphere.

Then, for the hook-up fan and the vacationist, there will be a real portable superheterodyne. We have faced this problem in what we consider a very practical way. First, we insisted that the whole works, including batteries, be carried in one case. Second, we insisted on enough batteries to operate the set for the usual two weeks vacation. Third, we insisted that the carrying case be cheap and readily available to any one. So we looked through the Sears-Roebuck catalogue, picked out one of their standard cheap straw suit cases and have put a Victoreen superheterodyne, all batteries, a standard loop, and a pair of head phones in that. It's a dandy.

Editorially Speaking *and*

ORDINARILY the man in charge of a magazine doesn't like to devote his editorial space in two succeeding issues to exactly the same subject but there is a problem in radio today that is so fundamental and that is bringing us to such a critical situation that I feel justified in discussing it again here just as I did in the last issue.

This subject is the matter of demanding *unlimited free service* from the dealer from whom you buy your radio set.

Perhaps you may think that the subject belongs more properly in the pages of a trade magazine and not in such a magazine as this but I think that a little consideration will show you that you and I are the ones who must solve this problem for the dealer or else you and I will be the sufferers in the end.

This demand for limitless free service is driving dealers into bankruptcy and if a large percentage of dealers are driven into bankruptcy, where will you and I get our radio sets and radio apparatus?

A popular magazine such as this is not supposed to have any interest in the dealer except that it regards him as a fellow human being but I think that in this new game of radio we may legitimately consider the dealer's continued prosperity to be an absolute essential in our own enjoyment of our favorite hobby because, until we become more expert than we are now, we must have him always at hand so that we can go to him in our troubles. And, just as we expect to pay for service when we take our physical troubles to the doctor or our automobile troubles to the garage or our plumbing troubles to the plumber and so on down the entire list, just so must we be willing to pay for the radio dealer's assistance and I would even go so far as to say that we ought to *insist* upon paying for it even if he trys to be a good fellow and offers it to us for nothing.

Why? Because the dealer who tries to give free service is failing to take into consideration all of the factors in his annual bookkeeping and is simply paving the way for a visit from the Sheriff and a "For Rent" sign hanging on the door of his vacated shop. He may not realize this but it is bound to come.

I would recommend that all radio dealers get hold of the June 16 issue of a magazine called "Advertising and Selling" published at 9 E. 38th Street, New York. In this issue there appears the first of a series of articles by H. A. Haring telling the results of a very thorough investigation he has made of the radio business and the conclusions he has drawn. I wish I had room to print all of this first article because it would be almost as interesting to the general reader as it would be to the dealer, but we are considering just now only the subject of service and so this is all I can quote for you at the present time.

In addition, I want to call attention to the very clear and business-like form of contract used by George A. Haas of Philadelphia and reproduced on the opposite page. This is so eminently fair to both the seller and the buyer that I commend it to the attention of everyone. But, to get back to Mr. Haring's article—after discussing several aspects of the radio business, he says:

"Look, if you will, at another picture of radio.

"At the other end, farthest from the manufacturing president is the service man who installs and services the set. More important to the purchaser than any other single link of that long movement of the set from factory to his living room is the work of the man who climbs over the roof to put up the aerial and who gives instructions for dialling, testing the batteries and tubes, overloading electrical capacities, and the like.

"'Service man' is the expression just used. 'Service kid' would more aptly state the truth.

"The department store in New York that claims to sell most radio sets in that city tells me:

"'Do service men help to sell sets? No, they hurt sales. They are mostly kids who have not reached business judgment or experience. They tell the most amazing whoppers to the people—not especially that they mean to lie, but they just don't know how to be cautious.

"'Every week a dozen high school boys apply here for jobs. When we insert an ad for extra help or for service men, the applicants are all kids, seldom one over 20, high-school boys. At one time I had a gang of 68 service men, but not ten of them were over 20.

"'The trouble with servicing radio is that electricians are already making $60 a week and won't bother with radio enough to learn it. Nobody but a kid has the enthusiasm that makes a really good servicer, and kids lack judgment.'

"Another New York department store tells me:

"'At the height of the season we had 110 service men last winter. Not 15 of them were old enough to vote.'

"Were it generally known how severe is the burden of radio servicing, two-thirds of those who failed as radio dealers would never have entered the business. Their 'fly-by-night' quality, so derided by successful competitors, has been a thing thrust upon them by the nature of radio. For the selling of radio carries a servicing problem unknown to other merchandise; the washing machine with all its troubles presented nothing its equal, and the electric refrigerator is 'fool-proof' in comparison with a radio receiving set.

"Installing and servicing were inseparable from early radio selling. The dealer had no choice other than to correct the manufacturing defects, to rectify the adjustments thrown out of balance in shipping and handling, to satisfy the complaints of the owner, be they real or imaginary. Eagerness to please the customer led to free servicing. In fact, nowhere does there appear to have been the least thought of a servicing charge.

"Servicing expenses begin with delivery of the set. Seldom does the customer buy 'as is.' The dealer 'installs' and 'demonstrates' and 'instructs the owner,' whether his residence be one mile away or twenty. Although a flat charge is customary for this initial servicing, competition and overly-enthusiastic dealers have gradually cut down the figure until it barely covers wholesale price of aerial and lightning arrestor.

"Radio dealers have been self-deceived in the flare-backs of their own service contracts and the warranty they have been giving their customers. Cost accounting hardly exists among retail-

The Burden *of* Free Service

Many Dealers Will Be Driven Into Bankruptcy if the Fans Do Not Ease Up in Their Unfair Demands

By HENRY M. NEELY

still Editorially Speaking

ers. Many of them have only the haziest of notions as to the expense of servicing.

"The dealer makes a sale, the mark-up margin of which he chalks down as 'profit.' He forgets that for six or eight months to come, his service department will be making calls on the customer in efforts to keep the radio sold until maturity of final installment of the price. The original sale occurs in mid-winter. The servicing extends over the ensuing summer. During the height of radio selling, the volume of apparent 'profits' looms so large that the servicing costs are barely evaluated at their true significance, but, when the dull months of summer are upon the dealer, each week's pay-roll for service men is magnified. 'Seasonal dullness' is, therefore, often blamed for more sins than are rightfully its own.

"Within a single week of April two radio dealers made almost identical remarks to me. One who is the largest single radio retailer in the country with a business last season of $7,000,000 told me:

"'Servicing has killed the profits of selling radio. The man who has paid $35 for a set, at a special sale, feels that he has laid out a big price and he expects to get something for his money. He demands servicing just as insistently as the lady who has paid $450. The result is that unless we revamp our policies, the cost of free servicing will just about equal the profits of selling the set.'

"The other dealer is a battery-shop man, a skilled electrician, twenty miles back from the Hudson River in the Catskills, who last autumn added radio to his line. He sold two sets during the 'season.' His complaint is:

"'I wish their houses would burn down! They give me more trouble than a hundred batteries would, and at fifty cents an hour for time I calculate I've paid out more already than I made on the sale, not to count all the gasoline I've burned getting to them.'

"Do those instances sound overdrawn?

"If so, listen to the statement of a world-famous department store in Chicago:

"'I hate to tell you what our servicing costs. There is one set of figures I never look at. Servicing takes more than the man's time—that's bad enough—but it's always some allowance for a B battery, or a tube, or something else. Servicing never comes to an end. No matter what we guarantee, the owner will call us six or eight months after buying.

"'Our trouble is that radio isn't the only thing sold by this store. A good customer must be satisfied and kept satisfied. That's why the radio department is the biggest leak in the whole store.'

"From a New York department store:

"'July fifteenth we expect to throw off one of our radio headaches. On that day we expect to quit servicing sets. We have been promising six months' servicing ever since we began to sell radio, but on January 15 we stopped doing that, and the last promise will expire on the fifteenth of July. After that day, we hope to make some money selling radio.

"'Our radio servicing has cost us 7 per cent of gross sales over and above what we have been able to collect from owners. That percentage ought to be 1 or 1.5 at most.'

"Now if—and it is no 'if' but a certainty—the most experienced merchandisers of America find radio servicing such a costly undertaking, is it any wonder that lesser concerns, with inexperience, find themselves engulfed under the severe burden?

"The costliness of radio servicing has a close second in the foolishness of much that goes under the 'guaranteed servicing.'

"The customer paying $800 for a radio in a period-design cabinet may warrant the sending of a uniformed flunkey to discover that the battery has run down; or the maker of our highest-price radio may fittingly insist on his rule that a preliminary visit shall be made to the home to examine the room where the cabinet is to stand with a color card from which madame selects a wrapping for the wires so that they shall harmonize with the color scheme of her room; but, for the ordinary radio, selling from $75 to $200 including accessories, such extremes of installation service would be sheer nonsense.

"Much of the so-called servicing is nothing more than instructions for use of the set. Next in importance would be run-down batteries, burned-out tubes, loose wire connections.

"Dealers estimate variously the proportion of such useless calls. Their estimates are of no interest, for the reason that all this foolishness is their own fault. No one else is to blame for the extravagant promises, made by themselves without adequate consideration, to give 'free servicing' for all time.

"No single change in the radio world will be so important, for the 1926-1927 season, as will be complete change of dealer-front in the matter of servicing. Servicing policies are today more important than single-controls, or the new detector tubes or cabinet models.

"April and May, for radio makers, are the months of 'distributors' conventions' and 'sales conferences.' For the present year, for one manufacturer after another, there has not been the usual jazzing about a 'revolutionary model shortly to be announced.' This has been displaced by sound talks and clear thinking on the servicing problems of radio.

"The servicing situation has been seriously complicated by time-payment selling, and for rather a peculiar reason. With automobiles the purchaser understands that his dealer sells the notes to a discount company, to whom it is useless to complain about the car. Unless you pay them, away goes the car. With radio, however, for some unaccountable reason, the owner thinks of his dealer as retaining the installment-notes. The purchaser is, therefore, merciless in his demands for ridiculous servicing so long as payments are due, often with the thought that the dealer is compelled to keep the set in working order. This attitude has been further enhanced by all the radio price wars, for price-slashing often brings into the market new sets, identical with that for which the owner still owes sixty per cent of cost, at a price so low that he could permit repossession of the first set and still buy a new set for less than the unpaid installments."

GEORGE A. HAAS
RADIO DEPARTMENT
2902 Germantown Avenue *Phone, Tioga 72-40* *Philadelphia*

CONDITIONS OF CONTRACT
Fully Specified

1. We guarantee radio sets and all equipment furnished by us to be free from defects in material and workmanship. If any defects develop within the manufacturer's guarantee period, provided the mechanism has not been tampered with, we agree to repair the set satisfactorily, or at our option replace it with another of the same make. Where such an exchange is made, tubes and batteries will not be included in the exchange.

2. We do not guarantee the reception of distant stations on any radio receiver, regardless of make or price. The securing of distant stations depends upon elements beyond our control, such as weather conditions, location of the radio, and the skill and patience of the operator.

3. Equipment such as tubes and batteries furnished by us are of standard make and tested quality. Owing to the fact that the life of the very best of such equipment is uncertain, and also because we have no means of determining the amount or kind of usage such equipment receives in the hands of a purchaser, we do not guarantee the life of either vacuum tubes or batteries. When our Service Department is called upon to replace batteries or other accessories in the home of a customer a cash charge is made for such service.

4. Storage batteries should be recharged and refilled according to instructions which we furnish at the time of installing the set. We are not responsible for damage to storage batteries which are allowed to completely discharge, or allowed to run dry.

5. We gladly give advice to our customers on request with regard to proper operation of their radio receivers. We feel, however, that in a period of thirty days any purchaser can fully familiarize himself with the proper operation of his radio equipment, and therefore on service rendered after the thirty-day period a charge is made at our regular rates.

6. This guarantee applies to.....radio receiver, No.....

..... purchased.....192

.....
Dealer's Signature.

Accepted..... *.....*
Purchaser.

Date..... *.....*

Here is a sensible and eminently fair form of contract to cover the sale of a radio set and the amount of free service to which the buyer is entitled.

GRIDLEAKS

by Bergey

Announcing Our *First* Cover Contest WINNER

Here is R. P. Free of Withee, Wisconsin, who is the lucky winner of our first Cover Picture Contest.

WELL, R. P. Free from away out in Withee, Wisconsin, is $50.00 richer and all because he sent us a little note of twenty-six words addressed to our Cover Picture Contest. This is what he wrote:

"For your 'Show Window' in the near future, would suggest a June bride and a radio nut, the fan of course, slighting her for his radio."

You will remember that we warned you when we first announced this contest that the final cover picture drawn from your suggestions might not look a bit like your original idea but that we were perfectly satisfied to pay $50.00 if you simply started us off on a line of thought that finally resulted in the kind of picture we wanted.

The award of the prize to Mr. Free is an excellent proof of this. The picture which resulted from his suggestion is on the front cover of this issue.

It doesn't look a bit like his idea, does it? Nevertheless it was Mr. Free's letter which reminded us that June is the bride's month and that the radio set is now just about as fine a wedding present as could be given to any modern girl.

So all of the members of our staff got together around a big table and began to discuss the suggestion. Some of us liked Mr. Free's idea just as it stood until somebody else said he thought that our cover pictures for some time past had contained too many figures. He said he thought it was time for us to spring a cover with just one big head and so somebody else suggested a bride in all the glory of her veil and orange blossoms listening to the radio set which she had received as a wedding present.

So we discussed that and came back once more to the idea of having just one large head instead of a full figure with a scenic background.

Then came the suggestion that we have the bride in her costume with a pair of headphones on but some of the girls in the office who have more knowledge of such things than we men have, said that no bride would disarrange her costume by putting on a pair of phones, so that put us squarely up against a problem.

Still, the desire not to have a scenic background meant that we could not use a radio set and loud speaker and therefore it was essential to use head-phones.

We were all completely stumped for a while when some member of the staff conceived the brilliant idea that an engagement ring would tell the whole story perfectly and so that is what we finally decided upon, and added a border of Orange Blossoms to complete the picture.

There were three other contestants whose suggestions were very similar to Mr. Free's, but it was Mr. Free's suggestion which really started us on the June bride thought, so in accordance with the announced rules, the first prize belongs to Mr. Free.

We made no offer of a second prize in this contest, but owing to the similarity of these other suggestions we are awarding each one a special prize of $10.00, as we feel that they are entitled to it.

The three winners of these special prizes are:

Miss Helen Guy,
143 Mapes Avenue,
Newark, New Jersey.

Mrs. Ursula Holmes,
444 W. Clapier Street,
Germantown, Philadelphia.

Mr. Eugene P. Balanger,
437 Sheldon Street,
Hartford, Connecticut.

Now, if you think that this is a mighty easy way to make $50.00, why don't you try it yourself? We are going to keep this contest open and will pay $50.00 every month for the suggestion which leads us to a cover picture.

Address the Cover Picture Contest, The Radio Home, Produce Exchange Building, Philadelphia, Pa. H.M.N.

And this is Earle K. Bergey, the artist who painted the final cover. Of course, we mean the handsome man in the circle to the right.

Dreaming *with* AL CARNEY *of* WHT

A Brief Glimpse Behind the Scenes of Station WHT, Showing the Care and Study Given by the Artists to the Many Requests Which Are Received from the Radio Audience.

Here is Al Carney in the act of ROARING for the photographer.

Photo by Priddis, Kenosha, Wis.

By VERA BRADY SHIPMAN

"AL, won't you smile in the picture?" the Kenosha photographer recently asked Al Carney, WHT's radio organist, as he sat for his photo on a personal appearance tour in southern Wisconsin.

"Why, of course I will," he answered, "I'd *roar* for you!" and he did—with this happy result.

You in the Middle West have listened in daily to WHT on the Wrigley building, Chicago, and heard Al Carney's organ seem to tell your very thoughts. How does he reach the hearts of his listeners? How does he respond to a request in the very spirit of the sender, you wonder?

It is just this, as Al told me himself, during a brief intermission in WHT's green room:

"When I begin a request program, I can picture the image of the sender. I can look into the home and see—perhaps the request is for 'Silver Threads Among the Gold'—then with it or something of its kind, it's the fireside circle—it's father, mother or perhaps one of the boys away from home—the home circle may be broken in recent years—it's always the picture in the heart of the sender of a ballad request. Those sweet young things want 'Always' or 'Let Me Call You Sweetheart,' and you know they may be cuddling or would like to be with their sweeties. The lights may burn low—and love is young. It may be flaming youth in a motor car but before the radio it's love's young dream!"

More requests are sent in for sentimental ballads than for all other kinds of music combined, according to WHT's organist. The patriotic request for national songs or anthems of a half forgotten foreign principality come with the dreams of home! Midst American loyalty, native patriotism occasionally sends its request for old home songs.

Then, too, jazzy lyrics of "blues" or "somebody's mammas" have their followers but are far in the minority when evening shadows bring radio home.

"Radio romance is sentiment of the heart. It's the old folks dream hour and the younger generation feels the spell of the times—and gracefully steps aside. Romance is queen."

Al listens in on his own broadcasting and changes his radio tones in many clever combinations. Several radical changes have been made from time to time in the organ through his own watching of broadcasting effects.

Born in Iowa, and educated in Dubuque schools and musical college, he came to Chicago and to motion picture organs with the dream of reaching the hearts of the people.

"In the theatre," Al continued, "I love the 'cueing,' the solo in spotlight, the bowing, and darkness as the picture resumes. The faces of the audience are blurred in the everchanging sea surrounding the organ.

"The radio audience must be visualized entirely. The player can picture his listeners in his fancy as he plays, fitting the mood to the musical number with no distraction, no side lights from the music."

And the radio family is encircled in the Great American Home, listening in to its favorites.

With Pat Barnes, WHT's popular announcer, Al Carney occasionally makes personal appearances in near-by cities on Chicago's silent nights. The audiences pack the theatres to see in person the boys whom they hear by radio. With Barnes, musical interpretations of well-known readings are often given, Carney improvising his music in his own way.

Requests for the music accompanying these readings are often received but the music is fleeting, elusive, a creature of the mind of the player and fitting the mood of the reader.

One little Wisconsin child writes that she wishes she belonged to Al Carney's family; a school teacher in southern Illinois tells of her radio enjoyment with Al and Pat; another, in Indiana, calls him "sunshine maker"; and a mother writes that she is sure he must look just like her boy.

These are some of the things which are worth while to Al Carney. Personally self-effacing, shy, with a delightful dimple (which girls would give hours in a beauty shop chair to obtain) and whole hearted, he just loves his radio audience.

Tune in on WHT at noon, or during the evening and you'll feel some of that inexplicable charm creeping into your radio set—and before you know it, you, too, will be requesting a love song from Al Carney, and will anxiously wait for him to sing your particular song or songs.

HELLO MIKE!

By WALTON BUTTERFIELD

ILLUSTRATED BY JAMES H. HAMMON

Being a True Account of the Fright That This New Instrument Throws Into Even a Veteran of the Stage

This panicky feeling does not begin as you approach the Wrigley Building. In the circle is a photo of the author.

YOU are, for the truthful purposes of this tale, a well-meaning, average young fellow of this workaday world. That you are somewhat of an actor and something of a playwright should not be held against you. The defense of this last statement cannot be gone into here, for this account has mainly to do with the meeting and greeting of Mike.

So, as average and as well-meaning as you have ever been in your life, you are walking down Michigan Boulevard, in Chicago, and glancing at the clock on the tower of the Wrigley Building, little suspecting that within twenty hours you will find yourself, with fast beating heart, on one of the lower floors of that most majestic skyscraper.

Down the windy street you go, footloose and fancy free, until you reach the building which houses the headquarters of the formidable sounding Drama League of America. Once on the proper floor and in the proper waiting room, you fish in vain for a card, send in a mere pronunciation of your name, and are soon making your introductions to the executive secretary of that august body.

While in the course of begging your favor, it is soon discovered that your typewriter is more aptly trained to the writing of plays than anything else and you are promptly and almost joyously introduced to another officer in the person of Mr. George Junkin. I say promptly, because Mr. Junkin is busily officiating at the next desk, and joyously, because, along with your name, has gone the explanation that you, no less, are the playwright who is going to broadcast one of his original short plays under the auspices of the League at one o'clock on the not-distant tomorrow.

You protest. Yes, you have some plays with you, strange to relate, but the fact is that you are entirely untutored in the mysteries of radio, much less the intimacies of the microphone.

All protests are politely but firmly ignored, however, and you are soon retracing your steps up the Boulevard and thinking only of the shakily pencilled notes on the margin of your newspaper: Station WHT, Wrigley Building, quarter to one, TOMORROW. Your orders were merely to present yourself, manuscript in hand, and allow the rest to take care of itself.

A gulp, a sigh, but not yet fear, as you repass the skyscraper and wonder just what in heaven's name awaits you on the morrow.

Tomorrow, as seems to be the way of the world, arrives, and with it a sudden sinking feeling around the heart which allows you to think of little else other than that radio appointment. This panicky feeling does not begin as you approach the Wrigley Building, but as soon as you put the right or left foot out of your bed. And it plays around persistently throughout your shower, your poached eggs with the toast very brown, your morning paper, and causes your hands to shake slightly as they rummage for the manuscript, and your legs far from slightly as you obey the lobby sign which directs you downstairs to WHT.

Never having done more than vaguely speculate as to the nature of these places from whence emanate such wonderful voices, . . . and some not so wonderful . . . pulse-stirring obbligatos, and soul-stirring orchestras, you of course speedily present yourself, beating heart and all, at the wrong door. And while the girl at the telephone is directing you further down the hall to the Artist's Reception Room, you catch a glimpse of the business offices of the station and even a corner of a room which smatters of volts, amperes, stabilizers, and such things about which you know nothing.

Once in the outer hall again you think longingly of a sudden departure, but the wellmeaningness of your nature recalls to mind the kindness of the Drama officials and you feel honor bound to go at least as far as the Reception Room.

There you find an atmosphere of quiet reserve. Beautifully panelled walls, deep cushioned chairs, soft glowing lights, flourish-

ingly autographed pictures of celebrities. A loud-speaker is radiating the beauty of Beethoven, while from the adjoining room comes the sound of the piano itself. You are, to say the least, impressed, though not at all relieved of that tight feeling around the heart. You have the feeling that you have entered one of the holies of holies, and so you unwittingly *whisper* when you have occasion to explain that you are there before the Mike by special appointment.

The explanation entirely dispels your incognito and you are introduced to the Announcer . . . or rather Announceress in this case . . . and quickly divested of your hat and coat. When in a strange place, however graciously your hat and coat may be removed from you to an unseen closet, you suddenly feel caught and imprisoned. And now you feel that the die is cast and come what may, you must go through with this thing.

The Announcer, in the person of Miss Jean Sargent, is the epitome of calm authority. She thoughtfully thanks you for being on time and explains that you do not go "on the air" for twenty minutes yet.

This gives you leeway to suggest that your voice is really much too deep for smooth broadcasting and that perhaps after all you are quite unsuited to the task at hand. But you are complimented on the evenness of your tone and led by another door to the very room which houses the volts and amperes. Here one of the operators, in shirt sleeves and with a green shade over his eyes, in maneuvering a regulator which evens the tones of the speaker who has in the meantime replaced the pianist. This man being able to control the most uneven or deepest of voices, you are bereft of excuses and led, with warnings for silence, through the door marked "For Artists Only."

The heart is now bettering its previous beatings by several flutters.

Now you are in a larger but equally well decorated room which contains two organs, two concert grand pianos, a couple of xylophones, many chairs, a desk, and, . . . yes, MIKE.

As a matter of fact, several mikes: long, short, and shorter, into the tallest of which a speaker is now directing his remarks. Two or three of the officials are whispering jollities and watching the individual who is broadcasting for some sign of the end of his remarks. They seem quite ignorant of the state of your heart and it is while one of the unused microphones is being adjusted and placed beside a chair and lamp that you discover a new agony.

The entire width of one end of the room

The characters of your play command your attention, and you are well off—at least to yourself for some time.

is walled in glass, on the other side of which are several long rows of pew-like seats from which visitors to the station may watch the broadcasting while they hear it over the air. Some thirty or forty fans are assembled for your radio debut; a discovery which of course contributes nothing but more flutters to the old heart.

It suddenly becomes apparent that the speaker at the tall mike is drawing his remarks to a close and you are hustled to the waiting chair and hurriedly asked if the arrangement of the light etcetera is satisfactory. With an unexpected burst of bravado you venture to whisper that you might be more comfortable at the little desk, using the hanging microphone. This causes one or two politely masked smiles from Miss Sargent and you later discover that you have merely asked for the use of the Announcer's private quarters.

Once ensconced in the place which has been arranged for you and directed to speak right into the microphone, to refrain from handling or kicking it, and to watch a small light signal nearby, you await the moment when it will flash red and so signify that you are on the air and that it is up to you.

The Announcer retires to the desk, switches something or other which transfers the . . . well, air . . . from the tall mike to the one hanging before her, and oh so calmly announces the letters of the station, the name of the speaker, the subject on which he has just discoursed and gracefully, if perhaps a trifle insincerely, compliments his offering.

It dawns on you about here that you have been so far removed from the cucumber's proverbial calm that you haven't the slightest idea about what this person has talked. More than that, it dawns on you that the spectators are now eyeing you with especial interest and you immediately conjure up mental pictures of the entire audience rising and walking out as one body some two minutes after you shall have had the audacity to "take the air."

Worse than either of these things, the room seems suddenly to have become unbearably warm and you are practically certain that while you may once have had a voice, however deep, you are now entirely and inconveniently bereft of such a thing. Simultaneously you move your chair so that the outpouring of listening visitors shall not be seen, and commence frantic pantominic communication to the Drama representative for water, and lots of it.

With polite disgust and probably for no other reason than that your name is already being announced, together with the nature of your hoped for reading, you are advised to take things more easily and given the assur-

ance that water will be sent for.

Now, what is this feeling which has so engulfed you? It is not like the actor's terror on the opening night of a new play, and yet it is.

But at least in the theatre you know that the great unknown on the other side of the curtain is limited to some thousand or so people. Here, however, the great unknown at the other end of the microphone is unlimited, both numerically and geographically. You are about to talk into space, with no immediate response but silence.

And you are so busy wondering just how it is that you do feel that it is with something of a shock that you realize there is a portentous silence and that the little light is flashing red. *You are on the air!*

With an unexpected burst of bravado, you venture to suggest that you might be more comfortable at the little desk.

Now the very first brilliant thing you do is to clear your throat with a horrible guttural rumbling which must of course do any and everything except awaken sympathetic interest from your listeners-in. So, to overcome this unfortunate start, you commence to read your masterpiece with a strange voice which miraculously comes from some place within you, but with a rapidity which would put to shame the world's fastest fire engine.

After a few seconds, however, your training comes to your rescue, your voice begins to sound reasonably natural, and like most earnest authors you even have the inclination to hope for signs of merit from your play.

Its characters command your attention and you are well off, at least to yourself, for some time. To be sure, you may lose the place a few times, and there are certain to be words which will somehow not allow themselves to be pronounced in the usual accepted manner, but you are at least fairly confident of escape from utter failure until you have the ill-luck to glance at your watch, which, aping the manner of famous speakers, you have at some earlier unconscious stage placed before you.

Now you are returned to the depths of panic and perspiration by the knowledge that the thirty minutes allotted to you have already come and gone, although you are still some five minutes from the crashing climax of your masterpiece.

The room becomes warm again, the words resume their tendency to jumble behind your teeth, and visions of empty spectator benches pop up between the lines of your manuscript. You imagine signs of boredom and impatience from those grouped around the Announcer's desk behind your back and you become positive that you are now suffering through something which is both your radio debut and farewell.

The last few minutes are finally achieved with a slight mental stimulus which ekes out to you from the climax of the play itself. The words "and so the curtain falls" are no sooner out of your mouth than you sink back in the chair, feel for your handkerchief, and happily discover the glass of water which you had expected to use at least a dozen times during the reading.

This gulped down, you begin to enjoy the sudden release from the exacting microphone. The Announcer is busy explaining again the name of the station, who you are and what you have done, and the Drama representative catches your eye and applauds your efforts by silently beating his thumb nails together. You timidly cast your eye in the direction of the gallery and are relieved to find it even more thickly populated than before.

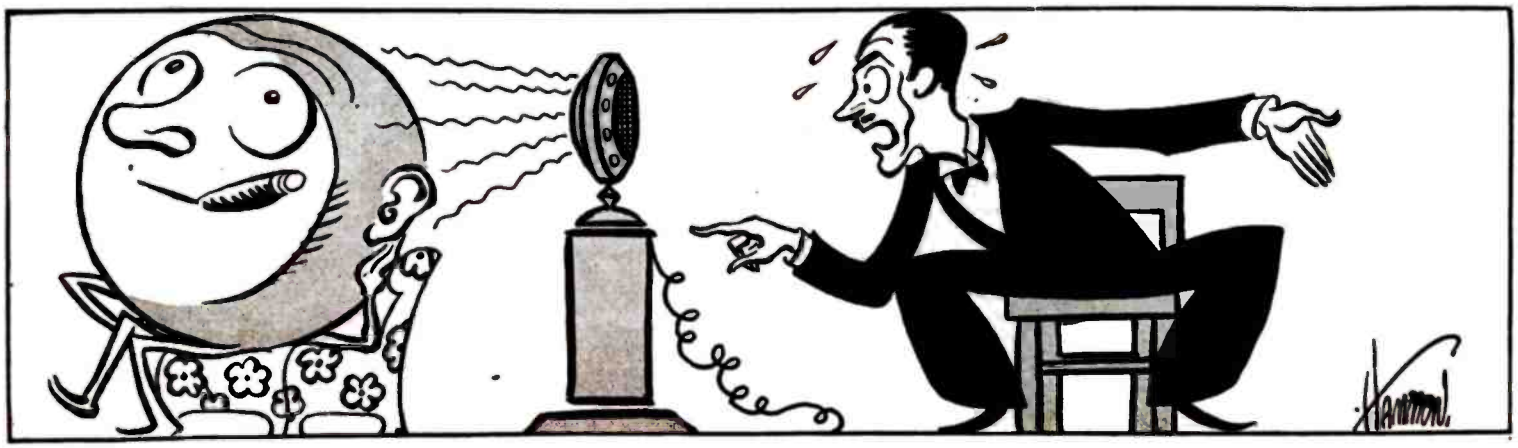
A jazz quartet having been announced, the air is switched to another broadcasting room and we are all free to talk normally for a few minutes. You gratefully hear that you have filled the bill, that your voice was so satisfactory even that the man in the ampere room went out to lunch, (a doubtful compliment, this) and hints are made that you may be asked back to meet Mike the following week.

To make shorter a story already long, on your arrival at the hotel you receive a telegram from the home folks in New York telling you that they were thrilled by hearing your voice. And this, followed by a large number of fan letters within the next few days, makes you realize that this broadcasting stunt has gone through that microphone to countless ears and hearts.

And so, when you return to the mike the next time, you do so with a nervousness recurring not so much from vanity as from a terrific feeling of *responsibility* that you must give something which will in some measure reward this almost inconceivable power which is at your command. Instead of speaking into a little round disc which may lead nowhere, you are directly entering homes and hearts which could never otherwise possibly be opened to you. Not even were you to live many times man's average span of years or to be endowed with the magic of no less a person than Santa Claus himself.

Could any man or woman fail to give the utmost in him in an effort to measure up to such a glorious, breath-taking opportunity?

Of course not, and so I say: "Mike, my hat is off to you!"



The Magic Carpet SOARS

Douglas Fairbanks had nothing on Louis Katzman as the above picture shows. Let's hope Louis doesn't lose his balance and fall over the edge of the Magic Carpet into some foreign country.

And in it's Flight, it Pauses Long Enough for the Anglo-Persians to Play Strains of Music from the Four Corners of the Earth.

By ESTHER VAN ZANT PETERSON

ONE Friday night, shortly after "The Whittall Anglo-Persians," under the direction of Louis Katzman, began to broadcast through the WEAF chain of stations, I sat in the monitor's booth between two studios at station WEAF. Completely isolated from the rest of the world, I watched the Vikings and listened to the Norwegian music that the instrumental quartette rendered so charmingly. My rapt attention was so centered on Aage Sorenson, as the first notes of his solo came from the loud speaker at my elbow, that I scarcely knew that Graham McNamee had come into my little "lookout" until I heard his voice.

"Don't mind if I shift the scenes, do you?" he asked.

Then he turned a switch and unearthly sounds like some kind of barnyard pandemonium enveloped me. Soon this din melted into the thrillingly exquisite notes of "A Song of India."

Before I had time to voice an objection to the interruption, Graham McNamee had jumped out into the studio on the right hand side. Through the open door I heard his voice—"Louder"—as he motioned to the musicians in the first row. Turning quickly to the window on that side I saw the scene that you have before you in the illustration showing Graham McNamee with the orchestra.

Then and only then did I realize that I was witnessing an honest-to-goodness radio rehearsal from back of the scenes. Louis Katzman and the Anglo-Persians were hard at work in their shirt-sleeves, instead of in the native costumes that one might expect to see at a dress rehearsal.

Some weeks later when we took the photographs, all of the musicians insisted upon keeping their coats on, but Louis Katzman proceeded without his as unconcernedly and as comfortably as he did the first time.

From my vantage point in the "lookout," I could see and hear everything that was going on. From time to time I was joined by Phillips Carlin and several other men and we heard the same notes tried over and over again until these critical listeners pronounced the transmission perfect.

Then it dawned upon me that not only

THESE Anglo-Persians are a radio treat no music lover should miss. They broadcast for an hour every Friday evening from

WEAF, New York	*WCAP, Washington*
WJAR, Providence	*WOO, Philadelphia*
WEEI, Boston	*WGR, Buffalo*
WTAG, Worcester	*WCAE, Pittsburgh*
WOC, Davenport	*WCCO, Minneapolis-St. Paul*
WWJ, Detroit	*KSD, St. Louis*
WEAR, Cleveland	*WGN, Chicago*

must a radio orchestra perform perfectly but the volume of each instrument must be so proportional that the music records over the air as a perfect unit. There was enough friendly argument on various points to make things interesting but after awhile the critics came to an agreement in each case and the work proceeded.

When the realization came to me that I should be less in the way and could take in the performance just as well from the studio, I abandoned the little box-like room and found a place far enough from the musicians to be comfortable but close enough to watch the movements of each one. With all my faculties intent upon watching the orchestra's response to Louis Katzman's every motion, I was so carried away by this revelation of the intricacies of radio orchestration that I did not know that we had been there over an hour. Suddenly one and all relaxed and I perceived that the rehearsal was over.

Almost before there was time to take a breath, familiar words came in a well-known voice from one side of the studio—

"And now once more the magic carpet soars in its flight over various countries of the world"—and I knew that Graham McNamee was on the air. Our audience had been increased by hundreds of thousands of listeners.

The orchestra, to a man, was all attention and soon the customary oboe solo proclaimed that the weekly program was about to begin. Practically every available space in the studio had, in the short interim, been filled by appreciative guests. Even the doors into the outer studio framed groups of faces pressed against the glass to catch a glimpse of this popular orchestra in action.

Among the spectators I noticed a youngster who sat in rapt attention during the opening and closing solos and it seemed to me that he bore a decided likeness to the player. It was as good as a show to watch the rest of the visitors, too. Feet tapping, bodies swaying, the most dignified-looking of them gave themselves over to the utter fascination of the rhythmic music and of watching Louis Katzman with every muscle of his body galvanized into action.

Several weeks later when I went back again to get better acquainted with the Anglo-Persians and to take some photographs to show you how they look at work the first person I saw as I entered the rehearsal studio was the small boy I had watched the first time. He was not missing a trick, without, in any sense, being under foot as so many children are under similar circumstances. I ventured a question as to how he liked being there.

"I've been here lots of times before," he informed me. "My dad plays the oboe and the English horn—you know, at the beginning and end each time. My name is Herbert Cohn," he continued.

It was no surprise, to me, to learn that Louis Katzman had been for a number of years the arranger for one of the biggest music publishing houses in this country. He has also arranged much of the music played by the famous orchestras of such men as Paul Whiteman, Vincent Lopez and Paul Spect. He has likewise had wide experience as an arranger for prominent phonograph companies. At present he is arranging and conducting for the Brunswick Company.

After trying every trick of the journalistic trade to bait Louis Katzman or one of the musicians to tell me a funny story of their broadcasting experiences at the WEAF studio I was about to give up in despair when we began to take the special photographs for this story.

It seemed anything but funny as we tried to catch the men in natural poses that would show how they look in action. The photographer had berated them in exasperation in terms ranging from coldly polite remonstrances to pointed remarks which I shall not repeat here but which I assure you they all understood.

Louis Katzman, conductor of the famous Anglo-Persians.

Just then I chanced to look in through the open door where the camera had been placed and I caught a fleeting glimpse of Ernie Hare and Billy Jones, the "Happiness Boys," whose weekly half hour had just been completed. If they told anything that evening one-half so funny as their antics out there in the corridor there must have been some total wrecks at receiving sets at the other end. At any rate they had an appreciative audience that included most of the leading lights of the Friday night staff at WEAF.

For a time it looked as if we should have to give the evening over to this impromptu program when the photographer and Louis quelled the riot long enough to shoot the photographs. Then they wheeled the camera away and unceremoniously shut the door in the faces of the spectators and the rehearsal was on again in earnest.

Every program is rehearsed step by step the night it is broadcast. For a whole hour they do it and they really work too. Louis Katzman would not tolerate loafing even if the musicians were so inclined and I have his word that they are the finest aggregation of musicians in the world.

In fact, they seemed so worn out after they had finished their performance that I had about made up my mind that I should be indeed lucky if I had the chance to ask a tenth of the questions that had come up in my mind as I watched them. Louis Katzman must have seen the eager look on my face as I whipped out the preliminary queries while he was putting on his coat. Just then Anthony Sanella, the saxophone artist of the Anglo-Persians, began to signal something to Louis when he thought that I was not looking.

"He's trying to tell me not to forget that we are going across the street to get something to eat. Won't you join us? I can talk much better over a cup of coffee," said Louis Katzman as he turned to introduce Mrs. Sanella who had just joined the group.

"What was that story you told me the other day about the letter Louis got from the radio fan about what an easy time you have of it?" Mrs. Sanella asked her husband.

"You remember, don't you Louis, the one about the records?"

"The fellow who wrote that he hoped we had made a record of 'In a Persian Garden' the other night when he heard us play it through KSD out in St. Louis? He had the idea that we simply turn on the recording machine any time while we are broadcasting and the deed is done. This man really was very nice about it for he told me that he had one of my other new records which he prized very highly because he had heard it so clearly as we broadcast the night we made the record. He went on to say that it must be pretty soft for us having the records to sell after we broadcast."

"He ought to have seen us the day we made that record," said Sanella, with a groan. "You particularly, Louis, after we made the fifth false start. You haven't forgotten have you?"

"Not on your life! It was as hot and as breathless as an East-side loft on a mid-summer afternoon, and we were feeling about as comfortable as I imagine the fur workers there do on such a day. The sixth time we were just about to finish the last strains when a sigh of relief followed by a stage whisper came from the rear ranks.

" 'That's that! Now where do we eat?'

"And so we had to do the whole thing all over again.

"At any rate we must have finished a per-

The Anglo-Persians in native costume. Louis, who is standing to the right, evidently told them something funny.

feet record the next time. Our correspondent, says that the record sounds just like he heard us play it," Louis continued with a humorous twinkle in his eye.

"Our radio audience does form strange ideas about us. I know because they are so frankly curious in their questions about our personal affairs.

"Not long ago I had a letter from a woman who asked me if it was true that I was a 'Young Turk' and had been so disgusted by the treatment of the Armenians by my fellow countrymen that I had sneaked out of the country and had come to America, to devote my talent to music to raise money to send back to the unfortunates. It seems that the lady's mission study class had just been studying about the frightful conditions she mentioned.

"'I told the class that I thought you must have had some terrible experience of the kind. Only one who has come through real tribulation could render that Oriental music so soulfully,' she wrote.

"It was a little hard for me to shatter her illusions by writing that I was glad that she liked my orchestra but that I should have to deny the rumor that she had heard, for as a matter of fact I was born in Kishineff, in Bessarabia which is now a part of the kingdom of Roumania.

"True—I did study music in Constantinople for a time. Perhaps that is where the idea that I am a Turk originated."

Louis then told me that he had his early musical training in Odessa, Moscow and other musical centers of the Near East as well. He studied under such famous conductors as Nikish, Weingartner, Zenowski and Ipolitov Ivanov. Before he was twenty years old he came to America, where, to this wonderful foundation, he added valuable experience under Walter Damrosch, Victor Herbert, Percy Grainger and John Philip Sousa.

A critical listener-in said to me one day shortly after the Anglo-Persians had given a particularly well chosen program that he had wondered just what Louis Katzman's musical background had been for he had been struck from the first night by the conductor's apparent versatility.

"What you have just told me accounts for it. He shows a rare familiarity with the music of both the East and the West. He knows the old masters and he has a real flair for the most modern of interpretations."

I have found Louis Katzman very modest of his attainments. While we were discussing his remarkable training for his profession, he shrugged his shoulders and said, "But then you see I have wonderful support in my orchestra."

Turning to a pile of letters that he had brought with him, he remarked, "Here's one from a man who wants to know the names of my star musicians. Stars—they are all stars."

"How about the man who plays the oboe solo at the beginning of each program?"

"I guess you mean Irving Cohn. Sure, he's a star; so are Anthony Sanella, saxophonist; Joseph Livalski, first violinist; Joseph Meresco, pianist; H. Faverman, first trumpet; John Cali, banjoist; Sammy Lewis, trombone—"

"What other personal questions do they ask," I interrupted for I could see that he was all set to name the entire orchestra and I knew that I could never remember all those names.

"Oh, yes—every once in a while someone asks me if I am married and how old I am. I am sorry that Mrs. Katzman is not here tonight so you could meet her. She hasn't been able to get out much for a week or so. Our little girl has been very sick. She's better this evening or I don't see how I could have come here. I have been completely unnerved.

"We have a boy, too; he's fourteen—a big fellow. He has not shown any inclination to follow his dad's profession so far, so I am afraid that we shall have to give up hope of making a musician of him."

He did not volunteer any information about his age but for the radio fans who are interested in this point I should say that he is about thirty-five. However he really does not look it.

Another letter said:

"I am glad that you give us a little variety. The grown-ups in this family like your classical and semi-classical numbers best but the youngsters prefer the dance music."

This criticism is well made. In my estimation one of the very good features of each of the Anglo-Persians' programs is that there have been several popular selections every time. Just when Janie Lou or the other flappers might be ready to tell dad to "step off the magic carpet" and "tune in some good old United States jazz," the musical scene shifts. The younger fry begin to sway to the tune of a lively fox-trot and in the twinkling of an eye they have staged an amateur Charleston contest or perhaps the junior glee club has essayed a little close harmony.

When I have tried to decide which of the programs I have liked the best I have wavered from one to the other until I have about made up my mind that the latest one is always the best.

Of course I except the red-letter occasions when it has been my privilege to sit in the studio while the Anglo-Persians were broadcasting. I wish that every radio enthusiast might have the same interesting opportunity.

Graham McNamee takes a hand in one of the rehearsals. Mr. McNamee is the man standing to the right with his arm raised.

PRIZE Winners *of First* RADIO RECIPE Contest

Here is Mrs. Ida May Phillips, 1665 Bruce Avenue, Cincinnati Ohio, who is the winner of our first radio Recipe Contest.

WE ARE very glad this month to be able to bring a little thrill of pleasure to three of our women readers by the award of the first list of prizes in our Radio Recipe Contest.

It has been most gratifying to us to see the widespread response which this contest has brought. Answers have been received from virtually every section of the country but right here it should be said that many of these could not be considered because they merely gave favorite recipes and did not comply with the rules of the contest.

These rules are perfectly simple

First, you must hear a recipe given **over the radio.** *Then you must make some change in it which you or your family consider an improvement. Then, in order to compete, you must send us the original recipe just* **as you copied it by radio,** *the name of the woman who broadcast it and the station from which you received it and then give the recipe as you changed it. That is all.*

.....

We are going to continue this contest as long as our readers seem to feel it is interesting.

Each month we will give three prizes—the first prize, $25.00; second, $15.00 and third, $10.00.

So look over the radio programs in your daily newspaper, tune in the women who are giving recipes and try for one of these prizes.

Incidentally, you will be surprised to find how much really helpful information you will get in these radio talks which are broadcast every afternoon from stations all over the country.

H. M. N.

MRS. IDA MAY PHILLIPS' recipe for "Upside-Down Cake," adapted from the one by Judith Anderson broadcast through the Crosley WLW broadcasting station in Cincinnati is awarded first prize—$25.00.

2 tablespoons butter (instead of 4)
Layer of apricots (instead of pineapple)
⅓ cup of water
Chopped and whole almonds
1 cup pastry flour
1 teaspoon baking powder
2 teaspoons vanilla
1 cup honey (instead of brown sugar)
2 eggs
1 cup sugar
1 dozen macaroons dried and rolled fine

Flavor the fruit with one teaspoon of vanilla. Melt butter, add honey and fruit as directed in original recipe. Mix the batter as in the original recipe. Sprinkle chopped and whole almonds in the batter. When ready to serve add the powdered macaroons to the whipped cream.

Editor's Note: I have tried mixing the chopped nuts with the fruit layer, instead of with the batter, with most satisfactory results.

ORIGINAL RECIPE

Upside-Down Cake

¼ cup butter
1 cup brown sugar
1 cup or more chopped pineapple
⅓ cup of water or pineapple juice
2 eggs
1 cup pastry flour
1 cup sugar (white)
1 teaspoon baking powder
1 teaspoon vanilla

Method.—In an iron skillet, over a low fire, melt the given quantity of butter. Tip

the skillet so that the entire bottom has been buttered. Add the brown sugar and cook until smooth and bubbling. Watch carefully that it does not burn. Add a layer of chopped or broken pineapple, drained from its juice. The exact amount was not specified because it will depend upon the size of the pan. (As submitted the recipe simply called for a layer of pinneapple.) Remove from the fire.

Make a batter by beating the yolks of the eggs with the white sugar. Add the water or pineapple juice and the pastry flour that has been sifted with the baking powder. Flavor with vanilla and fold in well the stiffly beaten whites of the eggs.

Pour this over the mixture in the skillet and bake in a rather slow oven 45 minutes or an hour. If the oven is too hot the topping (sugar, butter and fruit) will burn before the cake is done. When done remove from the oven and allow it to stand in the skillet ten minutes. Fit a plate on the skillet and turn the whole thing over as you would an omelet (not folding of course). This then makes a sponge cake with a topping. It is usually served with whipped cream. A sauce may be made of the fruit juice but the whipped cream is preferable. Other sorts of fruit may be used. The pineapple rings may be left whole and a cherry placed in the center of each when the cake is turned out.

Use a skillet about 9½ inches in diameter and 2½ or 3 inches deep.

Delicious! You just bet it is—all of that and more too. We tried the original some time ago and liked it so well that there have been "repeats" every time that we have had special guests. Then one night not long ago I gave the family a surprise by following Mrs. Phillips' version of this dessert and now popular demand has put it on the program as a "request" number every time it falls to my lot to prepare dinner.

But don't take my word for it. Try this recipe yourself and if the men of your family do not pronounce it the best ever there is something the matter with them.

Editor Radio Home,
Produce Exchange Bldg.,
Philadelphia, Penna.

Dear Sir:

Thanks! That's for your foresight in editing a magazine for the HOME. It's the only one which really strives to make radio enjoyable for women. The usual magazine seems to be issued for men with mechanical kinks in their brain or a small laboratory of tools. You have made it possible for the women to really know there is a lot of good times ahead in the radio broadcasting art and give them something to look forward to. For example, there was the story about cooking by Elizabeth A. Anderson in your April issue. Her name is like that of the woman to whom I listen—Judith Anderson, the Kroger Cooking Chat Lady, with her weekly recipes at three-thirty on Wednesday afternoons through the Crosley WLW broadcasting station in Cincinnati.

Not matter how nearly perfect a recipe may be, we women believe it can stand improvement. The other afternoon I tuned in and heard a recipe for "Upside-Down Cake." Tried it and liked it. But I also thought of another way to make it and did. To my delight, it was an improvement upon the one I made from the radio recipe. Perhaps there may be some other devotee to the culinary art who would like to try it or both and therefore I am sending it to you.

If you like, you may consider my improved recipe in your contest, but it is sent for your readers to try.

May you and your magazine enjoy the success it deserves and be found in every RADIO HOME in the world.

Very sincerely yours.
(Mrs.) Ida May Phillips.

1665 Bruce Avenue,
Cincinnati, Ohio.

Mrs. Pearly B. Raymond, who took the second prize by making an improvement on one of Betty Crocker's radio recipes.

$15.00 PRIZE WINNER

Mrs. Pearly B. Raymond
5324 Washburn Ave. S.,
Minneapolis, Minnesota.

Submits an improvement on a favorite Betty Crocker recipe.

Here's another good one to try when you have unexpected company for dinner. It can be prepared in short order and when served in the best dessert dishes, with piping hot sauce is a dish fit for a king. "Ask Dad, he knows." On days when you serve cold meat or substitute a salad for the meat course have this substantial dessert.

IMPROVED RECIPE

Date Muffin Pudding

⅓ cup shortening
2 cups Gold Medal flour
2 teaspoons baking powder
1 cup milk
2 eggs (instead of 1)
¼ cup sugar
½ teaspoon salt
½ lb. dates (put through grinder)
½ cup walnuts (put through grinder)

Sift the dry ingredients together. Add milk to well beaten egg yolks. Add melted shortening to the liquid and combine with dry ingredients. Stir in chopped dates and nuts. Fold whites of eggs beaten stiff. Bake 25 minutes in a hot oven. This amount of batter will make 12 muffins. Serve hot with the following sauce or with Hard Sauce

Vanilla Sauce (serve hot)

½ cup sugar
1 cup boiling water
1 tablespoon cornstarch
1½ tablespoons flour
3 tablespoons butter
1½ tablespoons vanilla
Salt to taste

Mix dry ingredients thoroughly; add boiling water; cook until thick, add remaining ingredients. Do not cook after adding the flavoring.

Hard Sauce

⅓ cup butter
1 cup powdered sugar
3 tablespoons hot water

Cream butter and sugar until smooth. Add hot water slowly and beat until light and creamy. Flavor to taste.

ORIGINAL RECIPE

Date Muffins

⅓ cup shortening
2 cups Gold Medal flour
2 teaspoons baking powder
1 cup milk
1 egg
¼ cup sugar
½ teaspoon salt
½ lb. dates, chopped

Mix and bake as given above and serve hot.

$10.00 PRIZE WINNER

Mrs. Ellen C. Burns
1001 Pine Street
Philadelphia, Penna.

Offers an adaptation of a Planked Hamburger Steak recipe given by Miss Ada Bessie Swann from Station WAAM.

PRIZE RECIPE

Planked Lamb Steak

1½ lbs. lean lamb
1 teaspoon salt
⅛ teaspoon pepper
4 tablespoons cold water
¾ cup soft bread crumbs
Nutmeg or mace to taste
2 tablespoons drippings (omit if lamb is fat)

Have the butcher cut lean meat from the neck or shoulder. If it seems very fat have fat trimmed off before the meat is weighed, that is, you should have the specified quantity of lean meat. Chop as for hamburger. To meat add salt, pepper, nutmeg or mace, water and drippings and mix thoroughly; then add the bread crumbs and mix again. Shape into roll, place on plank or oven-glass platter and flatten to desired thickness. Put on broiler rack, about two inches from flame, and sear quickly, with the door closed; then reduce heat, open the door and cook slowly for about 20 minutes. If you haven't any broiler, the meat may be seared on both sides in a smoking hot pan on top of the stove, then transferred to the plank and the cooking finished in the oven. Remove from the oven.

Place creamy mashed potatoes that you have prepared while the steak is in the oven in pastry bag and pipe all around the steak; make a cavity in center of alternate potato roses and fill with diced carrots and garden peas that have been seasoned and dressed with melted butter. About two cups of mashed potatoes, and one and a half cups each of the other cooked vegetables will be needed. Return to the broiler until potatoes are brown.

ORIGINAL RECIPE

Planked Hamburger Steak

1½ lbs. hamburger
1 teaspoon salt
¼ teaspoon pepper
4 tablespoons cold water
4 tablespoons drippings
½ cup onion
¾ cup soft bread crumbs

Mix as directed above adding the grated onion when the bread crumbs are stirred in. Garnish plank with Duchess potatoes filling alternate potato roses with prepared vegetables.

SPORT'S *Siren* Summer CALL

By PAUL GIBBONS

Babe Ruth, whose Symphony of Swat has kept the New York Yankees to the fore in the American League race.

IF ANYTHING in the world can be depended upon to overcome the usual summer slump in the radio business, the broadcasting of sporting events is unquestionably that thing.

All broadcasting stations are coming to recognize this fact and one of the greatest fields of usefulness for the smaller station is the broadcasting directly from the field of various sporting events of purely local interest.

This summer is not only one of the greatest sports seasons that we have had for many years but it is also notable through the fact that results of all of these sporting events are being flashed immediately from broadcasting stations all over the country.

The growth of this service is making the radio set virtually a necessity in many thousands of homes and this feature of radio alone should be a strong talking point for the salesman who is trying to do business during what has heretofore been the slump season.

THE mid-summer sun is in the heavens and the summer breezes are sending their soft zephyrs through the trees, flowers and shrubs and over the lawns and fields. In fact the winds and all the verdure in its resplendant green garb are mating and the love song they sing is sweet music to the ears of all normal mortals.

It reaches the ears of the urchin on the lots, the gentry in the town house, the business man at his desk, the professional man in his study and even the jurist in his chambers. To every stratum of humanity it sends forth the same message as it radios its way into every heart. It is the call to the open.

To the boy it may mean a ball game on the lot or merely a game of "duck-on-davey"; to the gentry, a stirring game of polo, riding to the hounds or mayhap just a daily canter over the estate; to the business or professional man the call may be to hurry through the day's business to go out and root for the home team whether they be pennant winners or just tailenders or again it may be the call to motor out to the country club for a round of golf or the peppy participation in an afternoon of tennis, or by others the call is interpreted as a lure to climb into the car and take the family for a motor trip rolling over the countryside for an hour or two.

No matter which of these numerous predelictions you may have, when you hear the call, answer it and hie yourself away—for these beautiful summer days were sent to us that we might make good use of them. It is wasting one of God's greatest gifts to bury oneself indoors with sunshine and health in every breath of air we inhale on these balmy summer days.

We are not advocating closing your business for the summer, nor even the neglect of it, but in our humble opinion, based on long observation, the man who devotes a good part of each week to exercising in the open will find himself better equipped to meet the daily problems he has to solve and will both lengthen his life and make it brighter and happier for himself and his family. The man who has a hobby is blest but the man whose hobby is tennis, golf, polo, or any other activity which takes him into the open is blest tenfold. It exercises his mind, his muscles, fills his lungs with pure air and keeps him young. It is truly the fountain of youth.

Sport, which a few brief years ago was frowned upon by many as being a luxury for the indolent, has come to be recognized as an absolute necessity and every live wire successful business man indulges in it in one form or another.

NOW score another one for the progressive golf officials. Here is one sport which we thought could never be flashed over the radio. But the officials in charge of the National Open Championship have worked out a system of relay messages and for the first time in the history of the event, the play of the national open golf tournament at the Scioto Country Club at Columbus, Ohio, July 8 to 10, will be broadcast.

The story of the championship flights will be put on the air by Station WEAO, of the Ohio State University (293.9 meters). Bleachers will also be erected, enabling spectators to view the start and finish of the first and second nine holes of play and be informed by radio loud speaker of the progress of the play.

H.M.N.

BASEBALL

MILLIONS of baseball fans are daily either going through the throes of despair as their favorites are being beaten or experiencing the joy and thrill of jumping to their feet and waving their hats in ecstasy as the home team bats in the winning runs. They are boys again for an hour and are better men for the experience.

The American and National League races are now in their full stride and many preseason hopes and promises have, temporarily at any rate, gone over the dam.

The Philadelphia Athletics touted by many experts as the favorites to win the American League pennant, got away to a poor start. The morale of the team is good and the pitching is all that would be expected of it during the abnormally cold days of the first six weeks of this season, but the boys who were expected to sock in the runs have been batting with Maxim silencers on their bludgeons. Despite this, the team after a miserable start did turn in nine successive wins in mid May and cannot by any means be counted out as yet.

As was rather freely predicted, Washington, while well up with the leaders, is not

showing very encouraging signs of repeating their pennant winning career of 1925.

The Cleveland team has been the big surprise of the American League clubs, being in the First Division at this writing, and if they can keep going at their present clip, must be considered as serious contenders.

The New York Yankees, however, is the team which is setting the league on fire. Sixteen straight wins were chalked up by Babe Ruth and Company in late May and unless someone can stop the Yanks, they'll make a runaway race of it. Ruth is playing the best ball of his career. The experts did not expect the novices, Lazzeri and Koenig, who are guarding second base and short-stop respectively for the Yankees, to play the splendid game they showed during the first half of the campaign. However, it is still a long route to October and the tenors of the circuit may be singing baritone or even bass when the nut-brown ale month rolls around.

Cincinnati and St. Louis have been the surprise teams of the National League, leading in that order at the halfway post, while the World's Champion Pittsburgh team were third but are now within striking distance of the top.

The great disappointment of the circuit was the early season showing of George Sisler's St. Louis team resting in 7th place in the junior league. There doesn't seem to be any logical reason for the poor showing of McGraw's New York Giants which have won about half of their games and are floundering around in the second division of the league with the lowly Phillies and Boston teams.

TENNIS

BUT these things are merely the problems of the baseball rooter and while there are millions of him there are an equal number of tennis devotees who are asking each other whether or not Tilden can retain his championship?

Do his two defeats by Richards this Spring indicate that he is slipping?

Is the United States team going to be able to defend the Davis Cup by turning back Messrs. La Coste, Borotra, Cochet and Brugnon, the probable challengers?

These are just a few of the high spots in tennisdom which, when you consider in addition, the numerous sectional, state, city, and what-not championships, give you ample indication that the devotee of tennis has plenty to keep him occupied these glorious summer days.

I might hazard a guess to the several questions propounded above and so might you, dear readers. And the chances are that you would guess correctly as often as I would. However, if only to give you the opportunity to take issue with me, I will attempt to chance a timorous expression of opinion.

Is Tilden slipping? There's a tricky question to answer. We say "Yes." Maybe not enough to cause him to lose his championship in the defense of which he will center all of his wonderful powers of concentration. He has always been a marvelous reservist. He seems always to have another gun or two to fire when he is apparently on the brink of defeat.

But still we say he *is* slipping and by that we mean that he will no longer be able to show the continuous and marked superiority over first flight players which he has shown throughout most of the last seven years.

His defeats by Richards and Chapin will in our opinion not be his only defeats this year. His previously played two close five-set matches with Chapin are a further indication of the set-back his game has received when he has even in a slight degree divided his attention between Tennis and outside earnings —in this case, his venture into the theatrical field.

This division of attention unquestionably affected his game and must have shown him at what disadvantage some of his challengers have been who have been trying to play tennis as a pastime and do time, however little, on a regular job.

Tilden may win the Nationals; it is a safer bet that he will than that anyone else will, but then again he may not—we shall see.

Big Bill is an extraordinary athlete. He is more than thirty years of age; he has an intensely nervous temperament, which it might be supposed would tend to burn him out; he restlessly turns from one energy consuming employment to another, and yet he still is the greatest tennis player in the game.

For several years his downfall has been predicted, but just about the time it looks as if he was a beaten man and so exhausted he might have to be carried from the court, he suddenly increases his pace and pulls through.

No real champion ever is beaten so long as a minute, a point or a punch is left.

Can the United States team repel the French and retain the Davis Cup? A positive "yes" is our answer.

La Coste may defeat Tilden again; he virtually did it in the Davis Cup matches last September, though we don't think he will. But of one thing we are as sure as one can be of any result in international sport, and that is that the young French star will *not* defeat Billy Johnston. The popular Californian always finds La Coste's game made to order for him. La Coste hasn't a chance against Johnston and very little against Tilden while Cochet will lose to both and with the proper precaution taken in its selection, the American team should win the doubles. The score should be four matches to one and I can't see now where the French are going to get that one point unless it is in the nature of an upset.

Richards failed to come through and win at Wimbledon? The odds were greatly against his doing so. The ball used abroad being lighter and sort of "floaty" in flight makes a tremendous difference in both timing and speed and the Yonker's youth is particularly handicapped by it. Tilden has been the only American, with the exception of Beals Wright, who seemed able to adjust his game to suit the changed conditions abroad and those who have failed include virtually every other player in America for the past two decades.

Larned, Clothier, Ward, Collins, Alexander, Hackett, McLoughlin, Johnston to mention a few of our champions, all fell down abroad and Richards hasn't as yet reached the position in American tennis occupied by most of those referred to above when they made their several unsuccessful invasions.

Richards on his trip abroad pointed particularly for Wimbledon. His other tournament play he considered merely casual practice. His heart, however, was set upon winning at Wimbledon. His failure, therefore, was a bitter pill for the New York lad to swallow.

Two years ago when he played at the great British tennis center he was eliminated by Jean Borotra. Although he came back to win the Olympic championships, the score was not entirely settled. A Wimbledon title means more in tennis than an Olympic crown.

Once again, the stiffest opposition Richards was forced to face was the tennis of a French representative. But it was not Borotra who stepped in to give him the keenest battle this time. Henri Cochet called the Richards of France due to the similarity of their respective styles of play, was the American youth's stumbling block. His two earlier wins over Reni Lacoste prepared us somewhat for his defeat of Richards, but no one expected his margin of victory to be so decisive and for the French star to turn Richards back setless was a staggering surprise.

Photo by Victor Dallin, Philadelphia

Philadelphia's new Municipal Stadium. Champions in every line of athletic endeavor will do their stuff in greater numbers in this huge amphitheatre than have ever performed in any one city in the history of the world. This picture was taken during the Shriners' Convention and shows a few of them drilling on the field.

Wimbledon was Richards' big opportunity. It was the Golden Jubilee tournament in the English classic. A victory in this important event would have meant much to the blonde boy of Yonkers.

William M. Johnston is planning another campaign for the National championship. He was not able to go abroad but is concentrating on and pointing for the championship in September.

He will arrive in the East late in July and his first appearance will probably be at Seabright, where the grass court circuit annually begins.

Bill has taken great care of himself all this year and one thing he has not done has been to go on dirt in April and slam whang his way through the season until the time has come for him to crack in the National singles.

Playing little tennis so far this year, his form at present is naturally below normal. But this is good news, for it means Johnston will set his course from August and rush to his peak in September.

Last season, as will be recalled, he stopped off at Skokie Country Club in Glencoe, Ill., for the Illinois State championships en route. His game showed marked improvement and his condition throughout the season was better than in years.

Howard Kinsey before going abroad said Edward Chandler's defeat of Johnston in the Northern California inter-club tourney in April, 6-3, 6-4, was not so much an indication of any real weakness in Little Bill as a demonstration of the intercollegiate star's strength.

Chandler is now in the East with Cranston Holman and Easterners will do well to keep their eyes on him. Chandler, if he keeps on as he is going, will rank among the best in the country when the time comes for the stars to be rated in the Fall.

Great interest is manifested in the intercollegiate tennis championships which were held at the Merion Cricket Club, Haverford, beginning June 28. Wherever court devotees congregated there was heated discussion regarding the relative merits of the various players.

There is no doubt that Ed Chandler, University of California star and the present Intercollegiate Champion, and Cranston Holman of Leland Stanford, who was ranked in the select first ten tennis players of the United States last year, stood out among the luminaries. They were the favorites because they finished first and second in the championship competition last year.

While many expected Chandler to retain the title, there were some others who felt certain that Holman would dethrone him.

The East also entered many brilliant players. Yale graduates were pulling for their captain.

Another player worthy of mention is Van Ryn, of Princeton, who has unusual ability.

Neill Sullivan, of Lehigh, another Philadelphia product, proved a thorn in the side of some of the championship contenders.

New Englanders thought highly of Whitbeck, of Harvard, who plays a strong all-around game, while Pennsylvanians banked on Harold Colborn.

The tourney proved to be one of the best in the history of the organization.

Thousands of players will engage in the 300 sanctioned tournaments throughout the United States this summer, hundreds of thousands will play the game on public park, private and country and tennis club courts, while millions will tune in on their radios when the big matches are being placed, for with the coöperation of the U. S. L. T. A. officials in assigning experts to describe the matches into the "Mike" you get almost as thrilling a picture of the match as if you were actually present.

Tennis is sure to enjoy its greatest season.

GOLF

THE golfers of the United States as well as linksmen throughout the world focussed their binoculars upon England. With the British National Amateur event, the Walker Cup International Team contests and the British Open concluded, following in quick succession.

With Jones, Sweetser, Gunn, Ouimet and their compatriots doing their stuff in England we would have no alibi if we had lost, even the golfers, like tennis stars, find their game not at its best on foreign fields.

The more skillful the performer, the more he or she is affected by the difference in the ball, the turf, the climate or other seemingly infinitesimal things which go to make up a championship competition. When these handicaps are successfully met, the laurel of victory is all the sweeter and all the more deserved. Our hats are off to our Gods of Golfdom, both Amateur and Professional, for bringing home the proverbial bacon. Sweetser set a fine example by winning the British amateur championship, the first time it has ever been won by a native born American.

This was followed in rapid succession by the splendid triumph of our International Walker Cup team over the British stars and to cap the climax, Bobby Jones' startling win of the British Open Championship.

And while this handful of stars were attracting the attention of the press and sports followers of the entire world, millions of loyal duffers were and are wearing that serene summer smile and absent-minded expression, the smile and expression that come with these soothing summer days.

The bunkers, out-of-bounds, water hazards and other festive traps are sending out their "lure of the Lorelei" to the millions of so-called duffers who are daily pounding the inoffensive little golf ball around the myriad of links throughout the land. And, while we normal beings blithely blunder into these pits of perdition and profanely dig our way out, the Kings of Golf, the par, birdie and eagle boys blissfully ignore them.

How many of us stop to think, when we are enjoying our favorite sport, of the unselfish time, thought and labor given by the executives of the sport to increase our pleasurable enjoyment of our favorite diversion?

It would be well for devotees of golf to give at least one thought to an organization which is becoming to a greater and greater extent responsible for the increasingly idyllic conditions which are surrounding the great links sport. The body referred to is constantly striving to make the lot of the golfer more happy. This is the Green Section of the United States Golf Association, a body of men who are devoting their thoughts, time and energies to the improvement of playing conditions here, there and everywhere.

"Bud" Chandler, Intercollegiate Tennis Champion. This brilliant young California player is considered one of the brightest prospects for future championship honors in America.

Many of the members of this organization, particularly men like the late Dr. C. V. Piper, chairman of the section, and his successor, Dr. R. A. Oakley, and others in the Department of Agriculture, have worked with might and main, unselfishly and without hope of reward, simply for the sheer delight of doing something for the game of golf. They have been constantly experimenting in an endeavor to discover curatives and preventives which will not only improve playing conditions but also lighten the cost burden.

The extent to which their efforts have met with the approval of golfers can best be measured by the way in which the Green Section has grown since its inception in 1921. Two hundred and eighty-seven golf clubs were what might be termed charter members of the section that year. The number has now increased more than threefold, the membership at the end of 1925 being 886. Such has been the beneficial effect that organizations modeled after the section have been formed in virtually every country in which golf is played.

The section has done great things consider-

ing the amount of money it has had. What it can do, however, is limited only by the amount of money it can get to work with. Last year its income from dues from member clubs was $14,945.31. The cost of field service was $11,644.06. The section needs more money to carry on its work properly. It should be an easy matter for it to raise more money through an endowment fund.

The only barrier that stands in the way is the problem of getting the matter before the attention of golfers throughout the country. There is no question that the amount required could be raised in short order simply by appealing to a few wealthy golfers. That, however, isn't the method that the officials wish to follow. They believe, and rightly, that the work which the Green Section is doing is of benefit to every man who plays golf and therefore that every golfer should take a hand in enlarging and perpetuating the work. It will be a matter that will be brought directly to the attention of golfers shortly and one that deserves their unqualified support.

TRACK AND FIELD

DEVOTEES of track and field sports, too, are planning a big year in 1926. Although they took it up many years after the Easterners, the Western athletes have been increasing the margin of superiority established by them two years ago and this is not without reason.

The necessity of having to train on board tracks is a heavy handicap to Eastern cinder path men when competing with the track teams from the Pacific Coast.

There is a vast difference in training conditions between the East and the West. California trackmen can train all the year around, and board tracks are never used by Western athletes while the Eastern stars must use board tracks five months of the year.

The majority of pulled tendons can be laid to preliminary hurts received on the indoor tracks. The indoor and outdoor seasons follow each other too closely and are detrimental to the average Eastern athlete who is usually high-strung and nervous.

Getting into good condition several times each year is also harmful for the Eastern runners. A heavy price is paid every time a man has to get into form and hard work is one of the requirements. The climate enables the coach of a Pacific Coast college to give his men light workouts throughout the entire year.

Although the meets are fewer in the West, they are run off more decisively and with more system.

Three Pacific Coast teams reached the National Intercollegiate meet in condition, and it is small wonder that none of the Eastern college outfits could stop Southern California's assault in the Intercollegiate championship.

In the last conference meet on the Coast, ten records were broken in thirteen events. The material in the colleges there is probably better than beyond the Rocky Mountains, while the coaching is about of the same quality.

TURF

INSTITUTION of negotiations for another international race to be held at Belmont Park in the Autumn, will enlist the interest of turf followers all over the United States, however doubtful of consummation the plan appears at this early period. Joseph E. Widener, President of the Westchester Racing Association, announced before going abroad that his utmost efforts would be exerted toward the promotion of such a contest and he has been quietly at work since his arrival. A three-cornered event among Lord Woolavington's English Derby winner Coronach, F. Alzaga Unzue's Madrigal and the best in this country for another $100,000 purse would probably attract a gate of half a million dollars on a pleasant day. It would claim the attention of the whole turf world and would provide a great stimulus to the sport in this country.

I'LL TELL *the* WORLD I'M HAPPY!

I'M the guy that won the first Cover Picture Contest, and now I've got just $50.00 more in the old kick than I had before I sent in my idea.

There you have the whole thing in a nut-shell. Mr. Free got an idea, sent it in to us, we changed it around to suit ourselves, and sent Mr. Free a check. Now he's happy, and we're happy too, because, thinking up a new cover every month isn't as easy as it might seem.

Here is a part of Mr. Free's letter:

"My heart is singing but one refrain,

'Oh I don't believe you but say it again!'"

Incidentally, Mr. Free is somewhat of a poet, judging from the above.

Now, why don't YOU send us in an idea for a cover? You stand just as much chance of winning the $50.00 as Mr. Free did.

The details of the contest are all told on Page 4 of this issue.

SESQUI-CENTENNIAL

PHILADELPHIA, recognized as the sports center—the sports capital, if you please—of the whole world, has entered into the Sesqui-Centennial celebration with prospects of establishing many new records in athletic games.

The program issued by Dr. George W. Orton, director of sports for the international exposition, provides assurance that on field and track and water and turf and canvas and what not the contests will be the most complete and bring more world-famous athletes together in the Quaker City than have ever visited any one hamlet in the history of athleticism.

Among the sports which will attract to Philadelphia's Sesqui-Centennial games the champions from all lands, bent upon breaking all existing records, are archery, auto racing, bicycling, billards and bowling.

Then there are fly-casting, cricket, canoeing, fencing, tennis, golf, gymnastics, handball, horse-racing, lacrosse, lawn hockey, motorboating and rifle-shooting.

Also there are rowing, swimming, soccer, lawn tennis, court tennis, trapshooting, wrestling and yachting. No doubt horseshoe-pitching, roque and lawn bowling also will have their competitions.

The national track and field championships, industrial sports, among which will be the great Pennsylvania Railroad games; shows for horses and dogs, a real rodeo and a mounted police gymkhana are listed as feature events on the sports program.

And there will be the three major "spectator sports"—baseball, football and boxing.

The new Philadelphia Municipal Stadium, which cost several millions of dollars and is the finest sports amphitheatre in the world, will seat 101,000 cash customers.

Available records fail to show that any athletic contest has attracted 100,000 persons who paid an admission fee at the gate. At least, not in America.

The crowd which watched Firpo beat Willard at Jersey City in 1923 is given as 100,000—in round figures. Probably 75,000 actually paid to witness that boxing show.

It has been reported that 90,000 saw California and Sanford play football. But about 25,000 were parked on hills overlooking the Berkeley stadium.

The largest crowd at a baseball game totaled 62,817 cash customers. This was in the World Series of 1923 when the Yanks defeated the Giants.

Philadelphia has a stadium which will seat 101,000 persons comfortably and have sports organizations competing for the honor of being the first to stage a contest before the world's record crowd.

Philadelphia this summer will be the Mecca of every sportsman in the world, who can spare the time and raise the dough to visit the Sesqui-Centennial and those who unfortunately cannot come will listen in and get it on the air.

A remarkable number of the events of the Exposition will be flashed to the world via the radio. This will run the gamut from sporting events to music.

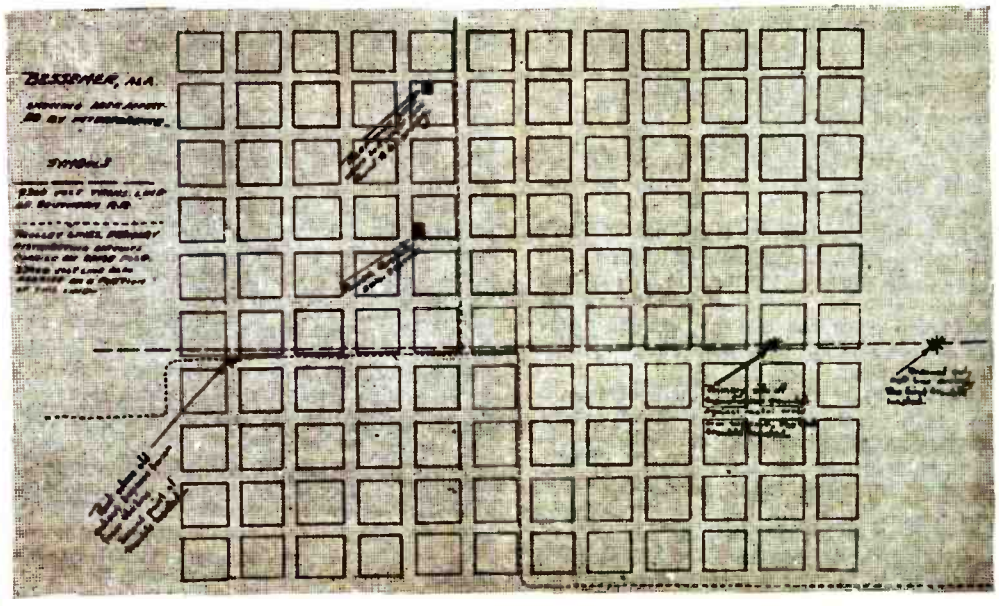
The advance of science through the radio has for the first time in history made it possible for shut-ins and those compelled for financial or business reasons to remain at home to participate in many of the stellar events of an international exposition.

Have your equipment in perfect shape so that you can tune in on the Philadelphia municipal stadium this Sesqui-Centennial summer of 1926.

INTERFERENCE

This Article Tells How the Trouble Was Located and Corrected in Bessemer, Alabama, and Paducah, Kentucky.

PART THREE



Here is Mr. Snider's diagram just as he sent it to us. The symbols are shown at the left of the diagram.

THE interference article is going to be easy for me this month because I am following in the footsteps of the Editor-in-Chief, and letting two of our readers write it for me. Incidentally, these two letters make each of their writers $50.00 richer. As the 3XP Staff has just participated in an interference hunt, it is a decided pleasure to pick out these two letters since they bring out most forcibly two of the things that every interference hunter runs up against.

If you start to hunt interference you will find that your friends are decidedly willing to coöperate. The only trouble is in the discrepancy between their definition of the word and yours. They are perfectly willing to let you do all the work! It didn't take Mr. Hummel of Paducah, Ky., long to find it out.

Several of our friends in different parts of the country have appealed to us for aid. We have carefully explained to them the necessity of keeping logs of the interference, and shown them how it would aid in the search. Then, when we have asked for the logs, we have received only a few scraps of paper with no information on them. "What do you need a log for? Don't you hear it?"

The letter from Mr. Snider, of Bessemer, Alabama, brings out very forcibly the necessity for perseverance, as well as showing how to use the "hot and cold" method. It is with great pleasure that we turn the rest of the space this month over to Mr. Hummel and Mr. Snider.

G. P. ALLEN.

CLEARING UP INTERFERENCE IN BESSEMER, ALABAMA

By JOHN B. SNIDER

READING the article in *The Radio Home* regarding how the radio fans in Lancaster, Pennsylvania, cleared up a source of interference which had been bothering them for some time makes the writer believe that their troubles were small compared to the trouble which the fans in Bessemer had in locating a series of interferences.

In Bessemer, at least two hundred and fifty city blocks were put out of commission insofar as radio reception was concerned.

About eight months ago, everyone tuning-in on a certain night heard the most ear-splitting roar which could be imagined. All of them felt sure that the entire electrical system of the city would go down, so great was the noise.

It was a pure sixty cycle hum, if a noise which could be heard a block and a half away on a loud speaker connected to any powerful set could by any stretch of the imagination be called a hum.

Immediately a few of the fellows around town who had had experience with set building and the like took the field. Loop sets were tried without success, the reason being that when out in any portion of the city where the noise could be heard on the receiver, the loop pointed to the nearest house lighting circuit.

A receiver was set up under the lines at the points at which the noise seemed to be the greatest and all of the lines in the city were cut out one at a time, but there was no lessening in the intensity of the noise. The main transmission carrying 23,000 volts which supplies the city with hydro-electric current was also shut down without any noticeable decrease in intensity.

All of the fellows who had been searching for the trouble became discouraged after about four months of searching and an appeal was made to the Radio Supervisor's office at New Orleans to have a man stop off in Bessemer on his next trip through the territory. While awaiting his arrival all sets in the infested area were shut off and no one even tried to use his set. Radio sales were at a standstill. Even people who did not own a set, but were contemplating buying one soon found that there was something in the air besides music and informed the dealers that they would be interested only when the interference was stopped.

The power company had a trouble finding set built and sent their best men out to try

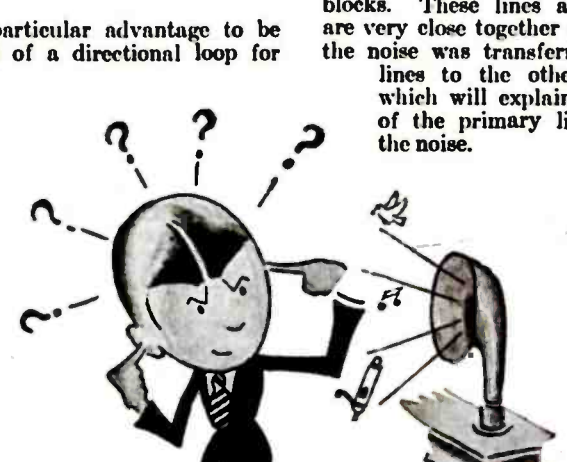
and find the source but without any more success than the others. The Radio Supervisor's man came to Bessemer and after driving all over the town for two days and the better part of two nights, left town with the statement that he could not locate the trouble and he solemnly vowed that it was the worst case of interference he had ever encountered. The only solution he could advise was to keep up the search until it was finally located.

This was extremely disheartening, to say the least, in view of the fact that about four months' time had been spent, and many gallons of gas burned in the cars which carried many different kinds of sets while they were riding around hunting trouble. Most people were in favor of moving to the country where they could receive concerts without the terrible racket which drowned out even the most powerful stations.

Finally after practically every one who had been on any of the searching parties had given up all hopes of finding the trouble and had sat down to await the time when the lines which were causing the trouble would burn themselves in two, another gentleman took the field.

Bessemer owes Mr. Dan Houston a unanimous vote of thanks. Mr. Houston, practically by himself, located the main sources of the trouble and the set which he used is one which the writer has never heard of as being a suitable set for locating interference. The set was a Freed-Eisemann neutrodyne with a loop built into the top of his Ford touring car.

There was no particular advantage to be gained by the use of a directional loop for when the noise could be heard, the loop pointed, as has been brought out before, to the nearest lighting circuit.



Mr. Houston started out first at the points where the noise had been reported as being the loudest and when the car got under the offending trouble, it came in with terrifying volume, but when he was further away it could be barely heard.

The first trouble which was located was that of the bell ringing machine in the local telephone exchange. Finding this was due to the fact that this noise was of a very peculiar crackling nature and only extended over a limited area. It was found by cutting out the power line supplying the machine with current and confirmed by shutting the machine down while the current was on the line.

The first trouble though, which had been bothering the entire city, was found on a 2300 volt transmission line of the Southern Railroad. This line supplies current to operate the lights of the block signal system and also the yards and depots between Birmingham and Bessemer. This current, of course, is stepped down to do this and short secondary circuits run on the same poles as those carrying the high tension current.

The finding of a cracked cut-out box on the primary side of the transformer led to further investigation of the interior of the box and it was found that the wire and interior of the box had been pretty well charred by the arc which had been burning inside.

This box though, did not relieve the trouble.

The second point of trouble was found in an old primary cut-out box which had been taken out of the line by strapping a piece of wire from one side to the other. Not being in the circuit, it is hard to see how it would cause any trouble but it was found to be in bad shape and the wire very brittle due to the heat caused by the arc which had been burning inside.

This did not relieve the trouble and so attention was turned to the railroad line again and the final trouble which was located and which cleared up the noise was found to be a wire on the primary side of one of the transformers on the railroad line which had rubbed against the metal support of the cross arm on which the transformer was hung and the insulation worn off and both the wire and the metal support were almost burned in two.

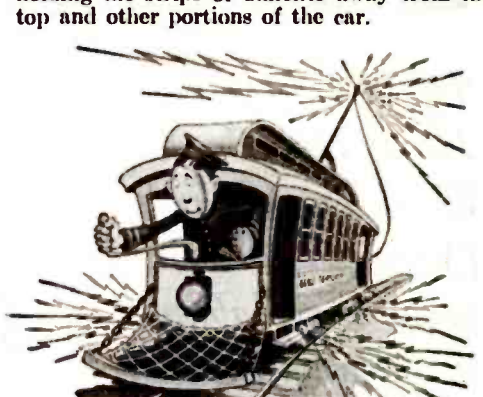
This cleared up the noise and then all of the interested parties got together to discuss the trouble to see if a way of finding out how the noise got into all of the house lighting circuits could be located. The only reason which could be figured out was the fact that the trolley wires and certain of the primary distribution systems, which of course went into the sub-station, paralleled the railroad lines, as shown by the map, for about six blocks. These lines and the railroad lines are very close together and the theory is that the noise was transferred from the railroad lines to the other lines by induction which will explain why the cutting out of the primary lines had no effect on the noise.

Then too, there is the fact that the noise, being on the primary of one of the power company's lines, in turn transferred the noise into the railroad line by induction and through this same induction into other lines which were nearby. Noises which originate on one line and are transferred by induction to another line are very hard to find, particularly where there is more than one source of the noise.

While on the subject of interference in general, let me give you one other source of local interference which I have never seen listed as an instrument which is capable of causing interference, and that is an electric meter. While of course I may be mistaken as to whether it has been listed, I do not recall it.

On one occasion I had a local noise which was cleared up when the meter was changed. The interference is due to the fact that there are in some of the older types of meters, coils which become loose and start vibrating. This vibration can usually be heard with the ear a short distance from the meter and it is in the nature of a slight hum.

Another thing that can be strongly recommended is the Freed-Eisemann combination with the loop built into the top of an automobile carrying about the usual length of wire as is used on an outside aerial. The loop in this instance was formed by drilling holes through a strip of bakelite and tying the ends to the back support of the top and to the windshield in front, the back ends being tied and the tautness of the wire through the holes holding the strips of bakelite away from the top and other portions of the car.



How Paducah, Ky., Found Its Trouble

By H. R. HUMMEL

WHERE the Tennessee and the Ohio meet, stands Paducah, Kentucky, home of Irvin S. Cobb—and the worst location for radio reception in the South, if reports of engineers and visitors are to be credited.

An old, old town, even at the time of the Civil War and lacking, since the dawn of the electrical era, supervision over its electrical outfits. As a result, the town is a maze of wires and noted for its antiquated equipment.

So much for an introduction; now let us get to our ills and the cures we found for some of them.

The street arc system was installed in this city about 1900 and operated by the city; lights were added as the city grew, for twenty-four years, with practically no increase in equipment.

Then radio stepped upon the stage and immediately made its exit. It was discovered that when the arc went on, radio went off. And by off, we mean not a sound was to be heard except the twenty-four year old brushes riding upon the aged commutators.

On moon-light nights, when the arcs were turned off and the pavements of the city carefully rolled up and put away, it was possible then to prove that there was such a thing as radio.

Slowly it dawned that it was either no radio or the junking of the city's light plant. To make a long story short, the plant was closed and power was purchased from the electric company—incidentally at a saving of about $2,000 per year. Then radio reception became a possibility.

But when the "great" interference was eliminated, other noises made their appearance. And by the way, they always will.

First the Associated Press wires, then the telephone companies, then the Postal and Western Union wires.

Tests were carefully made by a few fans and the causes were definitely determined,

Photo by Frederick Bradley, New York City

Such performances as the one pictured here, have caused the war on interference. Allen McQuhae, popular Irish tenor who sings with the Atwater Kent series of Sunday night concerts. He is here shown with the Atwater Kent Orchestra, which is under the leadership of Nicholas Beresowsky (extreme right).

mainly by checking the time and later pulling the suspected circuits.

We found a peculiar mental reaction when complaints were made to the above public services. Without an exception, they all denied that there was an interference and upon being convinced that there was, they placed the blame upon the other fellow and the burden of proof upon us.

Over a period of many weary months, a few of us worked, antagonizing temporarily, the heads of the different services by complaining to their home offices and incidentally using pressure of the right kind at Washington.

Then the pendulum began to swing the other way. The phone company cleaned up their interference, both telegraph companies have done the same, but it took outside men to cure the trouble.

We recall one amusing incident. Having worried one telegraph manager, he passed the buck to his superior, who in turn, passed the buck back with the statement, that the "interference was there and that there was no way of removing it and that was the end of it."

Well, to that gentleman's surprise, his home office, on receipt of that information, at once had a man down and in three hours it was a thing of the past.

Working to eliminate these interferences *one* at a time we again approached the arc system, which was slowly spreading a new interference from circuit to circuit. It being now in the hands of a private company, we paused at the work before us.

There is no reason why a few men should do all the work unassisted and at the same time damage their own business by making temporary enemies of the public service corporations.

It was decided to form an organization of a peculiar structure, the officers of which would not be accountable for results to anyone but themselves, for experience had proven that kicks and knocks from within are more exasperating than those from outsiders.

So petitions of affiliation were distributed for the Paducah Radio Interference Council, having as its purpose, the elimination of radio interference when practical. No dues, no constitution or by-laws and the officers selected and appointed by a committee, for an indefinite period of time.

We were after moral support and got it immediately through two thousand signatures and we are not annoyed by complaints of our members, for they cannot complain about something which has cost them nothing.

The Council has a Legislative Committee, headed by the liveliest man in the city and he always gets what he goes after. He is also a vice-president and his paper work is taken care of by a secretary.

We have a Finance Committee, headed by a vice-president, who is assisted by a secretary. All money, and we need very little, is raised over the phone, by our Finance Committee.

Then we have our Technical Committee, headed by a vice-president, assisted by a secretary, inspectors and observers. They do the digging and the dirty work.

The organization is headed by a President, an ultra-conservative and cautious banker, and he, in turn, in backed by our newspapers.

It is an ideal, flexible and workable plan, inexpensive and above all, it gets results.

So much for the plan of operation and we believe every city will, in time, be compelled to adopt something similar to obtain permanent relief.

Now to our last great interference. We found after tests that the *mercury arc rectifiers* at the central plant, which furnish the power to operate the street arcs, were creating the interference and that it was gradually spreading over every circuit, being picked up by house circuits and telephone lines and redistributed.

Eventually the Council demonstrated the fact, nailed it, riveted it and proved it and then we obtained the finest example of coöperation you ever saw, and compared to the nightmare we once had from interferences, we are now enjoying peace and harmony.

Don't think we have no noises. We have and always will, but you can cure most of them, if you will prove the causes of the trouble to those responsible, and do it in a quite gentlemanly way and you can afford to be calm when you know behind you is the moral support of the community.

But without an organization it is an uphill fight and not worth the candle for one or two men to try and clean the air.

The practical application of cures for all these interferences has been well covered by other writers and the only purpose of this article is, if possible, point a way to build up the moral support of the community for you.

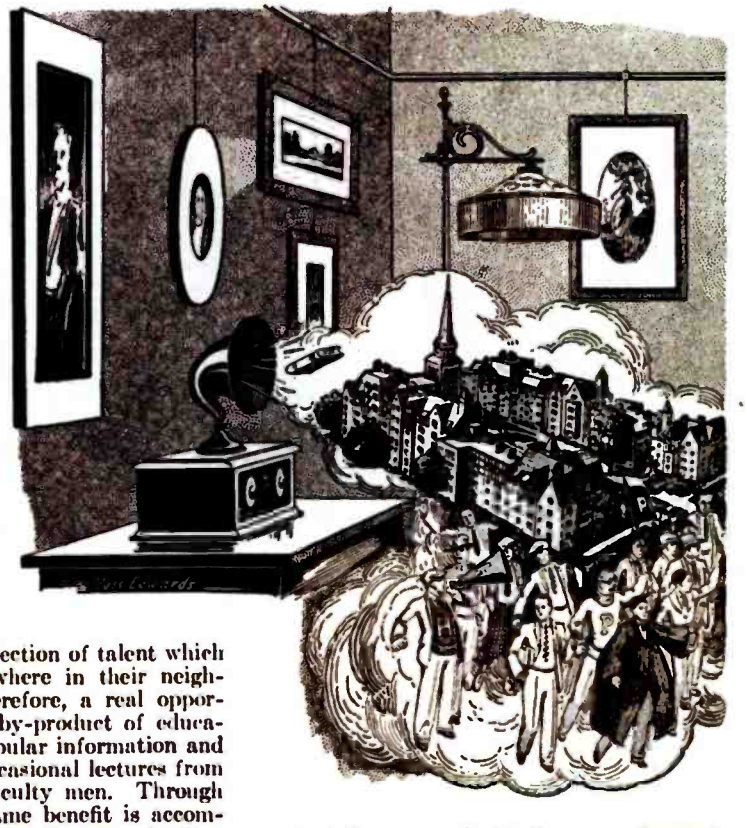
NOW that you have read these articles on clearing up interference in Bessemer and Paducah, and have seen how easily Mr. Snider and Mr. Hummel have both become $50.00 richer, WHY DON'T YOU SIT DOWN and send us an article on clearing up this nuisance in your own town or city?

Remember We Pay $50.00

for the best article submitted, and we don't mean maybe! Make your article about 2000 words with perhaps a diagram or two, send it to us, and WE'LL DO THE REST.

RADIO Moves The College

Universities Are Now Broadcasting Courses From Several Stations. Students Who Do Not Have the Opportunity of Attending College, May Now Do So Right in Their Own Homes.



SOME of our progressive educational institutions have found an opportunity through radio to establish a new sort of educational service. Apparently they are succeeding somewhat in moving the entire college campus into the living room, and this without crowding the rest of the furniture unduly.

Perhaps many of us will appreciate the Big-Ten football games or the other important sporting events that thus come to us in our easy chair more than the lectures. But the serious side of the educational effort is now available from a number of such establishments and a constantly increasing group of colleges is considering this sort of "extension work."

For business advancement, comfort, and happiness in any walk of life, there is nothing that is more important than knowledge. Many of us acquire this by taking formal courses of study, many through the school of hard knocks, and now we are to be afforded a new opportunity through the school of the loud speaker. It remains to be seen, however, whether many will avail themselves of any regular course of instruction obtained in this new fashion.

Probably there is not a very great percentage of listeners likely to stick to such a course of study. With the intense competition for our attention afforded by many other varieties of social, business, and entertainment features, considerable will power is needed to pursue those educational opportunities which come to us these days by radio and otherwise. But whatever the number of students may become, there certainly will be a problem in the field of radio education which will interest all of us.

Colleges and universities which look upon radio as a new agency for service have tried to use this tool in two ways. A few institutions have formulated definite courses of study at fixed hours throughout the week and have undertaken to get a student body which would thus attend class, each pupil in his own home. One of the leaders in this method of radio education is station KSAC of the Kansas State Agricultural College. That establishment is sponsor for one of the foremost of these attempts, if not actually the first "College of the Air."

But this station did not limit its effort to these formal courses. It gave quite as much time to the questions and answers of interest to the agricultural people of its state and has rendered a very important service through home-economics and popular-lecture broadcasting. In fact, the experience of KSAC indicates that the educational institution will get many times as many responses from a question and answer service on timely subjects of particular interest in the surrounding territory as it can expect from any formal courses of radio education.

It is not strange that the educational institution should desire to enter the radio field as a service agency. Such institutions have upon their faculty a collection of talent which is seldom equaled elsewhere in their neighborhood. There is, therefore, a real opportunity to extend, as a by-product of education, some service in popular information and training by means of occasional lectures from each of the qualified faculty men. Through this means much the same benefit is accomplished as is attempted by the state institutions of the middle west through their extension workers, farm educational courses, "short courses" in animal husbandry, and the like. And this service is not alone for the farmer; the city man is quite as much interested in learning of the latest developments of science and the city housewife of the modern methods in home-making and home-keeping, as is the rural listener. This is just as true, as is the unrefuted statement that the farm community wants good music just as much as the city family.

When Mr. Absent Minded Professor of funny-picture fame becomes a radio performer it has already been discovered that he must unlearn most that his long pedagogic experience has taught him. In the class room the student may come initially from choice, but once entered upon the course he stays by compulsion. He is there for fifty minutes by rule and regulation, whether from choice or not. And he may neither "cut class" with frequency nor forget examination day at will.

In the radio college, however, the "prof" has no idea as to the attendance or behavior of his pupils. Of one thing he may be sure, however; they will not stay in class for fifty minutes. Fifteen minutes is the upper limit and seven or eight minutes is a period of more certain attendance. These facts have been established by the experience of one of the most successful managers of a radio educational program. His experience was well summarized in one brief remark, "I always had to fight with the professors to make their lectures shorter."

And then many institutions are discovering that some of their best class room professors are dismal failures on the air. Their class room personality may be magnetic but their radio personality is "a total loss without insurance."

For such men, if they are willing to write out their remarks, their is no choice but to let the presentation be by proxy. Some dub instructor with a good radio personality can get across a subject of which he knows but little where the head of the department may utterly fail. This is simply another problem for the program manager of the college radio group.

Not all the troubles of the college dealing with radio are those of personnel. Those affecting the pocketbook are quite as conspicuous and serious. As in any other type of broadcasting, to get low cost one must content himself with low power operation; and the result is a small area of service and a limited possible audience. Such low power stations are, of course, always subject to much greater uncertainty in service even to those near by.

There is no other industry where it is more true that you get about what you pay for. Hence the institution which wishes to be successful in radio on any large scale must have a high-cost high-power station. And, unfortunately, it costs almost as much for a radio educational effort of two or three hours a week as for operation twenty to thirty hours a week. The investment is the same. The talent in program work, in engineering, and in operation must be equal; and when accounts are summed up at the end of the year,

Into The LIVING ROOM

By R. S. McBRIDE

Washington Representative of The Radio Home

DRAWING BY
RUSSELL EDWARDS

the cost per hour is appalling to them.

As a result of this financial problem some of our institutions have answered their radio question by collaboration with commercial stations operated locally or near by under other ownership. It has often been found of great mutual advantage to arrange for a daily or thrice-weekly series of educational lectures, even those which are so formal as to constitute a regular course of study. If cleverly arranged, each such lecture is an entity; and certainly each one must be made so attractive that many of the casual listeners will stay tuned in and enjoy the material presented.

This is not so difficult as it might seem, especially if the professor has been persuaded that two lectures for a total of fifteen minutes are the ideal evening's educational effort. Most any one of us is willing to wait seven and a half minutes for a change of subject if our favorite broadcaster is putting on such lecture; and before we know it we will often find ourselves giving serious attention to the speaker because he has something worth saying and says it well.

In going to a commercial station for its broadcasting, a college can well afford to pay commercial rates for the time consumed. As a matter of fact many such commercial stations are glad to get the college programs without compensation for the time consumed. If the program is such as to attract students regularly, it will be good enough to please a large part of the regular audience of that station. Thus the program manager of the big broadcaster welcomes university coöperation.

In going to such a station the university not only saves money, but it finds a ready-made audience. It finds up-to-date equipment that it could not alone afford to buy or maintain. Moreover, this equipment will change frequently as the broadcasting art improves; and the very best of engineers will be at hand to operate it with the highest skill.

What is perhaps the greatest educational broadcasting program ever undertaken was, for these and many other reasons, recently arranged on an almost national basis through commercial broadcasting stations. And so far as this work has gone, the results are more than justifying this choice.

Not all of the educational establishments adequately equipped to give radio lectures will solve their problem by using commercial stations. There are doubtless many areas, especially in the southern and western parts of the country, where the radio congestion is not great enough to prevent establishment of radio educational broadcasters. Such stations will often operate for limited periods of time and be maintained by the universities with profit to themselves and to the public. In such instances there will perhaps be a little greater advertising, promotion, or good-will value to the university than could come from furnishing programs at another station. But I believe this advertising value to the school or college necessarily must be made secondary to the service value.

There are not nearly enough wave lengths for all who would broadcast. It is utterly impossible to set aside a certain wide wave band, as one group of professors has asked, for the exclusive use of educational institutions. Even a single wave length assignment is impractical. And if it were made, the hodge-podge and confusion of Herodotus with baking of apple pies, and the heterodyning of calculus with early English poetry would be terrible. The service value of such an "educational" wave-length assignment would promptly be destroyed.

Every educational institution doing broadcasting must study this problem individually and every applicant for a broadcasting license from this group must get individual consideration by the Government officials, just as any other would-be broadcaster from a different branch of business.

Probably not over ten per cent of the public is at any one time seeking formal education through schools and colleges. And of this ten per cent presumably a small fraction will hope to get any great percentage of their schooling through the colleges of the air. Radio schooling, important though it is, must, therefore, not expect to dominate the radio situation.

It should be remembered, too, that a good lecturer can easily give in seven and a half or fifteen minutes more than enough to keep his radio pupils busy for all their spare time during the next two days, or even for the next week. As in any other kind of lecturing the pupil gains most through his own effort to assimilate information; the value of the lecture comes as a result of the lecture's inspiration of the student to hard work. The facts which he gets from the lecturer are a small part, in fact almost a negligible part, of the benefit. This is the reason that the class room personality or the radio personality is so much more important in determining effectiveness than the amount of wisdom that may be stored within the speaker's head.

Attendance upon the radio school cannot be too strongly urged upon those who have no better opportunity to get a formal education. And to those who think they are already sufficiently educated it may not be amiss to suggest that perhaps they could learn a little bit more this way.

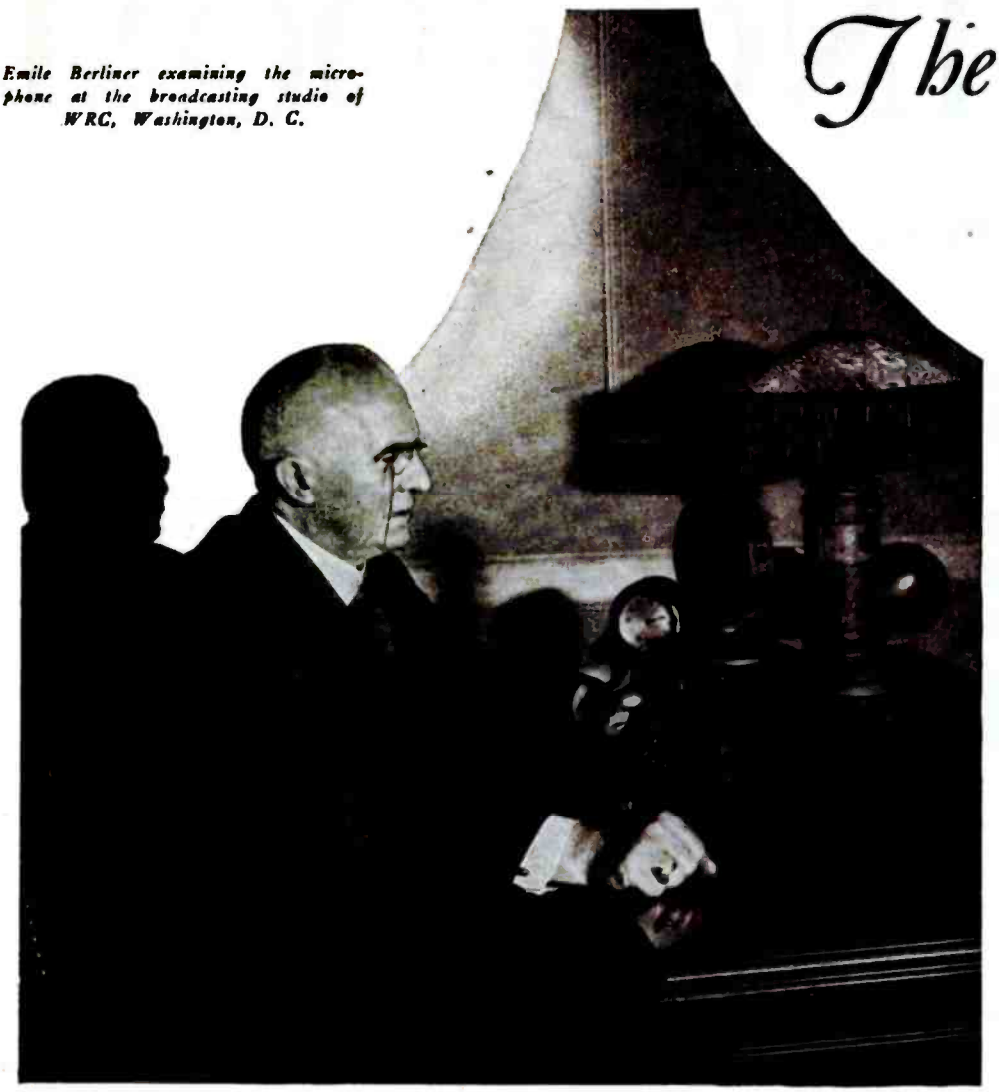
But such would-be listener of the school of the loud speaker must not deceive himself in thinking that he can get as much through this medium as by those personal contacts and influences that come through regular college attendance. The chemical laboratory cannot be transmitted on any known wave length. It is impractical that the question and answer work of the quiz-room be so transmitted.

Even with the best radio personality there is little enough incentive afforded to the student to stick by the course to its end. Graham MacNamee may take us to the principal football game, we may listen to the Bishop when he conducts the chapel exercises, but there is still a lack which leaves radio education in its effectiveness far behind that which even the shortest of the summer "short courses for farmers" can achieve.

It is futile to undertake to point out just how radio education is going to fit into our broadcasting scheme as a whole. As suggested above there will probably be many different solutions, each one suited to peculiar local conditions. But all of us can rest assured that radio as an agency of education has come to stay. Those of us who do not seek this form of improvement have only to turn the dial a little bit and find our jazz, our grand opera, or our market news.

Rest assured, however, that the educational institution is going to find available to it through stations of its own, through use of commercial stations, and otherwise, an ample opportunity for real service through this modern miracle of radio.

Have you sent in your suggestion for the cover contest? Don't forget there's a $50.00 prize for you if you win. See Page 4 for the details.



Emile Berliner examining the microphone at the broadcasting studio of WRC, Washington, D. C.

The Man Who MADE the MIKE

By CLARA LOUISE LESLIE

A Brief History of Emile Berliner, the Man Who is Responsible for the Microphone.

FIFTY-SIX years ago this spring, there steamed into New York harbor a passenger ship named the *Hammonia*. She came from Hamburg, Germany.

Among her cargo of immigrants was a lonely looking lad nearing his nineteenth birthday. There was nothing striking in his appearance; his clothes were neat, which was all that could be said for them; he spoke very little English—in short, he was to all intents and purposes, but a passing bit of the mixture that makes up the kaleidoscope of human life and longings at a great immigration port.

An observer might have noticed that the boy was a little more quiet than the average—a kind of observation more likely to be passed by—nor could even the deepest student of human nature have guessed that beneath this lad's thoughtfulness lay an incessant and constructive wondering, a persistent power of penetration that was one day to unlock the gates to so much happiness for mankind—that here was a future benefactor whose contributions in behalf of progress were to help "step up" the life of civilized people the world over.

The name of this young man was Emile Berliner.

It was to Washington, D. C., that he went to set about his first and foremost ambition in this new land—"the making of himself into a good American." There on 7th Street an old friend of his father's ran a little dry goods store. Berliner became a clerk in this store.

In his endeavors to learn good English he spent his evenings pouring over old copies of the Congressional Record which were sometimes used for wrapping paper when the little store got low on better quality. Later, through an old apothecary friend there fell into his hands a German book on physics, which greatly fascinated him.

Such was the reading matter this struggling young dry goods clerk chose for himself.

Then, in 1876, came the Philadelphia Centennial and with it rumors about an apparatus which enabled one to carry on a conversation over an ordinary telegraph wire. Bell's new telephone, which had been exhibited almost by accident at the Centennial, was much talked of but almost never seen.

In studying his book on physics, the chapters in it which had interested Berliner most of all were the ones dealing with electricity and acoustics. Without realizing it, Berliner had, now at the age of twenty-five, worked himself well into the field of science.

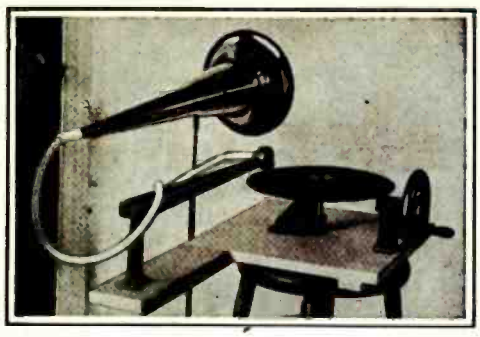
The idea of talking over a wire fascinated him. He resolved to try it for himself; this was in January, 1877. In his little back bedroom on the third floor of a house on 6th Street in Washington, he began to collect batteries, wires and all the paraphernalia familiar to boys and sometimes too familiar to mothers and housewives, and here each evening after his long hours in the store, he worked far into the night, forgetful of everything except his one determination to understand for himself this new scientific mystery.

He saw clearly the logic of the undulatory theory of the speaking telephone—that the minute vibrations of speech could be carried over a wire only by a smooth continuous wave current rather than by the fitful, make and break contact which serves to construct telegraph code.

Around to the fire alarm office he went one day to talk to his friend Richards who was in charge there. He wanted to show him what he knew about sending telegraph messages and was practicing on an old disconnected Morse key.

"Hold on," said Richards as Berliner started to work, "you must press down the key, not simply drop it."

"What difference does it make," asked Ber-



First disc talking machine (Gramophone), exhibited before the Franklin Institute, May 16th, 1888, by Emile Berliner. The small hand wheel at the right turns the disc.

liner, "whether I press it down or not, if it makes a contact?"

"You have to make a firm contact," said Richards, "otherwise your message might not be readable at the other end. That's why we employ men as long distance operators, exclusively—women do not have a firm enough touch."

"Do you mean to say," asked Berliner, "that more current passes over that contact when I press hard?"

"Decidedly," replied Richards.

"All right, goodbye," said Berliner. And he lost no time reaching his little bedroom "laboratory."

He knew he had it! He rigged up a diaphragm and contact, kept testing it with his galvanometer until he got what he wanted, namely a loose contact, and there alone that night with the aid of his tuning fork he demonstrated to his complete satisfaction that the principle he had caught sight of that afternoon was correct. It was the principle that a loose contact is best for sending an undulatory current.

And so the microphone was born!

It was a crude little instrument made from a wooden soap box, with a tin bottom for a diaphragm and affixed inside of it was a screw clothing hook which operated as an adjustable contact.

And the little instrument when connected to a line battery and a receiver, *talked!*

The gist of the invention lay in the conception of its operation!

The small struggling Bell Company, trying to commercialize their inefficient magneto telephone, learned through their Washington patent attorney that there was a new telephone application pending in the Patent Office and they sent their superintendent to Washington to investigate it.

Superintendent Thomas A. Watson, formerly Bell's mechanic and the man who had fashioned the original Bell instruments with his own hands, and who had had the honor to hear the first articulate sentence ever spoken over a telephone, saw in Berliner's apparatus a telephone system that entirely ignored Bell's contrivance.

While Bell, a wizard, had seen deeply enough into the science of telephony to utilize the principle of the undulatory theory, his instruments themselves came far from giving satisfactory service. There was still something lacking. The principle of the original magneto telephone was based on the former discovery of the celebrated Faraday, that a piece of iron when moved in front of a permanent magnet produces a current in a coil surrounding that magnet.

Bell had a transmitter and a receiver which worked by means of talking or listening in front of an iron diaphragm, which meant that the slight energy of the voice was responsible for producing the electric current over the wire. With Bell's original instrument, it was necessary to speak loud, to crowd one's lips into the mouth piece and often to repeat a message many times: extraneous disturbances were likely to render the instruments temporarily useless. Marvelous as seemed the invention from any standpoint in those days, it was as yet not in a condition for large commercialization; it would at best do only for short distances.

So Watson, interviewing this young dry goods clerk and examining his magic soap box, was secretly surprised to find here an instrument that employed a battery current and in addition thereto a transformer that boosted the current, and a contact so delicate, so susceptible to the slightest vibration that, as it afterwards turned out to be, it was microphonic! The Bell telephone "wafted" the voice, but in this instrument after being minutely caught, the message was *pushed* beyond.

After a brief half hour, Watson took his departure with the terse remark, "We will want that, Mr. Berliner; you will hear from us shortly."

And thus it happened that to the Bell telephone were added its most valuable and indispensable instruments, the microphone and the continuous current transformer.

Further experimentation brought to light the fact that it was the combining of Berliner's more powerful battery transmitter with Bell's magneto receiver that made perfect and complete the Bell telephone as we have known it ever since.

And it is remarkable that Berliner's loose contact microphone and his transformer have never ben superseded since he invented them. They are both indispensable in radio broadcasting and will be for some time.

And how this young self-taught physicist floundered into the mysteries of telephony and dragged to light these great fundamentals in the remarkably short period of a few months, even before the Bell telephone was in public use, is something Berliner himself has never been able to explain.

The completed Bell telephone, at last an article of practical commercial value, plainly capable of revolutionizing all industry and even society, was a tempting target for many plausible prospectors at the United States Patent Office in those days.

There came an army of inventors, some honest, some deluded, some plainly pretenders, who fain would lay some personal claim, great or small, to this stupendous new thing in industry.

To tell the story of it with the attendant greed, the falsifying in high places, and the broken hearts would be to depict a drama.

For fourteen years the legal battles raged! And it was the Berliner patent, issued finally in 1891, that was the chief object of assault. Enough to say that the company, with the Bell Patent about to expire in 1893, spent approximately a million dollars in defending this Berliner patent—at the time of its issue the most valuable patent ever granted! Attacks subsequently waged against it ended triumphantly for Berliner in the Supreme Court of the United States.

Momentous as this all seems, this was only the commercial side of this amazing thing—the microphone. The story of its future possibilities has never been written. It would be too big a strain on one's imagination to attempt at this time to write it.

A few weeks ago there was razed in Washington an old brick homestead—the birthplace of the modern talking machine.

The house was a landmark dear to all who knew its past associations, and throughout the civilized world people have been made

Here in this house, 1458 Columbia Road, Washington, D. C., Berliner invented the first Gramophone in 1887.

happier as a result of the scientific achievement wrought there many years ago. But the heedless hand of progress swept away the stately structure and this chrysalis of so much melody and happiness was doomed to disintegrate among the husks.

For more than forty years, 1458 Columbia Road was the home of Emile Berliner. He lived at that address when horse cars were still the mode of travel in Washington. It was he who in the upper left front room of this house experimented with the patience and persistence that finally brought to light a fundamental in the art of sound recording —namely the superior lateral cut disc record, the type of record now used almost universally in talking machines.

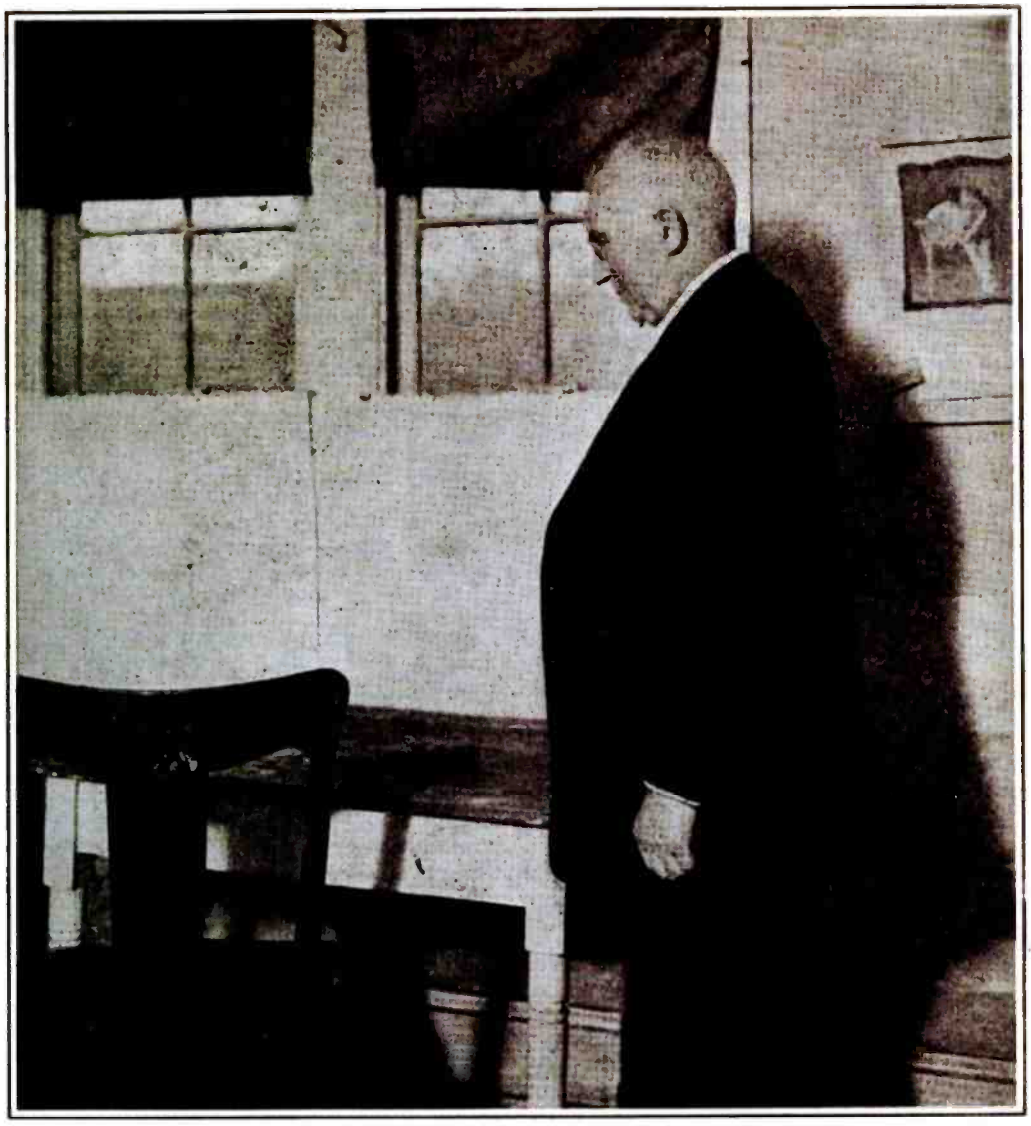
Berliner invented and patented his talking machine in 1887 and named it "gramophone" (the writing of sound.) The original instrument was motivated by hand.

During the process of further development it became known in this country by a different name but throughout the rest of the world machines of this type are manufactured under the original name of gramophone. According to latest reports, a gramophone company is just now being organized in Australia.

It was on this soil that Berliner invented the first talking machine which utilizes a groove of even depth and varying direction, and in which the record groove not only vibrates but also propels the stylus across the record. For this and for his telephone inventions he was awarded the John Scott medal and Elliot Cresson gold medal by the Franklin Institute. Such a sound record in which the sound waves are cut horizontally like writing is now more widely used to give a picture of the voice than records cut in the up and down manner.

Berliner also invented and perfected the present method of duplicating disc records. In his office today may be found a picture of the best known dog in the world. It is in the form of a legal document—a patent granted to him for "His Master's Voice." It was Berliner who foresaw the commercial possibilities of this picture and secured exclusive rights for the use of it as a trademark.

It is perhaps safe to say that no other one man in the history of the world has ever contributed quite as much to the interest of music as has Emile Berliner. He is a self-taught scientist, having always specialized in the subject of acoustics.



Emile Berliner visiting the little room at 812 6th Street N. W., Washington, D. C., where 49 years ago he invented the microphone.

He is himself enough of a musician to play the piano and violin and about 25 years ago he composed some American anthems, one of which was played on the White House grounds before the President by the full Marine band, and was afterwards sung in the local schools for a number of years.

And in the new, improved method of making talking machine records the microphone principle instead of the direct voice is now being used for recording. This, as far as Mr. Berliner is concerned, looks rather like a monopoly in genius. Truly Berliner has set human life to music!

It is interesting to look back and see where such singular ability had its origin. Emile Berliner was born in Hanover, Germany. This was in the days of small provinces and many monarchies. In those times the province of Hanover, of which the city of Hanover was the capital, was ruled by a king who was blind. Due to his misfortune, this king had developed an unusual fondness for music. Consequently, he contributed from his large wealth toward the maintenance of the Royal Opera in Hanover and in this way made it possible for citizens to hear the highest class of music at a price within reach of even the poorest.

Berliner's mother was one to avail herself of this privilege and she passed on to this child of hers a passion for harmonies. Berliner's father was a great student of fundamental logic and with this combination for an inheritance, Berliner became what he is, a genius in the art of music and acoustics.

After having made such unprecedented contributions to science, Mr. Berliner began about 25 years ago to devote himself to the subject of public health. His impetus in this work came from the loss of a little child.

He believes that prevention of disease is better than cure. Accordingly he now maintains and supports the Bureau of Health Education in Washington. For more than four years this Bureau has sent out free of charge to every new mother in the District of Columbia, a booklet on the care of her child.

The infant death rate in Washington has been reduced over 75 per cent since 1901, when Berliner began a campaign of newspaper education for Washington mothers.

For a number of years Mr. Berliner was president of the Washington Tuberculosis Association and he is still chairman of its important committee on publications. As such he became author of the well-known health rhymes which have been used for many years in the public schools in Washington.

Emile Berliner is responsible for the national pasteurization of milk by having planned the Washington milk conference of 1907, which was attended by the leading sanitarians of the government.

When his Columbia Road residence was vacated, Berliner built an adjacent office building at 1464 Columbia Road where he now puts in regular hours directing his health work and developing his latest invention, acoustic tiles.

These tiles which are virtually diaphragms, promise to end the cries of "Louder! Louder!" heard in convention halls, and auditoriums.

Radio and the MUSIC STUDENT

Conducted by G. W. HARRIS

SCHEDULED FOR MONDAY EVENING, JUNE 28

Broadcasting over the WEAF link on Monday evening, June 28, the WEAF Grand Opera Company will present in tabloid form Wagner's most popular opera

"Lohengrin"

No finer treat for music lovers has ever been put on the air

Wagner's "Lohengrin" and Rossini's "Barber of Seville"

SCHEDULED FOR THURSDAY EVENING, JUNE 24

Broadcasting from Stations WJZ and WGY, the Royal Typewriter Salon Orchestra, Conducted by Bernhard Levitow, will play Rossini's

"Barber of Seville" Overture

No music-lover will want to miss this

Richard Wagner

IN sheer might of genius—in grandeur of conception, originality and boldness of execution, vividness of characterization, intensity of expression, and sustained power—Richard Wagner towers like a colossus above all other dramatic composers.

He was one of the great revolutionists of musical history. He created a new art form—the music-drama—which he conceived to be the highest form of art, a means whereby man may be revealed to man both as he is and as he may be.

Wagner's nature was thoroughly and preeminently that of a dramatic poet, and he left the world a rich legacy in music of deathless beauty, fadeless splendor, and unfailing power. He was one of the great master-minds in the history of humanity, and his work lives after him as one of the vital forces of civilization.

Richard Wagner was born in Leipzig, on May 22, 1813, the youngest of a family of seven children, several of whom became actors and singers. His father, a clerk in the city police court, died when Richard was only six months old, and his mother soon afterwards married Ludwig Geyer, a successful actor and singer and writer of comedies.

Richard's earliest experiences were in the shadow of the theater, and his first inclinations were towards literature rather than music. As a boy in school he was a good student, particularly in Greek, and showed special aptitude for German verse, writing a tragedy on Shakespearean models when fourteen. Although Weber's operas made a strong impression on him, it was not until he was "overpowered," as he himself expressed it, on hearing a Beethoven symphony that he received his musical impulse. But thereafter he mastered musical science with extraordinary rapidity.

At nineteen, having made a thorough study of Beethoven's symphonies, he composed a symphony which was performed in Leipzig in January, 1833. In that year he was appointed chorus master at the Würzburg Theater (where his brother Albert was stage-manager), and there he composed his first opera, "The Fairies," writing his own libretto, as he did for all of his music-dramas. He became opera conductor at Magdeburg in 1834, where he wrote "The Love-veto" (also known as "The Novice of Palermo"); at Königsberg in 1836, where he married Wilhelmine Planer, an actress; and at Riga in 1837, where he began "Rienzi." Hoping with that opera to rival Meyerbeer's triumphs in Paris, he went to France by sea in 1839, being nearly shipwrecked on the way.

After two years of disillusion and extreme privation in Paris, he was rescued by an appointment as assistant director of the Dresden Opera. He remained in that position seven years, and there "Rienzi" was produced in 1842, "The Flying Dutchman" in 1843, and "Tannhäuser" in 1845. But these works were not appreciated. His plans for improvement of the Dresden Opera were constantly thwarted, and "Lohengrin" could not obtain a performance.

Accused of taking part in the attempted political revolution in Saxony in 1849, Wagner, to avoid arrest, fled to Switzerland. The creative work of the ensuing thirteen harassed and distressful years of exile includes many prose writings and the music-dramas "Tristan and Isolde," "The Rhine Gold," "The Valkyrie," and Act I of "Siegfried."

Wagner was permitted to return to Germany in 1861, but his fortunes did not begin to mend until King Ludwig II of Bavaria became his patron in 1864. Despite the king's favor and the staging of "Tristan and Isolde" in 1865, of "The Mastersingers of Nuremberg" in 1868, and of other works, plans for a special Wagner Theater in Munich were frustrated by court cabals and persistent opposition by local musicians.

In 1861 Wagner separated from his first wife, who went to Dresden, where she died in 1866. In 1870 he married Cosima, a daughter of Liszt, after her divorce from her first husband, Hans von Bülow.

King Ludwig's plan for a special Wagner Theater at Munich having fallen through, Wagner fixed upon Bayreuth, in 1871, as the place for it. At length, with the aid of world-wide subscriptions, the theater was built, and the dream of his life was realized with its dedication in 1876 by the first complete performance of "The Ring of the Nibelung," comprising the four music-dramas: "The Rhine Gold," "The Valkyrie," "Siegfried," and "The Dusk of the Gods." His last dramatic composition, "Parsifal," was produced at Bayreuth in the summer of 1882. In the following

To the left is Richard Wagner, who wrote the romantic opera, "Lohengrin."

To the right is Gioachino Antonio Rossini, who wrote the "Barber of Seville"

Devora Nadworney, the sensational American contralto, who sings with the WEAF Grand Opera Company.

Carl Rollins, the baritone soloist of the WEAF Grand Opera Company.

autumn poor health forced Wagner to seek relief for the winter in a warmer climate. He went to Venice, where he died suddenly on February 13, 1883.

The Story of "Lohengrin"

WITH "Lohengrin," Wagner broke away from operatic conventions and influences of the past to a greater extent than in any of his earlier works, and achieved a musical style of distinction—succeeded, for the first time, in raising his music to the full level of his poetic conception. "Lohengrin" was the first of his operas to win general acceptance, and it still remains, after three-quarters of a century, the most popular.

This romantic opera in three acts, with words by the composer, was composed at Dresden in 1845-47, and was first produced at Weimar, on August 28, 1850, the anniversary of Goethe's birthday, under the direction of Wagner's great-hearted friend Franz Liszt. Wagner himself could not attend that first performance, much as he longed to do so, for he was in exile—at Zurich. He did not hear "Lohengrin" performed until 1862.

The story of Lohengrin, the son of Parsifal, upon which Wagner based his drama, is taken from several sources, the old Celtic legend of King Arthur, his knights, and the Holy Grail being mixed with a distinctively German legend of a knight who arrives in his boat drawn by a swan. The version used by Wagner is largely that of the old Minnesinger Wolfram von Eschenbach, and is, in briefest outline, as follows:

Henry I, called the Fowler, King of Germany from 918 to 936, has come to Antwerp for the purpose of raising troops to help him to expel the Huns, who are threatening his dominions. He finds Brabant in a state of anarchy. Gottfried, the young son of the late Duke, has disappeared mysteriously, and Telramund claims the dukedom. At the instigation of his wife, Ortrud, a Frisian princess who is a pagan and practices sorcery, Telramund accuses Elsa, the sister of Gottfried, of having murdered the boy to obtain the throne for herself.

Elsa is summoned before the King, enthroned under a spreading oak-tree on the banks of the Scheldt, and he decrees trial by order of battle. Commanded to name her champion, she tells of a knight seen in a dream; upon him alone will she rely.

Not until the signal trumpet has sounded twice and Elsa has knelt in prayer does her champion appear. He comes, a knight in shining silver armor, standing in a boat drawn by a swan. He accepts the gage of battle, after asking Elsa to become his bride, if he is victor in the combat, and exacting a promise that she shall never ask his name or whence he comes. He vanquishes Telramund, but spares his life. The King, however, banishes the false accuser and makes the stranger Protector of the dukedom.

Act II opens with a night scene. Telramund and Ortrud are plotting revenge as they crouch on the steps of the Minister, opposite the palace. Elsa appears on the balcony of the women's quarters and sings her happiness. Ortrud calls her to come down, and with affected humility soon ingratiates herself again with the credulous maiden. They go into the palace together, Ortrud first promising to use her magic powers to insure to Elsa forever the love of her unknown lord. Elsa rejects the offer with scorn, but it is evident that the first seeds of doubt have been sown.

Day dawns, and the nobles assemble for the wedding. The bridal procession starts, but before Elsa sets foot on the Minster steps, Ortrud dashes forward and claims precedence by virtue of her rank, taunting the bride with ignorance of her bridegroom's name and station. And Telramund publicly accuses the unknown knight of sorcery. The two conspirators are thrust aside, and the procession files slowly into the church.

Act III begins with a solemn wedding march, while the maids of honor conduct Elsa and her knight to the bridal chamber. There, after a love scene of enchanting beauty, her doubts and fears become overpowering. How is she to know, she cries out, that the swan will not come some day as mysteriously as before and take her beloved from her? In vain he tries to soothe and warn her in words of tenderest love. She will not be appeased, and in frenzied excitement puts to him the fatal question, "Who art thou?"

At that moment Telramund rushes into the room with drawn sword. Elsa hands the bridegroom his sword and as he lifts it over Telramund, that would-be assassin falls dead at his feet.

The final scene takes us back to the banks of the Scheldt. There is another conclave of King and nobles, and before it the knight answers Elsa's question. He is the son of Parsifal, the lord of Monsalvat, the keeper of the

Aids to Appreciation;—"Lohengrin"

CONCERNING Richard Wagner and his works there is a voluminous literature in German, English, French, and other languages. A few of the most interesting books, easily obtainable, in English are the following:

Wagner's autobiography, "My Life," (2 vols.) published by Dodd, Mead & Co., New York, at $7.

"Wagner and His Works," by Henry T. Finck, (2 vols.) New York: Scribners.

"Richard Wagner: His Life and His Dramas," by William J. Henderson, New York: Putnams.

"Wagner as Man and Artist," by Ernest Newman, New York: A. A. Knopf.

The complete vocal score of "Lohengrin," with both German and English words, is published by G. Schirmer, New York, at $2.

Excerpts from "Lohengrin" are to be had in phonograph records as follows:

Victor Records—

Elsa's Dream (Act I), sung by Jeritza (6172), $2.

King's Prayer (Act I), sung by Journet (915), $1.50

Beloved Swan, and Lohengrin's Farewell, sung by Harrold (74813), $1.50

Lohengrin's Narrative (Act III), sung by Williams (6314), $2

Bridal Chorus (Act III), sung by La Scala Chorus (16537), $0.75; same by Victor Opera Chorus (35494) $1.25

Prelude to Act III (Bridal March), played by Boston Symphony Orchestra (547) $1.50; by Herbert's Orchestra (55048), $1.50

Lohengrin Fantasie for 'Cello, played by Bourdon (35339), $1.25

Lohengrin Selection, by Sousa's Band (35114), $1.25

Columbia Records—

Bridal Chorus, by Columbia Band (A6), $0.75

Introduction to Act II, by Prince's Orchestra (A5065), $1.25

Prelude, by Chicago Symphony Orchestra (A5894), $1.50

Brunswick Records—

Prelude to Act III, and Wedding Music, by Cleveland Orchestra (15090), $1.50

Holy Grail. It concludes with:

"The Grail obeying here to you I came.
My father Parsifal, a crown he weareth,
His knight am I and Lohengrin my name."

His mission is to succor the distressed, but his mystic power vanishes if the secret of its origin be known. As he speaks, the swan appears once more, drawing the boat that is to bear him away. Lohengrin bids a last farewell to the weeping Elsa, giving her his sword, horn, and ring.

Now is the moment of Ortrud's triumph. She rushes forward and declares to the wondering crowd that the swan is Elsa's brother, imprisoned in this shape by her magic arts, and that he would have been released but for Elsa's curiosity. But Lohengrin's power is not exhausted; he kneels in prayer, and the white dove of the Grail wheels down from the sky to take the place of the swan. Lohengrin detaches the chain from the neck of the swan. The bird disappears, and in its place stands Gottfried, released from the spell put upon him by the sorceress. The dove draws the boat with its celestial passenger away, and Elsa sinks lifeless in the arms of her brother.

The orchestral prelude to "Lohengrin," one of the most marvelously beautiful things in all music, is a tonal picture of the descent of the Holy Grail, mysterious symbol of the Christian faith, and the Grail motive is the key to the whole work. The delicious harmonies that accompany its descent increase gradually in warmth and power until the sacred mystery is revealed to human eyes, when they culminate in a stupendous climax of tonal splendor; then they die away again to a pianissimo, and gradually disappear as the angels bearing the holy vessel return to Heaven.

Aids to Appreciation

A PIANO transcription of the Overture to "The Barber of Seville" is published by Oliver Ditson Co., Boston, at 50 cents.

The Overture is procurable in phonograph records as follows:

Edison Records—
By Creatore and his band (51000), $1

Victor Records—
By Pietro (Accordion) (35524), $1.25

Vocalion Records—
By Metropolitan Opera House Orchestra, Conducted by Gennaro Papi (35032), $1.25

Reproducing Piano Records:
Duo-Art—
Played by Rudolph Ganz (523-4), $3

Ampico—
Played by Pelletier and Loeaser, conducted by Bodansky (59783II), $3

Rossini and "The Barber"

ROSSINI'S opera "Il Barbiere di Seviglia" (based on Beaumarchais's comedy, which had already been turned into an opera by Paisiello) was first performed in Rome on February 5, 1816, under the title "Almaviva," and, curiously enough, was at first an emphatic failure. The people of Rome were at that time devotees of the music of Paisiello, and resented the impertinence of the "upstart" Rossini in venturing to take a subject that had already been treated by the older master.

But the music of "The Barber" is so bright and exhilarating that the work soon recovered from the shock of its unfriendly reception, and to this day it remains not only Rossini's most popular work, but indeed the most popular comic opera ever written. The action, story, and music all fit together with such marvelous felicity, the music is so bubbling over with life and gaiety, the whole thing romps along with such delightful spirit that the effect is irresistible even now. And to compose this masterpiece Rossini took *exactly thirteen days!*

The scene is laid in Seville. Count Almaviva has fallen in love with the fascinating damsel Rosina, whose guardian, Bartolo, keeps her under lock and key in the hope of persuading her to marry himself. The barber Figaro, who is in everybody's confidence, befriends the Count and smuggles him into Bartolo's house in the disguise of a drunken soldier. Whereupon the guard arrives and Almaviva is arrested and carried off to jail.

In the second act the Count succeeds in getting into the house again, this time as Rosina's music-master. But in order to gain the suspicious Bartolo's confidence he has to show him one of Rosina's letters, pretending that it was given to him by a woman friend of Almaviva's. Bartolo is delighted with the news of the Count's infidelity, and hastens to tell the scandal to Rosina, whose disappointment and jealousy nearly wreck Almaviva's well-laid plans. Happily he finds opportunity for persuading her of his constancy while her guardian's back is turned, and induces her to elope before Bartolo has discovered the fraud practiced upon him.

The music is a delightful example of Rossini in his gayest, merriest mood, and sparkles with wit and fancy. The Overture, although originally written for an earlier opera, is particularly happy in its merry spirit and forecasts the mood of "The Barber" very delightfully.

When Donizetti was asked if he believed that Rossini had really written the score of "The Barber of Seville" in thirteen days, he answered, with a malicious twinkle in his eyes, "It is very possible; he is so lazy." Yet this "lazy" man was one of the most prolific of composers. He wrote some forty operas before he was 38 years old—and then vowed never to write another. He lived to be 76, and he kept that vow.

Gioachino Antonio Rossini was born at Pesaro, Italy, on February 29, 1792. His father was a horn-player in opera troupes in which his mother sang, and as they had to travel to earn a living, the boy was left at Bologna when four years old.

In 1807 he was admitted to the Conservatory there to study composition with Padre Mattei, and he took a prize for a cantata at the end of his first year.

Later he specialized in operas, his work culminating in "William Tell," produced in 1829. This was also his last opera, as well as his greatest masterpiece. In 1836 he heard Meyerbeer's "Les Huguenots," and resolved to compose no more. His famous "Stabat Mater" was begun in 1832, but was not completed until 1841, and had its first performance in the following year.

From 1837 to 1855 he lived in retirement at Bologna and Florence, then returned to Paris and in his villa at Passy lived the life of a voluptuary, surrounded by devoted admirers and friends. He died there on November 13, 1868.

Bernhard Levitow, violinist, conductor, and musical director of the Hotel Commodore, New York City.

Bernhard Levitow

BERNHARD LEVITOW, violinist, conductor, and musical director of the Hotel Commodore, New York, the broadcasting of whose excellent programs and conducting of the Hotel Commodore Ensemble has made him a popular favorite with radio fans everywhere, was born in Hartford, Conn., in 1886. When he was eight years old he began the study of the violin with a pupil of Bernhard Listemann, and at 16 won a scholarship at the New England Conservatory of Music, in Boston, where he studied for two years. Then another scholarship, this time at the National Conservatory, in New York, placed him for five years under the personal guidance and instruction of Leopold Lichtenberg, a celebrated pupil of the great Wieniawski.

On the completion of his course at the National Conservatory, in 1910, Mr. Levitow started to tour the country as a concert violinist, with the assistance of Andre Benoist as his accompanist. He was meeting with steadily increasing success, when in 1912 the shock of his mother's death upset him so completely that for many months he was unable to touch his violin.

In 1913 he returned to New York and became conductor of the Century Theater Orchestra. After a successful season there, he went to the Bowman Hotel Corporation, and ever since the opening of the Commodore he has been its musical director.

Toot! Toot!! All Aboard *The* Pennsylvania SPECIAL

The popular George Olsen, leader of the Pennsylvania Hotel Dance Orchestra, listening to one of the many "Fan" letters which Norman Brokenshire is reading to him.

And Go With Us on a Trip Through the Hotel Pennsylvania Grill in New York City, With George Olsen as the Conductor.

By

BETTY ANN GRAY

"ALL aboard the Pennsylvania Special." Don't you hear that whistle? Tune in WJZ any Tuesday night at 10.45 or Friday at 7 P. M.—it has been changed so that the Wednesday night date has been shifted to the dinner music on Fridays—close your eyes and hop aboard the Special with me. I'll take you down to the Hotel Pennsylvania Grill in New York on a personally conducted tour to take in George Olsen and his orchestra.

Of course you are crazy about the dance music, the songs and the byplay between George Olsen and Norman Brokenshire. Judging by the stack of letters on George Olsen's secretary's desk the rest of the world shares your feeling.

This feature has been on the air for many months, twice a week, and there are more letters of appreciation and requests for "Horses" and "Just a Sailor's Sweetheart" than ever. I have been told that Olsen is leading the list at WJZ in the amount of mail received each week from the radio audience. "Horses" is mentioned in at least 75 per cent of these letters and on one occasion when he omitted this number in this broadcasting, the flood of protests was overwhelming.

Down here in *The Radio Home* offices, enthusiasm and discussion run strong on this program. The other day I chanced to go into H.M.N.'s office just in time to catch him saying over the telephone:

"No, I can't go Friday night. I want to listen to George Olsen. We have a bet up on whether Fran Frey will sing "Horses" again. . . .

"Tired of him? Not much! I could listen to that boy every night."

Just then H.M.N. saw me and said, "Why don't you go over next week and see if Olsen is as good as he sounds? It ought to make a good story to see how the patrons of the Grill react to the broadcast program."

You may believe that I was glad that I happened to come into the office at that particular time. I was even gladder when I found myself in the Grill the next Tuesday night.

Perhaps it would be well to describe here the general setting. As you go into the Grill you find yourself on a dais with an orchestra stand in the center and with two rows of tables extending on both sides and half encircling the dance floor. This arrangement enables the dancers to come very close to George Olsen—and they do while he is talking into the "mike," even though the raised section is about on a level with their heads.

To the right, backed up against the orchestra stand, is the control board where two operators work. Close at hand is Norman Brokenshire's table where I sat. When he is announcing "Broke" stands at his "mike" beside the control board. Ordinarily he would be within easy hearing distance (about 15 feet, I should say) of Olsen but the latter broadcasts in a tone scarcely above a whisper. For this reason the operators as well as "Broke" use headphones in order to catch every word.

Thus can they avoid those ghastly gaps that the radio audience is so quick to criticise.

That evening, the operator kept his earphones on all the time, but "Broke" took his off between announcements to explain things to me or to chat gayly with the others at our table. Repartee at distance with the aid of earphones must be a tax on even his agile wit.

At first I was a bit disappointed to find that our table had been placed so close to the orchestra. Soon, however, it became apparent that this was a wonderful advantage, for not only could I hear perfectly but in addition I had an equally good view of the orchestra, the people coming into the Grill and the dancers.

Soon after I had settled down to watch the crowd I noticed a stir and a general craning of necks in our direction. Then I heard one of the dancers say to her partner in a stage whisper, "Look, quick! Can you see if his pearl studs really are as big as birds' eggs?"

Then I remembered a newspaper item I had seen some time ago in which the writer had facetiously remarked that George Olsen had pearl studs as big as an auk's egg. While I was turning this over in my mind, "Broke" whispered to me, "Here he is."

There at my elbow stood George Olsen. My first impression was of a vital, energetic young man, who at first glance looked scarcely older than a college boy, but who on closer inspection revealed the complete assurance of a man of the world. He chatted with us for a few moments and, just as I was about to begin my preliminary questions, he glanced at the clock, made a dash that would have been worthy of Douglas Fairbanks and the next thing I knew he was standing at the "mike."

Hardly a sound was audible but I concluded that the program was about to begin. Then I heard "Broke's" voice as he turned to speak into the other "mike" beside me. He had the earphones on his head and I realized why they were needed for I had not heard a word of what Olsen had been saying. Seeing my look of amazement the announcer slipped the phones off and handed one to me. I kept it long enough to hear Olsen throw a remark about a straw hat to "Broke" which the latter picked up instantly and answered in kind.

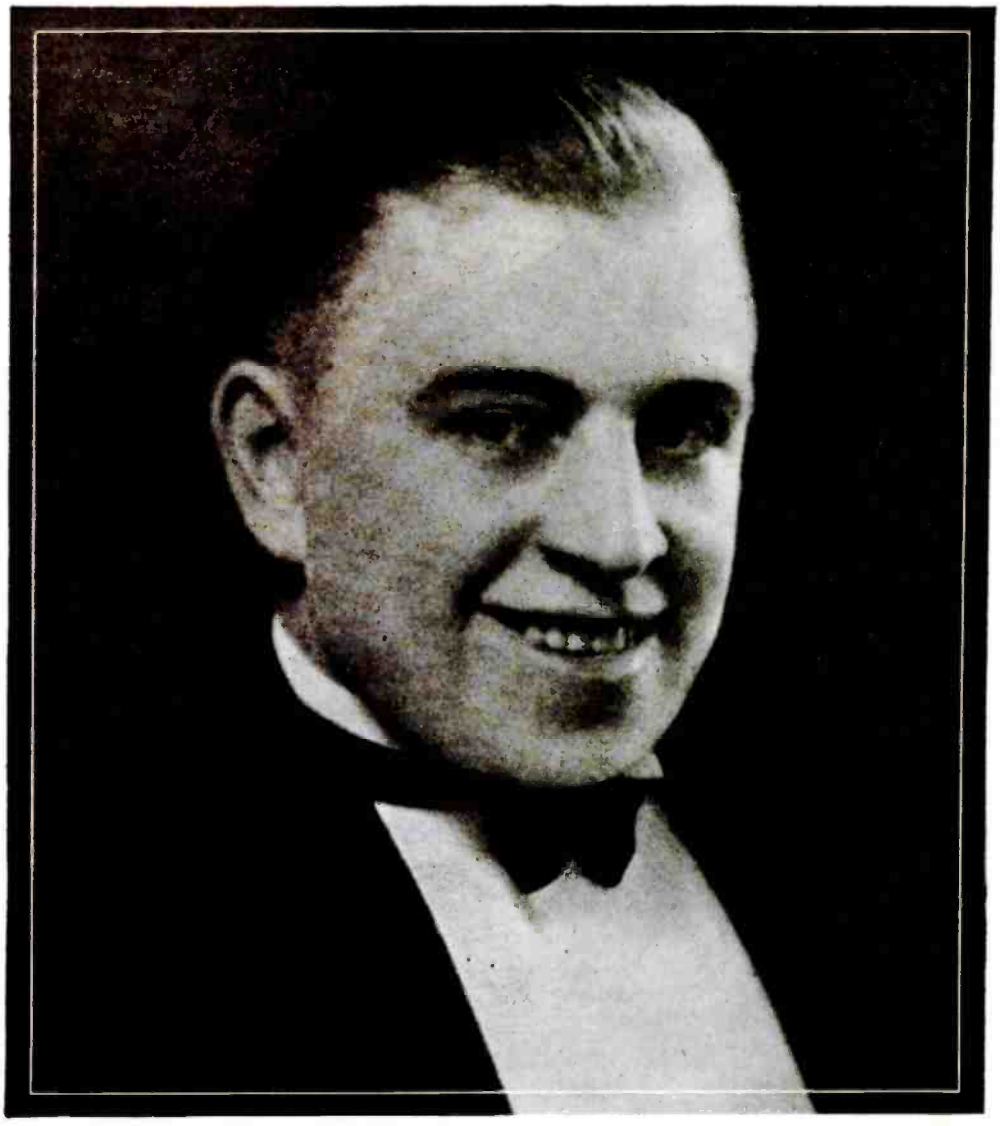
The dialogue that you hear is entirely impromptu on both sides. "Broke" whispered to me between his turns that he had to watch and listen very intently because otherwise he could never tell when he was expected to respond. Just how he does it remains a mystery to me for there are people buzzing on all sides and many other distractions.

In my eagerness to tell you about the opening of the program, I almost forgot to mention an amusing or rather interesting scene that I witnessed soon after the orchestra commenced to play the first dance number. I noticed that George seemed to be watching the entrance to the Grill whenever he had a chance. Suddenly, although the orchestra continued to play, I saw him leave the stand hastily. Then I noticed that he had gone out to speak to a girl who was just coming in. He kissed her and paused to whisper a few words and before most of the spectators realized that he had left, was back at his place in the stand.

"His sister," was my first thought—for they did not look unlike.

"His bride," my companion murmured to me.

Later I spoke of the incident to George's secretary and she told me that they had been married only a short time. The bride was Ethel Shutta, who will doubtless be remembered by some of my readers as the singing comedienne of the "Louis XIV" company that has been playing in Chicago this season.



A close up of George Olsen in a happy mood. In fact he seems to be in a happy mood in all the accompanying photographs.

The Grill had by this time begun to fill up with what I can best describe as a cosmopolitan-looking crowd. The lights were dimmed for a particularly good dance number when I noted a strange voice talking to "Broke" and I turned to find a young man with a very attractive girl standing at our table.

"I just had to tell you how much we have enjoyed George Olsen's programs. We have been listening in all winter. We're from Kansas you see and I made up my mind as soon as my husband told me that he would bring me with him on this trip that we were going to manage our plans so that we could come in here one night while you were broadcasting George Olsen."

"It has been worth the effort, too," spoke up her husband. "I wouldn't have missed this for anything. Do you suppose that Fran Frey will sing "Horses" tonight? Gee! He sure is great. Which one is he anyhow? The wife thinks that he is that blond lad that looks a little like Olsen but I have picked that dark haired fellow over there."

Before we had time to tell him that they were both wrong, the orchestra began the opening strains of the selection in question and Fran Frey stepped up to the "mike." There he stood with the utmost nonchalance facing the dancers who all stopped dancing with one accord and crowded around the raised stand. They had to do so to catch the words, for, like Olsen, he broadcasts in a very low tone of voice.

As soon as "Broke" saw that announcements were over for the time being, he handed me his earphones for which I felt truly grateful for without them I should have been able to catch only an occasional word.

It was like a three-ring circus. I wanted to watch the crowd to see how they liked it; I could not bear to take my eyes off the singer for fear I'd miss something; and George Olsen and the announcer were apt to begin those mysterious signals any moment.

"Do you know before hand which numbers you are to announce?" My curiosity could not stand the strain any longer.

"Not any more than you do," came "Broke's" prompt reply. "That's the reason I watch George so closely and keep these things handy so I can slip them on at a moment's notice. It keeps me on the alert but it's lots of fun."

Meanwhile George himself joined us for a

Last but not least, George at the Mike. Evidently there is something funny in the letter he is reading.

second while the singer was still at the "mike." He had just had time to turn to me with the remark, "Well, how do you like us!" when—"Great stuff," boomed a voice at my elbow. There stood a clergyman who went on to tell us that he had promised the members of the Boy's Club of his church that he would try to look in on George Olsen's orchestra while he was in New York and bring them back a faithful report of their favorite radio feature.

In the course of the hour a number of others came up to express their appreciation. Without exception they were radio fans who had planned to come to the Grill while they were in town to see the orchestra in action. "Broke" told me that he had had as many as fourteen people come up and speak to him in this way in a single evening.

"Broke" was back at the "mike" before he had time to tell me anything further. Then I saw that there were three singers at the other one. The way the dancers crowded up and an occasional word of comment that came to me above the general din told me that there was something good going on. As soon as the opportunity came I clapped on the earphones, just in time to catch the refrain of Lu, Lu, Lou.

"Lulu, Lou—
She's fat and forty and
she's cuckoo, coo.
She's shabby, shot and
shorty, too, too, too
My Lulu Lou."

Verse after verse of nonsense followed; some seemed so familiar that I thought that I must have heard them before. It hardly seemed worth while to write them down, I knew them so well, but I found later that they were not so easy to remember after all. In fact, only by a stroke of good luck am I able to give you the right words for the refrain. When I attempted to put them down, all I could seem to remember was that she was fat and forty-two, which you see was not correct at all.

My stroke of luck was that I met Bob Rice—Fran Frey and Bob Borger are the other two—who was one of the three boys singing this number, and he wrote the words down for me. It was amusing but he had to stop and think to get them straight even though, as he told me, he has sung them over and over again in the last few weeks.

I wish I could show you a photograph of the boys singing this number, and the expressions on the faces of the dancers crowded up against the stand. It is so well-worth seeing that I made several unsuccessful attempts to get a picture for you.

George Olsen and his "boys" lead a busy life of it. His working day often is from 10 A. M. until 4 or 5 o'clock the next morning.

The morning is taken up by phonograph recording; the afternoon by rehearsals, more recording or on Wednesday and Saturday by a matinée; then comes the dinner music at the Hotel Pennsylvania; next, the evening's performance at the theatre, followed by the after-theatre music at the hotel. This strenuous day is more often than not followed by more music, for you see Olsen has many engagements for social affairs such as fraternity dances. I understand that he withdrew from the night club with which he has been associated during the past season because he felt that he had too much else to do.

For the sake of those who do not already know which theatrical performance he may be heard in, let me say that his orchestra is a special feature of "Sunny," the outstanding musical comedy hit of this year. Olsen's orchestra is on the stage in several scenes, perhaps the best known of which are the ones giving the Pennsylvania Special and the famous "Pee—rade."

While the orchestra was playing the familiar "Never Get the No Place Blues," "Broke" informed me that this song had been written by Fran Frey in collaboration with Al Bernard, one of the "Record Boys" whose Thursday night programs from WYZ are so popular. Another favorite of the Olsen repertoire, "A Corn-Fed Indiana Girl," was written by George Olsen, Fran Frey, and Eddie Kilfeather, the orchestra's pianist.

Apropos of the last mentioned song George Olsen told me an amusing story that came to him the other day through the mail. A New Jersey teacher whose letter proclaimed her to be a very up-to-date as well as up-and-doing young person wrote that in a recent geography lesson she had mentioned casually to her class that Indiana is a great corn State.

"One little fellow raised his hand eagerly and said, 'I know a song about Indiana corn and I can sing it, too.'

"Almost before I had finished my suggestion that he sing it for us," she continued, "he began a perfect imitation of the man who sings, 'She's a Corn Fed Indiana Girl.'

"Half a dozen other children apparently knew it, too. One youngster announced that she had heard George Olsen's Band play it on Friday night."

Another letter of real appreciation begins, "Gosh, I can't write to everyone of you but I'd like to. . . .

"You see I am a musician myself, grinding an organ in the movies way down here in ole Virginia.

"My chief joy is eleven o'clock at night Tuesdays, when I close the console, hop in the Ford and fly home to tune in on WJZ. It's my only chance to hear brand new little songs, new harmonies—a wee touch of life.

"I love the man who sings 'Sailor's Sweetheart,' and the one who pops the cork? He's great. In fact, the only one I don't like is the one who starts the bell ringing at the end."

After George wound up his program and had made his parting speech about jumping aboard the Pennsylvania Special—that was the night when he said "I'm not going to string you along about going on the special to some fascinating place; I'll tell the truth, I'm going back to more work,"—he joined us for a few minutes. It did not take me long to find out that he is a college man; a University of Michigan graduate, I understood him to say. He began his broadcasting early in the radio broadcasting days from station KGW of Portland, Oregon. His orchestra has also been broadcast as a feature from the Capitol Theatre and I have been told that he is one of the few leaders whom "Roxy" has honored in that way.

I have also been informed on very good authority—not by George himself—that he does not have to work so hard in the pursuit of the almighty dollar. This informant says that Olsen and his brother inherited a half million each from their father and that, through judicious investment, this sum has grown well past the million mark. Rumor has it, too, that the orchestra is coining money through its various activities.

If you are in New York and have time to take in George Olsen at the Pennsylvania Roof where the orchestra has now moved for the summer season, or "Sunny" do not fail to do so. I have found both worth while, in fact I think that I can recommend them as the best shows that I have seen this season.

BRUSH *Your* TEETH *And* Join the Club

**TOOTHBRUSH, Rah,
Toothbrush, Rah,
W H D I
Toothbrush**

Radio is Being Used to Spread the Gospel of the Toothbrush Among the Kiddies of the Middle West and Save them Pain and Dentists' Bills in Later Life.

LEARN that yell, promise to brush your teeth every night before you go to bed, and listen for WHDI, the Dunwoody Institute radio station, Minneapolis, every Monday night and you may become a member of the Radio Health and Toothbrush Club of America.

That is the full name of it but old and young, far and near, call it simply the Toothbrush Club.

Primarily it is a children's organization but you would be surprised at the thousands of grown up members it has and the way they tune for the program. For the toothbrush club is entertainment, not just health propaganda, and children are the entertainers.

It celebrated its fourth birthday only a little while ago and on the program that night were children who were born about the time that Dr. Frederick W. Pepper, a Minneapolis dental surgeon, inaugurated the club.

Dr. Pepper was called upon one evening to give a talk to the children on care of the teeth. That was on the former Minneapolis radio station WLAG which later became WCCO.

He liked it. And he thought he saw in this brand new and fascinating business of broadcasting a tremendous agency for spreading a gospel he had been preaching for a long time.

Year after year he had stood at a dentist chair and inspected the teeth of men and women, boys and girls, who ought never to have come to see him.

"I decided," he said, "that thousands of the people who came to me would never have had to do so if they had formed in youth the habit of cleaning their teeth and had kept it up."

And so he proposed to the management of WLAG the formation of a club among the children to be known as the Toothbrush Club, with no other requirements for membership than a promise to brush the teeth every night at bedtime.

Upper left—Carter McDonald, cheer leader of the Radio Health and Toothbrush Club of America, Station WHDI. The smiling gentleman is Dr. Frederick W. Pepper, Founder and President of the Tooth Brush Club.

By EARLE R. BUELL

That is how the Toothbrush Club was born.

At first Dr. Pepper entertained the children. He sang little songs and he told little stories. Occasionally he would get in a word about the toothbrush or the care of the teeth but usually it was just entertainment for the youngsters while mother was getting dinner or doing the dishes.

The thing became a tremendous success.

But presently the effort of preparing a new program each week to be presented by himself became burdensome and he invited some of the members of his club—little children who could sing or play or tell a story—to take part in the program.

It was then that he discovered something that has been learned by several other radio entertainers of children—that the program they liked best was one in which their own friends took part, one in which the artists were children and the entertainment was such as to be within the understanding of all of them.

And so the Toothbrush Club became a unique program. Each week the studio of the station became the meeting place of the club, or at least it seemed so to the listeners. The fan could picture a great hall filled with children with Dr. Pepper bustling here and there upon the platform, talking informally to the children and to the audience and directing the entertainment.

Applications for membership came in by the hundreds and then by the thousands each with the pledge, sometimes in scarcely decipherable writing:

"I promise to brush my teeth every night at bedtime."

The idea had taken hold far beyond the expectations of the doctor or anybody else.

And then came to be noticed another strange and unexpected thing. More and more letters from grown-ups kept coming in among the children's letters. Some congratulated the club on its programs, some congratulated it on the idea, and some paid it the highest compliment of all by making application for membership and solemnly taking the pledge of the club.

It was all in fun but the club had begun to bear the finest fruits of anything that had been done in the field of dental hygiene in that part of the country, if not in the world.

Children—and even adults—were learning

the value of brushing the teeth. They were forming the habit. And as every doctor knows, the condition of the mouth and the teeth plays a vital part in the health of everybody.

The club branched out. It had a regular secretary, who was also the accompanist. It had a cheer-leader, Carter McDonald, a schoolboy, then about 12 years old. And its membership began to run into the hundred thousands.

Soon a new thought developed. All the Toothbrush Club members seemed imbued with the idea of "selling" the club to somebody else. And so the formation of chapters began.

The first applicant from a town that had no member was given a certificate as chapter secretary in that town and local chapters were formed. The applications now came in in bunches. It looked as if every radio listener would sooner or later become a member.

Then came a blow.

The old WLAG station fell into difficulties. Soon it was abandoned and the Toothbrush Club had no where to brush its teeth. It was a tragic time.

But Dr. Pepper could not sit idly by and see the Toothbrush Club die.

He went to Dunwoody Institute, an endowed educational institution directed by Dr. C. A. Prosser. He consulted Dr. Prosser and M. R. Bass, the director of the Institute's radio station.

He found that WHDI (William Hood Dunwoody Institute) had a tremendous radio following all over the Northwest.

He proposed that it adopt the Toothbrush Club and it did.

WHDI speaks with the voice of the historic old WBAH, the Dayton company station, Minneapolis, which donated its apparatus to the school when it gave up its license. Because this powerful set is located within the city limits of Minneapolis it is used only three or four hours a week and then at less than its 1,000 watts capacity.

The president of the Toothbrush Club has his own personal song which he occasionally sings to the members. Scarcely any of them know that it was written to the tune of "My Buddy" by Lindsay Lucas, a Minneapolis youth who has not been able to see or to hear for many years.

This is the way it goes:

Some youthful members of the Toothbrush Club. Left, Barbara Rose Beaudry, Harmonica champion of Minneapolis. Upper Center, Stanley Korengold, story teller and impersonator. Right, Mary Ann Devay, and Lower Center, Clarice Granville, Tiny Toot Soprano of the Toothbrush Club.

MY KIDDIES

Days are long since you heard me speak;
I think of you, dears, all through the week.
My kiddies, my kiddies,
Nobody quite like you.

Missed your laughter, your heart-felt glee;
Love to know that you think of me,
My kiddies, my kiddies,
Your buddy longs for you.

One of the favorite stars on the Toothbrush Club programs is Mary Ann Devay. There is scarcely a listener in the whole Northwest who has not heard her. She has done more broadcasting than half the other radio artists in the Twin Cities. She has been at it for years. But not very many, for Mary Ann is now five years old.

Another and a younger artist is Stanley Korengold, four year old impersonator, who filled in in the cheer leader's shoes on the Tiny Tots' program recently.

Barbara Rose Beaudry is another little star. She is seven but she is a veteran before the microphone. For three or four years she has been playing harmonica solos to the great delight of the children, and perhaps the greater pleasure of the grown-ups.

Clarice Granville is a five-year-old singer who has been frequently heard.

Others on the birthday program were Adeline Fergestad, story teller; Carl Lano, singer and David Knowlton, Jr., playing the banjo-mandolin.

Charlie Cloud's juvenile orchestra is one of the combination organizations that add to the variety of the offerings.

The Radio Health and Toothbrush Club of America is one of the oldest radio clubs in the world and Dr. Pepper is contemplating the devotion of his entire time to the work and the establishment of new stations for the club all over the United States.

Good-Bye, ICE-MAN!

Response of Radio Fans Indicates That Better Results and Greater Satisfaction Are Obtained From The Electric Refrigerator.

By

ELIZABETH A. ANDERSON

The tray being drawn from the upper compartment contains 20 cubes of ice ready for the table, frozen from water whose purity is under personal control.

Photo Courtesy Servel Corporation.

"I'D rather have an electric refrigerator than a new car," said one of my friends to me one day just after we had heard a radio talk on the subject.

Her remark has been lingering in the back of my mind for some time, chiefly I suppose, because I have heard no little discussion about whether women are really and truly interested in radio talks on the modern improvements in household equipment that have done so much to take the drudgery out of their every-day existence. My investigations to prove to myself that they are have brought to light some very interesting facts.

Among the thousands of letters that these talks have brought from women in all parts of the country, I came across one from a woman in Waycross, Georgia, or near there which was written in direct response to a refrigerator talk.

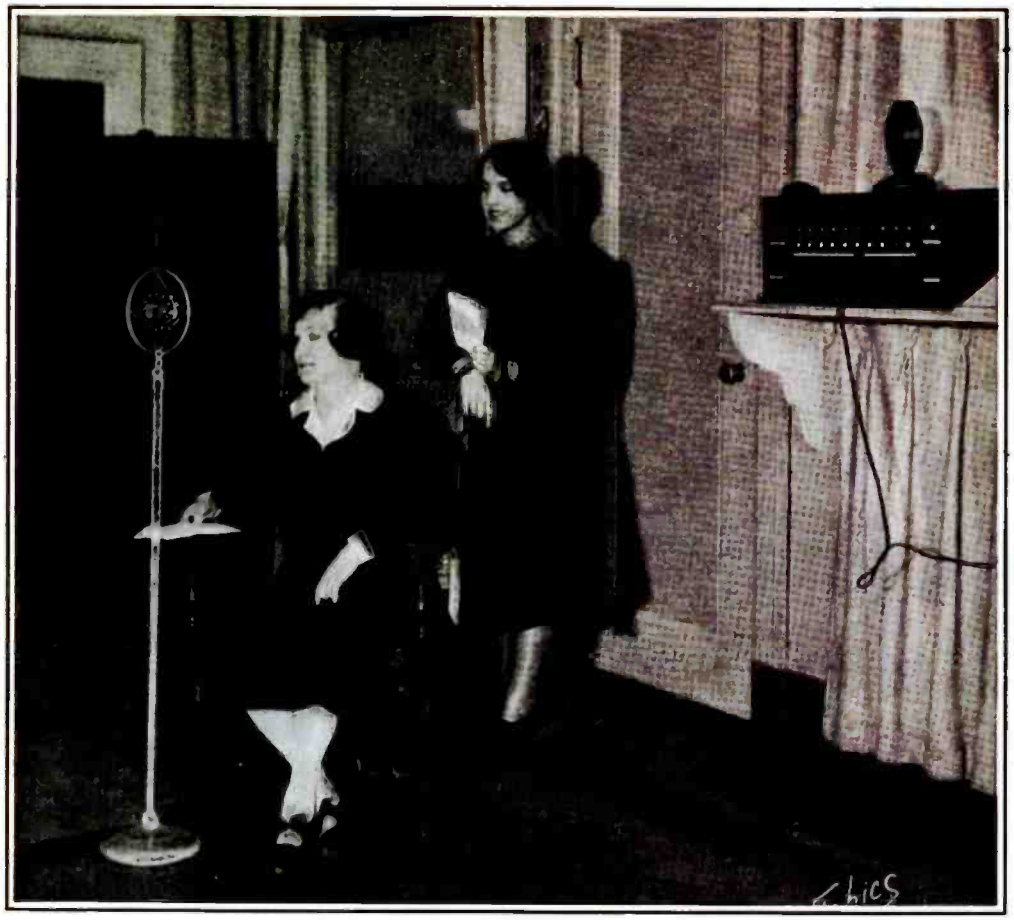
"Thanks to you, my benefactor, I have my heart's desire—the electric refrigerator that I have longed for, for almost a year.

"Some months ago I went to visit an old friend who has one. We just revelled in delicious desserts and frozen salads while I was there and it took so little time to prepare them.

"I raved about it to my husband when I came home but when I told him the price, I could see by the way he whistled that I might as well forget it for a time. That didn't discourage me entirely, though. I began to save every penny I could from the household expenses. When I had almost enough for the first payment, I asked Mary—my friend who had the refrigerator—to invite us to supper some evening and to fix that wonderful fruit salad and frozen Charlotte like she had for our card party.

"My husband was loud in his praise of both the salad and the dessert so Mary took him into the pantry and showed him the electric refrigerator.

"The next day was a scorcher, too hot, even in the morning, for Jim to go to his office. After a while he began to play with the radio to kill time, and there's where 'Lady Luck' stepped in to help me out. It was the Women's Hour, but instead of the usual recipes



Mrs. Cassels seated before the microphone with Betty Lutz, WEAF's "flapper announcer," standing behind her.

you were giving a refrigerator talk and you were just telling how we could buy one on the time-payment plan. You must have been a convincing speaker because that afternoon when I was fretting that the iceman had not come, Jim (my husband) said that I was to stop worrying, we'd get us an electric refrigerator and the old iceman could go to Guinea.

"We made our first payment the next morning and now Jim says that he would not give it up if we had to pay for it all over again."

This letter is so typical that I have quoted it at length, but it is not a bit more to the point than a number of others that broadcasters of other refrigerator talks have shown me. We went through the lot very thoroughly one day to pick out those that contained suggestions or questions that I thought would be of most help to our readers.

"Radio is educating the housewife of today? Yes I think it must be," began one of the electrical experts who has given a number of talks," when I think back on my experience of several years ago, and then read letters like these.

"The last time I broadcast, I counted twenty telephone calls before I left the studio after my talk, and in the next day's mail there were about a hundred letters—all intelligent questions, too, from women who were really interested.

"Their queries covered every phase of the refrigerator question that you can imagine, from the best place to keep the baby's bottles to whether under certain circumstances it is better to install the mechanical part in the kitchen or in the basement below. But not a single woman suggested that she could get the current from the door bell if the telephone would not do.

Here is a question that has, I know, occurred to many women who have on hand good and expensive refrigerators that require ice. These ice-boxes cost too much to be cast aside without a qualm. It is asked by Mrs. L., a youthful householder of Buffalo, New York.

"You said in your radio talk from WEAF a few days ago 'We will simply install an electric motor somewhere under the ice-box, or below it in the basement, or wherever we find it most convenient . . . . connect the whole affair with the house current which already shines in our lights and operates our vacuum cleaners or heats our irons—and the deed's done.' Do you mean that I can convert my old (new refrigerator, I should have said, for my mother bought it for me when I was married a few months ago) into an electric one or would it cost so much to do it that I'd better give up the idea?"

This listener refers to the talk that Mrs. Lilian Cassels gave late in May from WEAF. Did you hear this talk or any of the others of the series? I hope so. They were all very fine. In fact this series of talks on the electrical household impressed me so much that I went to see Mrs. Cassels as soon as Miss Cuthbert, the director of women's programs of the studio, told me that a refrigerator talk was scheduled for May.

The expert's suggestion to this writer applies to others in the same predicament. She said:—

"If you have a good refrigerator of sufficient capacity for your present and emergency needs; if a reliable dealer assures you that the insulation is right and that it is adapted to the installation of the electrical equipment, you need not hesitate to electrify your old ice-box. If, however, such an authority refuses to install his equipment you may be reasonably sure that his prime motive is to render you a service. In case a doubt still exists in your mind, consult another dealer or, better still, someone connected with the company that supplies your current."

If, like another writer whose letter also was received after Mrs. Cassels' talk, you are undecided just what type and make of refrigerator to select, study your own case from every angle. Mrs. Cassels wrote to her:—

"Choose the kind that will best meet your requirements. Remember that it takes more current to run an over-size than it does to operate the tiny apartment model. Do not, however, let extreme economy handicap you to the extent of buying one of too small a capacity. Food will stay fresh a long time in an electric refrigerator and you can often buy so-called perishable foods in quantity to advantage."

Getting ready for the refreshments. Notice that the little cakes of ice just fit into the glasses.
Photo Courtesy Kelvinator Company.

The question of expense of operation is one that according to the number of letters on the subject sent to every broadcaster of refrigeration talks—is all-important in many cases. Fair dealers dwell rather upon the saving of food and the convenience rather than the economy of operation.

A confirmed radio housekeeper from one of the New Jersey seashore resorts has given me a bit of encouragement that I am glad to pass along to any of our readers who may be hesitating to buy an electric refrigerator because rates are high their localities.

"When we finally made up our minds to take the step of buying our refrigerator," she tells us, "my husband was rather dubious as to the operating costs because the rates are so high in this town. We have found to our delight, that the current has cost us a little less than did ice for a similar period last season. Added to that we can count a very real saving of food not to mention the convenience."

Mrs. Cassels, too, is very definite on this point for she says without qualification:

"Now after watching the results of electric refrigeration over a period of months, in an apartment house where this kind (small) of kitchens exist, I can tell you that the one electric refrigerator has cost its owner, in electric current, just one-half what the other refrigerators in the building—ice cooled—have cost their owners. This besides the enormous saving in time and food effected by the electric."

In order, however, that there may be no misunderstanding on this point let me add the following information based on statistics supplied by public utilities companies.

It has been estimated that the average household will consume for electric refrigeration in active service the year round about 800 kilowatt hours of current in a year. This is said to be a conservative estimate.

Above—Lilian Cassels believes in electric refrigeration as this compact combination unit in her own kitchen proves.
Photo Courtesy of the Delco-Light Company.

A Wilmington, Del., correspondent, in writing to Station WCAU in Philadelphia from which a most interesting electric refrigerator talk was given a while back, raises a question that is frequently voiced.

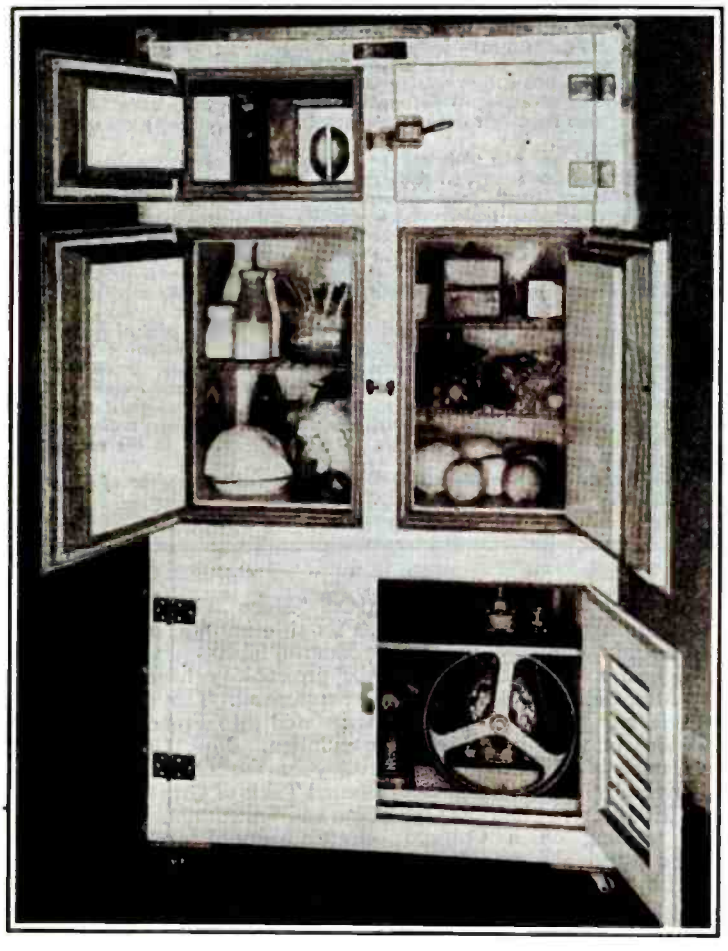
"Is it true that milk will keep for as long as two weeks without souring and if it is so, why?"

The answer was:—

"For several reasons, this is true. First electric refrigeration is consistently colder than ice refrigeration. If your mechanism is properly adjusted your food compartments will always remain below a fifty degree temperature, above which temperature bacteria molds and ferments may begin their destructive work, particularly in the presence of moisture which always exists to some extent in an ice-cooled box. Secondly, then, the electric refrigerator is dryer. Lastly the temperature is permanently unchanging.

"When, in the ice cooled box, the ice gives out or the doors are opened, the temperature begins to rise and the ferments that cause souring of milk and that are always present in the air begin their deadly work and in the presence of moisture their purpose is soon accomplished.

"On the other hand in the electric refrigerator, when the doors are opened, the machine automatically begins to work and the low temperature is maintained."



Another type of refrigerator, showing freezing chamber (upper left) where desserts are quickly chilled or frozen. The lower compartment contains the refrigerating machine which is accessible when the doors are opened.
Photo Courtesy Servel Corporation.

These advantages are most graphically described by a Chicago woman in a letter to a local station.

"One day, soon after I had placed my food supply in the refrigerator, a telephone call came for me to go to the bedside of my mother who was very ill in a distant city. I hurried right off without a thought of the things that I had put in the refrigerator. It was two weeks before we got back, and I could scarcely believe my eyes; the milk I had left in my electric was still fresh and sweet, the butter was as good as when I last tasted it, some tomatoes were perfectly firm and other vegetables were in a usable condition."

One of the greatest advantages of the electric refrigerator from my point of view (and my feeling on this point has been confirmed by many radio fans who have written in response to talks they have heard) is the possibility of preparing frozen desserts and salads with a minimum of trouble and work and of serving appetizing chilled foods at any desired time.

There is a special freezing chamber where you can actually freeze sherbets and rich, creamy desserts. Space forbids me to go into detail here on this point but I can say in general that the proper recipes to select are those containing a high proportion of cream, such as mousses or parfaits. Recipes that require constant stirring should not be chosen.

Mrs. Cassels, in her WEAF talk, gave some good suggestions on the subject of chilled foods. I wish, for the benefit of those who missed her talk, that I could repeat them here. However I am glad to be able to give you two excellent recipes that she has prepared especially for our readers. The salad, I think you will agree, is the best version of that kind of salad you have tried yet and the dainty gelatin

dessert that Mrs. Cassels created for this article you need not hesitate to have for your most elaborate dinner party.

There is little doubt in my mind that you will agree with the correspondent who wrote in the day after the talk to say that she felt sure that Mrs. Cassels really uses the electrical devices she describes in her talks or she could not seem so convincing. Mrs. Cassels' own apartment is the best proof that she has faith in her teaching. The kitchen would be a joy to any woman's heart. The illustration showing Mrs. Cassels at work near her electric refrigerator gives you a slight idea of what it is like.

Mrs. Cassels is a Westerner. She came originally from Portland, Oregon. However, she had her first business training on a Chicago paper and when she was left a widow with three small daughters to raise, she returned to newspaper work. With the task of keeping a roof over their heads and making it a real home, she saw that in order to swing both jobs she must herself instill love and beauty into housework. Highest efficiency in both depended upon finding every possible way to lighten the daily tasks. In other words, Mrs. Cassel first learned to respect the value of electrical equipment through its application to her own needs.

Her first electrical work was entitled "More Leisure Hours" and, as its title implies, deals with the wonderful labor-saving devices that the present-day housewife has at her command. This book has been translated into French for foreign circulation. Mrs. Cassels is secretary of the Electrical Women's Round Table of Greater New York. She has edited and managed the electric pages of several New York papers, edits and publishes The Electrical News Letter and has written booklets on lighting and electric equipment.

Two of Mrs. Cassels' Best Recipes For Use With Electric Refrigerator

Frozen Cream Cheese Salads

PLACE in a mixing bowl one and one-half cups of fresh cream cheese. Add to this 2 tablespoons salad oil, ¾ teaspoon salt, ¼ teaspoon paprika.

Mix until smooth; add one-half cup each of nuts, green pepper and pimentos (chopped separately) and one-half cup mayonnaise. Blend well together, then add lightly one-half cup whipped cream.

Place this in molds or in baking powder cans from which the frozen salad may be slipped and cut into round slices. Place the mold in the electric freezing compartment and leave it there three hours—or longer if desired.

Then remove from mold, lay on a bed of lettuce-heart leaves. Garnish with a radish rose and a ring of green pepper and serve.

Strawberry Sweethearts

MASH one pint of ripe strawberries, measure the pulp, add an equal quantity of sugar, measure it again. If not sufficient to make one and one-half cups, add a little water.

Place one tablespoon powdered gelatin in a cup, using in all four tablespoons water; dissolve it by covering first with cold and then with boiling water. Place cup in a pan of hot water on the back of the stove. Add two-thirds of this mixture to the crushed strawberries, reserving one-third for later use.

For your mold, use any plain one or a pan of pleasing proportions. In this mold fit two heart-shaped cookie cutters, the kind that are just open heart-shaped rings. Strain from the strawberry pulp one-half cup of clear juice; using about one tablespoonful of this, add a teaspoonful of the dissolved gelatin; then pour this mixture into the little tin hearts.

Now place the mold carefully in the coldest compartment of the refrigerator and leave it there until hard enough to hold the hearts firmly in place. Then remove any jelly that may have leaked out. Be careful not to break the hearts loose.

Now fill the hearts with the crushed fruit. Whip one-half pint of cream, add two tablespoons of sugar, whip in the remaining dissolved gelatin, lastly add the strained strawberry juice to color it delicately. Pack this whipped-cream around the hearts, so that strawberry pulp and cream will all be at the same level. Place in the freezing compartment until thoroughly set. Then loosen the heart molds with a hot knitting needle and lift (just the rings, not the jelly) out. Replace the dessert in the refrigerator to chill again.

When you are ready to serve it, turn the jelly out on a plate of glass covered with a dainty paper lace doily.

Technical and Hook-Up Section

SUN SPOTS *and* DX

Astronomical Theory Points to Bad Time for Distance Fans for Next Three or Four Years.

BY HENRY M. NEELY

JUDGING from the mail which comes to this editorial desk, the radio fans whose chief delight is hunting for the ultimate in distance are becoming very much dissatisfied with their favorite sport. It is complimentary but rather disconcerting to have many of them demand that this magazine do something about it. I only wish we could. Unfortunately our sphere of influence does not include atmospheric and solar conditions and so the only thing that we can do is to review what little knowledge we have of affairs and discuss the matter from this viewpoint.

Frankly, the conclusions which we reach are not encouraging to the DX fan. In fact, they may be summarized by a blunt statement that I personally expect DX reception to become less and less satisfactory until the period from 1928 to 1930 and during those years I expect the sport of hunting for distance to be given up entirely.

After 1930—if I am still on earth—I expect to have my radio set reach out farther and farther for another five or six years.

This prediction is based entirely upon what little astronomical study I have had time for but it has been more than confirmed during the past week by getting hold of the latest book by the Abbe Th. Moreux, Director of the Observatory of Bourges. This book is called "Astronomy To-Day" and is published in this country by E. P. Dutton.

Now, bearing in mind the dates of my prediction, consider what the good Abbe has to say about sun spots—

"We have still by no means measured the full extent of the sun's influence. Just as the photosphere seems to exert a direct effect upon the emission of heat, and thereby influences our climate, so the chromosphere, through those features which are themselves connected with the spots, acts as an electrical source which is always operating to alter the earth's magnetic field. This introduces us to a chapter of what I have elsewhere called endogenous meteorology which up to the present has scarcely been investigated at all. It is not my desire here to outline even the shadow of a theory, and I will merely say for the sake of clearness that when large prominences occur, our magnetic needle seems to play the part of a detector of wireless telegraphy; it is by its means that we learn about the electrical outbursts which have their origin in the sun.

"The abnormal deviations of the compass needle have long been familiar, but we needed all the delicate exactness of modern recording instruments in this particular department of physics to make plain to us the part which the sun plays in these perplexing phenomena. Since the researches of Sabine in 1851, however, the fact that the variations of the compass depend upon the solar activity has been placed beyond reasonable doubt; indeed, the parallelism between the curves of the two phenomena is striking.

"At the time when certain spots are crossing the sun's central meridian, or when large prominences are blazing out in the chromosphere, not only does the phenomenon produce a deviation of the compass but also the general electrical condition of our atmosphere is affected. The northern or southern auroræ suddenly shine in the sky, and light up the regions round the poles; powerful currents circulate in our telegraph wires, and sometimes interrupt telegraphic communication. During the latest solar periods, numerous examples of these disturbances have been collected, and the fact cannot now be doubted; the sun acts on the earth in the same way as a dynamo would act on a solenoid placed within the magnetic field.

"Similarly the so-called earth currents, which circulate from east to west and cause the compass needle to point towards the magnetic north, are due to the sun, and their alterations in intensity, as well as in direction, must be explained by reference to its electrical storms."

SUN spots increase and decrease in number and area in a fairly regular succession of minima and maxima with a cycle extending over an average period of about eleven years. Usually, beginning at a minimum, the spots increase very rapidly for about five years and then decrease more slowly until the next minimum.

The last minimum period was during the summer of 1923. There were few spots from then until 1924 when the number and the total area began to grow.

During this past winter we have been on the steepest part of this upward curve and the curve will continue to go up until the maximum which will occur some time between 1928 and 1930.

The fact that everyone all over the country has been complaining for the past year of a decreasing range in radio reception and the added evidence of the almost general dissatisfaction with the results of the last international tests seems to fit in very well with this unfortunate theory. I have seen in several of the magazines that the blame has been placed upon the Aurora Borealis but, as the Abbe Moreux shows, the Aurora is not the cause but is simply another effect of the increasing sun spots upon the earth's magnetism.

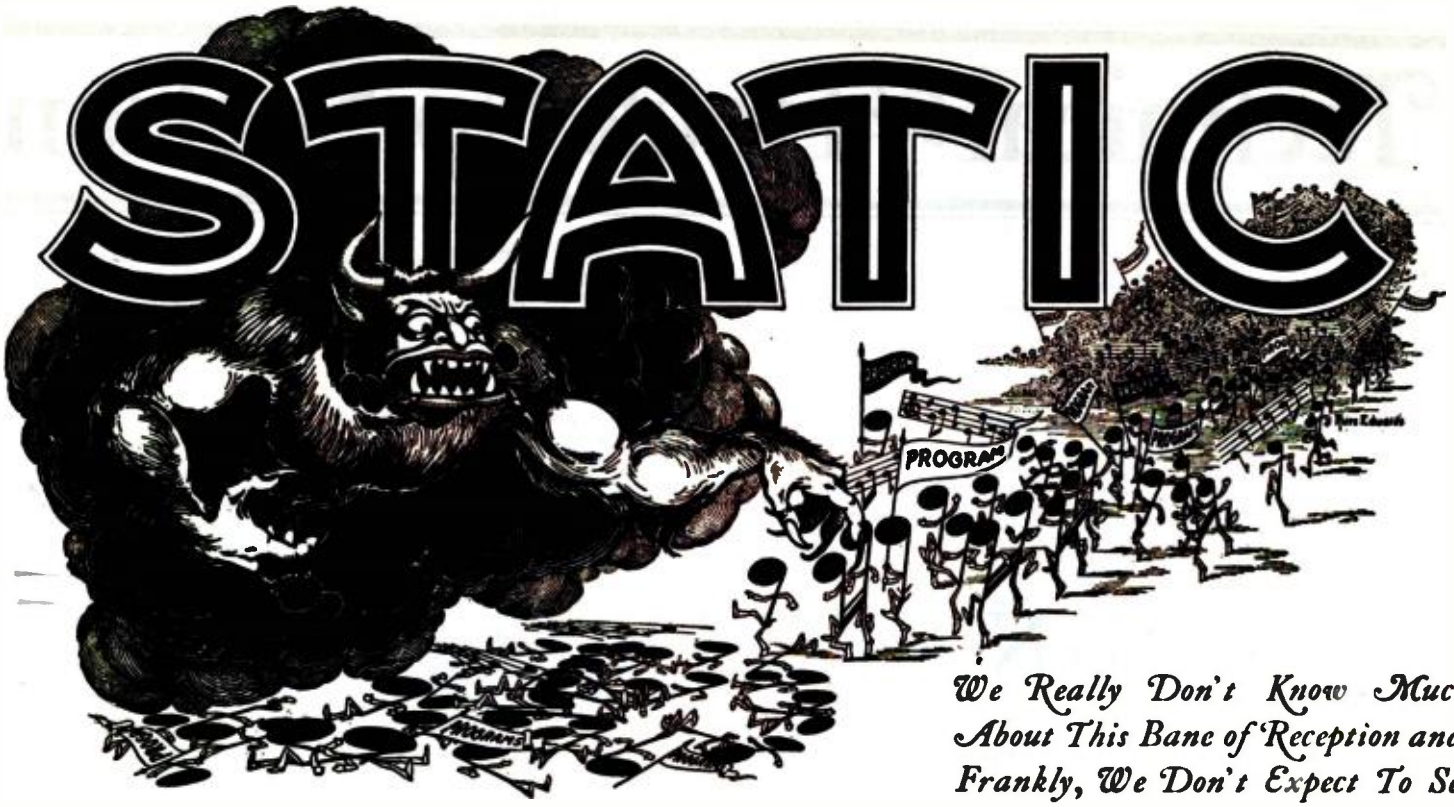
Radio fans are really now in a position to be of great assistance to astronomers by keeping accurate and dependable records of their hunt for DX as well as the behavior of nearby stations during the next three or four years. Physicists are advancing some extremely complicated theories to explain what causes the sun spots and how the spots themselves in turn effect the earth and every bit of added data is of value to them in checking up these theories.

Meanwhile — assuming that this astronomical theory may turn out to be correct—manufacturers and dealers would do well to concentrate their efforts on selling radio entirely *as a home entertainment attraction* giving absolutely dependable reception from local stations. If DX disappears for the next three or four years, it will indicate an increasing demand for the WEAF method of covering the country by wire link with the local station in each city broadcasting the program exactly as given in the studio in New York. This magazine has always been 100% in favor of this method and believes that this link service should be extended to include day-time programs for women as well as the present night time events.

In spite of the storm of contradiction which it will provoke, I have no hesitation in repeating a statement which I have frequently made—that no one has ever built a radio set which could be depended upon for consistent reception of perfect quality from any but comparatively nearby stations. If you put that distance at 100 miles, you will not be too conservative. Except in unusual locations, any reception from a greater distance is bound to be accompanied by distortion or noises or both and this means unsatisfactory radio.

There is no reason why any manufacturer or dealer should feel at all discouraged by the outlook here pictured.

More and more, we are getting evidence in this office that the influence of women is rapidly limiting the man's hunt for distance and I personally believe that the woman is becoming the greatest factor in radio.



We Really Don't Know Much About This Bane of Reception and, Frankly, We Don't Expect To See It Eliminated For Many, Many Years To Come.

By EDWARD B. PATTERSON

THAT static, atmospherics, strays, or X's, can cause annoying noises in the loudspeaker or head-phones everyone will agree. The noises of this particular class are not of the man-made variety but are caused by Nature probably in a bad humor. As these cracklings were detected from the earliest time, the possibility of poor programs serving to irritate Dame Nature seems entirely remote.

Since static insists on becoming offensive at this time of year, an outline of its characteristics followed by an article on devices for static reduction may be of interest. Accordingly the cause and nature of static will first be considered.

There is a wealth of scientific material on the subject of static as it appears to intrigue the scientists in practically the same proportion as it annoys the lay radio fan. In pawing over the dusty volumes as well as the recent reports we find one striking divergence of opinions which should be mentioned here at the start to show there still remains much to be learned about static.

One group of scientists insists that thunderstorms contribute little to the atmospherics which we hear.

The other group believes thunderstorms supply all the static.

Take your choice.

The thunderstorm in the minds of many radio fans is intimately associated with static and in this respect their ideas run along the same lines as the scientists of old who first put static to use.

Although we think of static as a total loss, nevertheless in 1895, Popoff, the Russian, found static useful. He connected a coherer (form of detector) to a lightning rod and discovered he could detect thunderstorms. Improvements on this storm detector were made by Lera in 1898 and in 1901 Fenyi of Hungary perfected a system which would record thunderstorms within a distance of 100 miles. In 1903 Turpain of France after extensive observations concluded that records of static were of use in weather forecasting. (1) Storm detectors of a similar nature are employed today by several electric light companies.

To get a bird's-eye view of the static situation we should consider the main groups of atmospherics. Static like Gaul has been divided into three parts.

DeGroot made such a classification after extensive work in the Dutch East Indies. The first was the "hissing" type and due to unidirectional discharges of electricity from a portion of the charged atmosphere in contact with the aerial.

The second was of the "clicking" type and was believed due to thunderstorms less than 500 miles away.

The third consisted of the "grinding" or "rumbling" static and was thought to be caused by the bombardment of the upper layers of the atmosphere by waves of cosmic dust or by electrons from the sun. The discharges under such circumstances would not be visible like lightning. (2)

The drawing on page 44 serves to illustrate in a general manner how these three classes of static are created. "Grinding" static may also be composed of distant "clicking" static.

As previously mentioned there is disagreement among the scientists on the sources of static. Nevertheless, it is generally conceded that the hissing static is caused by the aerial coming in contact with the charged air during snow, sleet, and rain storms. It is likewise conceded that this form of static is not common. However, actual storms are not necessary as during warm foggy weather the writer on board ships has observed the hissing static which in several cases lasted for hours. The hot gases from the stack passing the aerial strung above it may have been a contributing factor.

With the two remaining types there is disagreement as to which is the more intense. This may be due to the fact that in different parts of the world, where observers

THROUGHOUT this article you will find figures in parentheses. They refer by number to the following literature and are given for the benefit of those readers who may want to pursue this study more in detail.—

1 Fleming, Principles of Electric Wave Telegraphy and Telephony, pp 664, 1919
2 Proc. I. R. E. vol. 5, pp 72; 1917
3 Electrician (London) vol 69, pp 1015; 1912
4 Glazebrook, Dictionary of Applied Physics vol 2 pp 1044; 1922
5 World Power vol 3, pp 20; 1925
6 Nature 110, pp 680; 1922
7 Proc. Royal Society A, vol 103, pp 84; 1923
8 Electrician (London) vol 93, pp 150; 1924
9 Comptes Rendus vol 173, pp 843; 1921
10 Ann. d. Phys. vol 17, pp 383; 1922; and L'Onde Electrique vol 2 pp 7; 1923
11 Proc. Phys. Soc. (London) vol 37, part 2, pp 23D; 1925
12 Zenneck, Wireless Telegraphy pp 326; 1915
13 Proc. I. R. E. vol 7, pp 207; 1919
14 Proc. I. R. E. vol 8, pp 358; 1920
15 Proc. Phys. Soc. (London) vol 37, part 2, pp 32D; 1925
16 Electrician (London) vol 67, pp 20; 1911
17 Proc. I. R. E. vol 14, pp 133, 1926
18 Proc. I. R. E. vol 9, pp 28, 1921
19 Jnl. Franklin Institute vol 191, pp 619; 1921
20 Proc. I. R. E. vol 14, pp 7, 1926

have been stationed, conditions have varied.

Eccles of England and his friend Airey were active in making a study of static. Eccles stated in 1912 that strays are usually ascribed to lightning flashes between masses of charged air or between charged air and the earth, as every lightning flash produces a stray and every lightning storm within a few hundred miles of a wireless station produces strays of intensity according to the distance. But in the temperate climates it was found that strays were often abundant when there were no storms. Accordingly special receiving apparatus was set up in London and Newcastle, England. The same strays with the same intensity were observed at these two points at a distance apart and it was concluded the source of the disturbances must be at a considerable distance from England and that the source was probably in the tropics.

In an article on atmospherics at a later date he notes that static often occurs in the summer in temperate climates and extends during a few days over large areas and as these periods coincide with meteorological conditions such as usually accompany thunderstorms and other unstable atmospherics, it is supposed the strays are due for the most part to lightning discharges.(4)

Next a report of interest to those ambitious individuals who forecast static disturbances will be given. In 1915 a committee of the British Meteorological Office went on record with the following: Severe atmospherics accompany periods of low pressure (barometer), high wind velocity, heavy rainfall, rapid changes of temperature, and more especially rapid fluctuations of pressure.(5) You will note that about every cause possible has been included and any expert who wishes to choose his DX listening hours by consulting the weather map should have a busy time.

Later, Watson Watt of England, not satisfied with other investigations wished to find if thunderstorms were the only, main, or merely a subsidiary source of the atmospherics.

By special arrangements twelve of the English Government direction finding or compass stations were asked to submit reports on the direction of static. Comparing the observed directions of the atmospherics with the weather maps showing the area over which rain had fallen during twenty-four hours, 239 out of 288 cases indicated the apparent source of atmospherics was definitely associated with the rainfall area.

Watt therefore concluded that a very high proportion of the well defined sources of static was in areas in which rain was falling, and particularly on the advancing edge of such areas. More than 80 per cent of the cases observed during two years were in rain areas and 36 per cent on the forward edges. As a reason for this last observation he mentioned the separation and accumulation of charges caused by ascending currents is believed to be more pronounced on the forward edge and to be sufficiently marked for the production of electro-magnetic waves (6)

Appleton and Watt both of England decided to set up an oscillograph and actually look at static. Some of their curves compared with regular radio frequency impulses are shown in the accompanying drawing. Nearly one-half of the curves observed were of the aperiodic type with the approximate duration of 1/500 second. The other type was of the quasi-periodic form and seldom comprised more than a single oscillation.(7) The research involved in taking a look at static was tremendous.

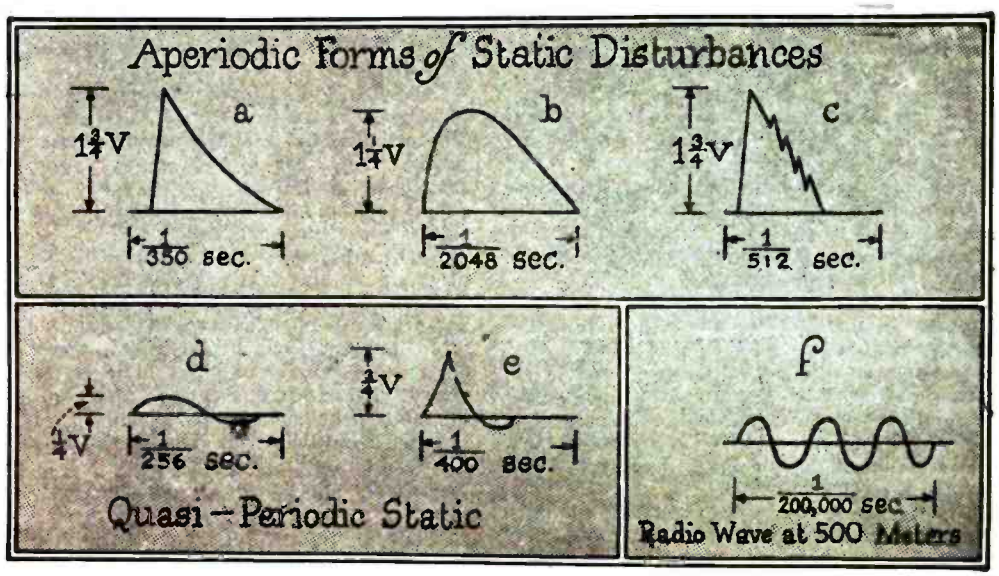
You probably want to know what these curves actually mean. The pulsations represented in the curves were believed to be capable of "shock-exciting" any receiving system. They would act on the tuned receiver in the same manner as a hammer blow on a tuning fork.

But the curves were questioned by T. L. Eckersley, also of England. Although not in these exact words, he said, "Gentlemen, your curves are very pretty and indeed of interest. However, if static is of the form shown by your observations, then the static problem would never have assumed the prominence it has. The strays you have shown would produce disturbances absolutely negligible compared with ordinary working signals."

Eckersley, after walking all over Appleton and Watt and their curves matematically, concluded that perhaps the little ripples on curve "C" might cause the disturbing form of static. After considering the huge amount of energy necessary to produce atmospherics he finally closed with the thought that it is difficult to see what other mechanism than an actual lightning flash can be concerned in the production of static. (8)

Rather than present too much of the thunderstorm evidence a few more foreign comments will be given before perusing the American reports.

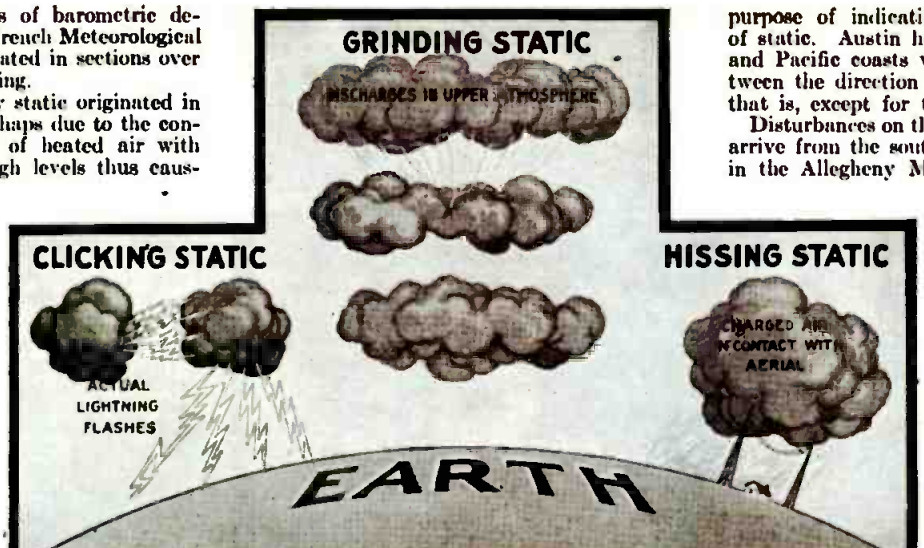
Smith-Rose of England has gathered together important observations of several French scientists.(5) Lacoste(9) and Rothe (10) from experiments at Strasburg found



static orignated in areas of barometric depression. Bureau, of the French Meteorological Office, found static originated in sections over which polar air was passing.

It appeared that heavy static originated in mountainous sections perhaps due to the convection of large masses of heated air with subsequent cooling at high levels thus causing a separation of electrical charges, which discharges would give rise to the atmospherics.

Watt also observes in a recent paper that the sources of atmospheries are located close to the cold front which lies along the barometer trough and in some cases atmospherics have originated in regions of barometeric minimums where no storms have been reported.(11)



Zenneck, after digesting reports of other scientists, came to the conclusion that atmospheries seemed to originate primarily in lightning discharges between two clouds or between a cloud and the earth. The fact that static is observed on clear days, he claimed, was not contradictory to the theory as the distance over which clouds can be seen is very small as compared to the distance at which the lightning stroke can affect a receiver.(12)

The possibility of static coming down from above due to discharges occurring in the upper atmosphere as distinct from actual visible lightning is supported by several scientists DeGroot and Airey previously mentioned, were believers in such a source. Weagant(13) and Pickard (14) of America and Wilson(15) of England are friendly to such a theory.

Wilson recently showed mathematically how this "upside down" lightning might actually occur at the high levels as the electric field of the clouds could cause ionization at great heights with the result that a continuous or discontinuous discharge between the cloud and the upper atmosphere would take place. Atmospheries would be produced but the discharges would not be of the visible variety.

Pickard, starting on the assumption that the sun was responsible for all the electrical activities on the earth showed the possible discharges which might occur in the upper atmosphere as based on Airey's theory.(16)

We are now ready to consider the research of a very noted authority whom we have not mentioned as yet. He is L. W. Austin of the Bureau of Standards who has devoted years of his life to the study of radio waves and factors affecting reception. He has specialized on the habits of static in this country and has compiled many instructive reports, parts of which will be mentioned.

He observes that static is stronger in the summer than winter, in the south than in the north, on the land than on the ocean. Disregarding local conditions, static is nearly always stronger in the afternoon and night, and on the low wave-lengths the increases appear confined to the night.(17) It is recognized the position of the sun has a definite bearing on the intensity of static.

Austin has found static increases rapidly with the wave-length being on an average about twenty-three times as strong at 17,000 meters as at 3,000 meters. The increase appears roughly proportional to wave-length.

At Washington there is a well marked minimum of static at about 1.30 AM and again about daylight. There are other minima but these shift from day to day and vary with the seasons.(18)

From this we may be glad that broadcasting is on the lower wave-lengths. For the radio fan who is not particular about the hours he keeps, it may be possible to choose hours to listen-in for distance at which time the static level is at a minimum.

Austin believes there are two types of static in respect to tuning. One type gives a pure "shock" effect and is heard simultaneously over a wide range of wave-lengths and the other gives crashes which are not heard simultaneously at all wave-lengths.

The latter is called the spectrum type and seems to consist of a large number of independent waves of different lengths forming a continuous spectrum, so that to whatever wave the receiver is tuned a corresponding static wave is obtained. The directional static appears to be of this type.(19)

He does not think static is composed of only the single pulse or aperiodic type which purely shock-excites the receiver (see curves), since none of the aperiodic types of artificial static produced in the laboratory have been nearly so difficult to eliminate as the natural disturbances.

The clicking and hissing forms of static do not appear to Austin as being very annoying. The grinding or rumbling static creates the havoc. This last type probably originates somewhere in the upper atmosphere and is propagated in the same manner as radio signals sent from an airplane.(18)

Austin also notes that if the disturbances originate in the upper atmosphere by discharges between air bodies at different potentials, it is difficult to understand how such discharges, which give rise to electrical waves more powerful than those from the largest radio station, can take place without luminous phenomena.(19)

Thus far we have paid close attention to the nature of static; now let us see where the disturbances noted in this continent are created.

On the accompanying map of the country you will see little arrows which are for the purpose of indicating the general direction of static. Austin has found on the Atlantic and Pacific coasts very little connection between the direction of static and rain areas that is, except for thunderstorms.

Disturbances on the Atlantic coast generally arrive from the southwest and may originate in the Allegheny Mountains or in Yucatan. At New Orleans static comes from the south and southwest.

On the Pacific coast conditions are absolutely different as the static sources appear to be local. The nearby mountains seem to be the atmospheric factories and for this reason static is very directional.(17)

At San Francisco and San Diego static comes from a sharply defined easterly direction and in the northern part of the coast at Bremerton Mt. Rainier is accused of being a static source.

Porto Rico receives its static supply from two sources. Static arrives from a direction about south-southeast probably from a center in South America and also from direction a little north of west from a center in Mexico. This Mexican source probably supplies the Atlantic coast of the United States.

The central section of the United States around Madison, Wisconsin, however, is in a class by itself as here static comes from no prevailing direction.

Thunderstorms and rain areas seem to be main sources, according to E. M. Terry of the University of Wisconsin.(17)

In a letter to the writer, Dr. Terry who has been conducting the tests at Madison on the directions from which static is received says: "We found that we have relatively little static of the 'grinders' type here in the Mid-West. Ours is almost entirely of the 'click' type, and seems to come largely from the thunderstorm areas. In fact, in many cases we were able to trace storm areas across the continent by means of our direction measurements alone. We did not find that any preponderance of static coming from the direction of Mexico."

From the foregoing it can be seen that conditions vary in the different sections of the country. However, it is of interest to note the international check on static which has been made at Riverhead, Long Island, at Belfast, Maine and in England by engineers of the A. T. & T. Company.

The effect of static on reception was generally similar in both countries and the major source of the static on the long waves was found to be of tropical origin.(20)

The various opinions of the world's leading scientists have been presented in order to give a general idea of static, its nature and causes.

Now comes a question paramount in the minds of all radio fans:—Can static be eliminated? Frankly, no devices in the past or present have succeeded. Furthermore, it is not believed any device of the future will eliminate static.

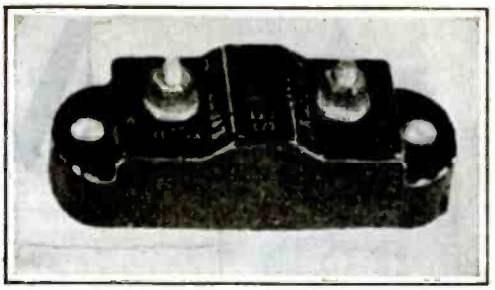
Well, then, if no device eliminates static, how about those which serve to reduce static?

That is another story. It will appear next month.

Lightning Is NOT Dangerous

By

LESLIE G. BILES



The Sensory Lightning Arrester.

OF all your acquaintances who have radio sets, have you ever heard of a single one who has had his aerial struck by lightning? No; and you never will—that is, if the proper protective measures are taken when the antenna is installed.

Well, if there is no danger from lightning in this respect, why all the talk and fear of the aerial in summer time? The talk, in common with much of the usual advice freely given, is dispensed by those who know nothing of the subject on which they speak.

You can believe it or not, but we know of several individuals who, only a few years ago, actually took down their aerials in the summer time because they were afraid of lightning.

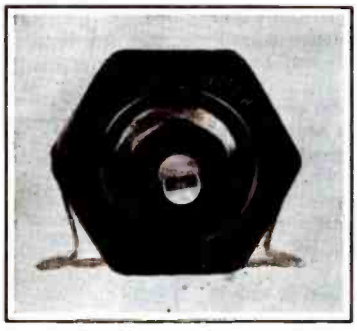
They do not do it now because they know *the aerial is one of the best forms of protection from lightning.*

Taking the aerial down in the summer is absolutely as silly as taking the lightning rod from the dwelling or barn just as soon as the warm months and the thunder storms roll around.

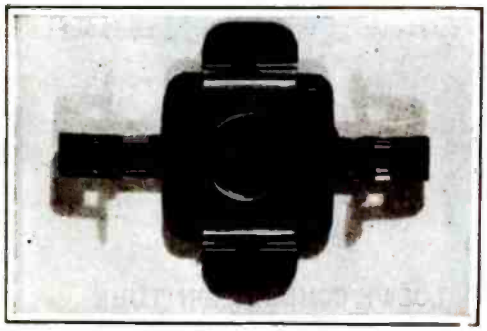
To understand the function of the aerial, consider the action of the lightning rod. It prevents the atmosphere over the building from storing up a charge of electricity because the little charges which may accumulate are passed on to the ground.

In the same manner the properly grounded antenna provides a leakage path for the atmospheric electricity to the ground.

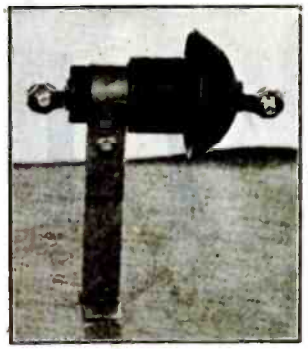
The Brach Lightning Arrester.



The Keystone Lightning Arrester.



The Micamold Lightning Arrester.



The Wirt Lightning Arrester.

There are cases where this ridiculous fear of lightning has led to very foolish extremes. What about the person who detaches the aerial lead-in from the set and then throws the wire out of the window, on the assumption that such a procedure prevents any damage? Technically speaking this is "flirting with fate."

The aerial hanging free and not connected to ground begins to store up the tiny electrical charges, which are present in the air in large quantities during electrical storms. As time goes on, the charge becomes greater which enhances the possibility of a lightning stroke between the aerial and the thunder clouds overhead. It is only under such a circumstance that an aerial may be considered dangerous.

It used to be that aerials were provided with lightning switches, and the operator during severe storms when communication or reception was impossible, would throw the switch and connect the aerial direct to the ground wire. Little safety gaps—needle points or brass strips spaced a hundredth of an inch apart were and still are to be found on the marine radio sets. One side of the gap is connected to the aerial and the lead to the receiver and the other side to the ground. When the aerial accumulates a small charge of electricity a little spark jumps the gap and the charge is passed to ground. Even when the sparks are hopping across the gap in frequent succession, the operator still sits at his post.

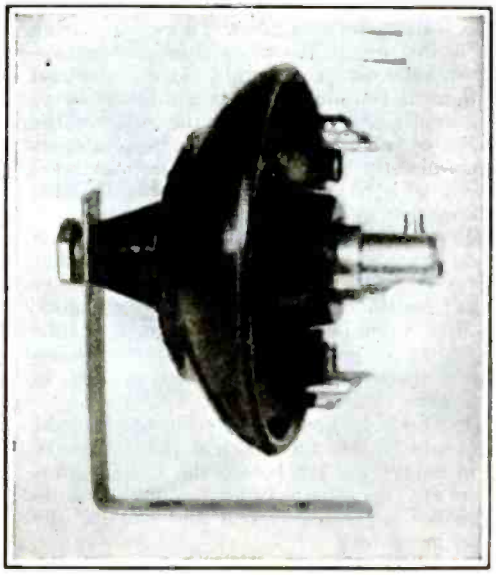
It can be seen that as long as a leakage path to ground is provided, the aerial will act as a protection and many little devices to provide this leakage path have appeared on the market. They have an advantage over the switch in that they are automatic and always ready to act whereas the switch has to be thrown and may be forgotten.

One side of the aerial is connected to the lightning arrester and from here to the aerial post on the receiver. The other side of the arrester goes directly to the ground.

However, it is important to bear in mind that the lightning ground must be a good one (that is, a low resistance ground) or else there will be no leakage path for the electrical charges.

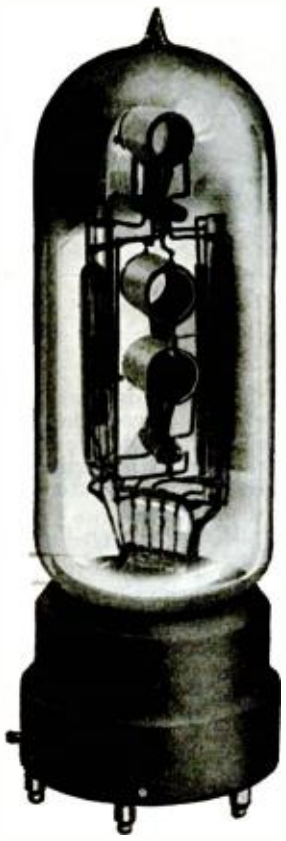
It should be remembered in making your connections from the arrester to ground that the Underwriters' regulations specifically state that in all cases the ground wire should be as large as, or larger than, the lead-in wire.

The water pipe is usually the best available ground connection, but in cases where it is necessary to make a ground by driving a pipe in the soil, be sure it comes in contact with moist earth.

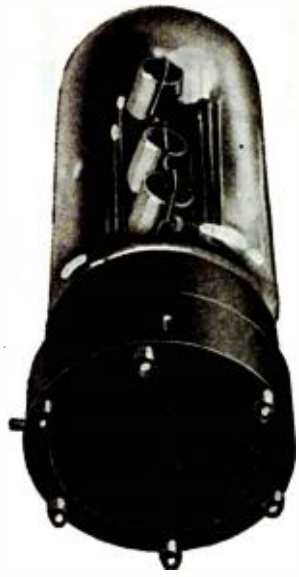


The Storm Guard Lightning Arrester.

MORE New TUBES



Combination tube with self-contained resistance coupled amplification system.



Another view of German combination tube developed by Loewe.

By EDWARD B. PATTERSON

PART TWO

IN THIS second article, Mr. Patterson goes more thoroughly into researches on the operation of tubes from the house lighting electric supply. It should be emphasized that readers must not expect these tubes to be immediately available in the stores. Not only are there many problems of commercial production to be solved but patent uncertainties also stand in the road of manufacture and sale. H.M.N.

IN THE article on "New Tubes" appearing in last month's issue, a three-in-one tube (a tube with three grids, three plates and a filament contained in a single glass cover) was described. In addition the steps in the design of tubes with renewable heaters operating directly from the house current were traced with a view to giving more detailed information in this follow-up article.

However, a development has recently been made which should be given attention here at the start. Three-in-one tubes with self contained resistance coupled amplification units, all in a vacuum under the same glass tube cover, have put in an appearance—tubes which almost amount to receiving sets in themselves.

Dr. David L. Loewe, of Berlin, has brought the tubes to this country and plans to have them on the market before the Fall months. There are two general types, one for the radio frequency amplifier system and one for the audio amplifier.

The accompanying drawing shows the construction of one of these audio amplifying units consisting of a detector and two stages of resistance coupled audio amplification. The three grids and plates are clearly visible, one on top of the others. The plate resistances, grid leaks, and the coupling condensers have been placed inside of the glass rods. Other rods act as supports to the elements of the three tubes. The coupling condensers are rolled up thereby having a cylindrical shape and are not of the square or oblong types so familiar to American radio fans.

According to Loewe, the coupling condensers and the resistances are in a separate vacuum of their own as the glass rods have also been evacuated and sealed in the same manner as the outside glass cover of the whole tube. The drawing shows the general positions of the various units with respect to one another.

The combination feature can be employed for radio frequency amplification and several different forms have been designed for the purpose. It is claimed a tube with two or three double grid units overcomes difficulties previously encountered in resistance coupled radio frequency amplification for the broadcast band.

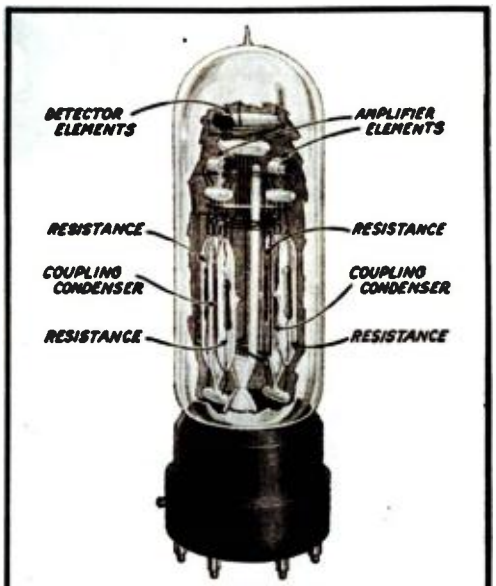
A model of the Loewe R. F. tube is shown in the accompanying photographs at the top of the page. Note how its construction differs somewhat from the combination audio tube.

At this writing, none of the tubes has been available for test at our laboratory and therefore we are not prepared to go on record as to the efficiency and actual operating qualities but as far as compactness is concerned, the combination tubes are beautiful jobs. Perhaps at a later date we will further consider the Loewe multiple tubes, which are said to be well received by European radio fans.

Rather than continue at once with the description of the AC tubes started last month, it may be of interest to learn what some of the leading radio authorities have to say on the subject of these tubes in reply to letters sent them by the writer.

Dr. J. H. Dellinger, Chief of the Radio Division of the Bureau of Standards, is quoted in part as follows: "The desirability of operating electron tubes on alternating currents instead of batteries has been recognized for many years. As far as actual practice is concerned, the progress to date has been in the direction of providing special devices which convert the alternating current from a supply system to sufficiently smooth direct current for use in the ordinary tube. There have been many steps taken in the direction of providing a satisfactory type of special tube which could be operated directly on the alternating current supply. These steps have been taken at various times in the past ten years."

At this point Dr. Dellinger mentions the tubes described by Freeman and Morecroft and the equi-potential cathode of the Nicolson type mentioned in the last article. He



LOEWE COMBINATION TUBE.

also calls attention to the Hull tube which will be considered later on. He further states:

"While the tubes of the various kinds mentioned have accomplished reasonably well their aim of producing a real equi-potential cathode, thus eliminating one source of 60 cycle hum produced in apparatus using such tubes, it nevertheless remains very difficult to produce a tube satisfactory in every respect with the hum entirely eliminated.

"Electron tube apparatus is so extraordinarily sensitive and the presence of an alternating current power supply sets up such powerful electric and magnetic fields that the problem here attacked is one of great difficulty." In conclusion he says, "It will be most interesting to see whether tubes of this type will supersede the other much simpler electron tube of the ordinary filament type."

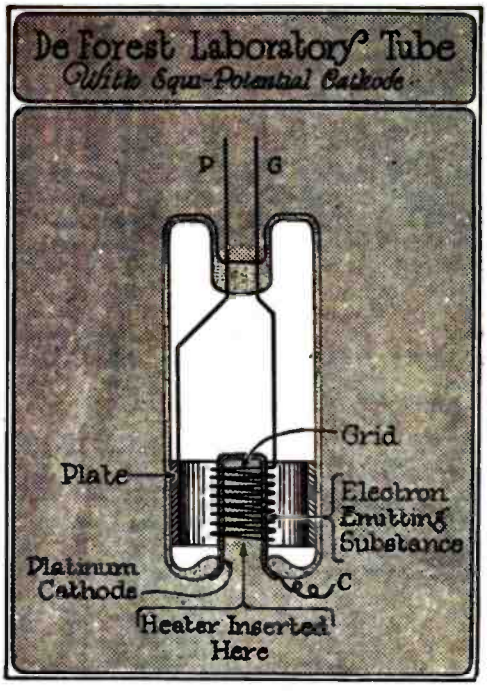
Dr. Lee DeForest, inventor of the audion, remarks:

"So far as I know the tubes which are designed to operate from alternating current are constructed along this same line—a thimble cathode coated on the outside with electron emitting substances and containing a wire wound heating unit which may or may not be in the evacuated vessel—preferably outside thereof."

He explains that such a construction is by no means new. As far back as 1918 he worked out a power tube utilizing the alternating inductive magnetic field between a large coil inside the evacuated space and a smaller coil containing iron core slipped into a glass sleeve projecting into the evacuated vessel.

He is not very optimistic over the future of the AC tubes as can be seen from the following:

"The problem of using tubes on alternating current and supplying the heat by one of the above mentioned methods has always been an interesting one and offers some prospects of a practical nature. However, with the already abundantly demonstrated practicability of some of the best A and B eliminators now on the market, the advantages of the



Tube devised ten years ago was not successful on account of sealing difficulties.

other method of using alternating current for cathode heating appear to me as secondary.

"With a good A and B eliminator operating on alternating current, it is so easily possible to do away with both types of batteries and use the standard tubes—but I do not believe that the other method will prevail in competition, particularly now that the life of the vacuum tube has been greatly lengthened and the cost placed at such reasonable figures."

Dr. Irving Langmuir, authority on vacuum tubes and research engineer of the General Electric Company, says:

"There is a real need and wide field of application for radio receiving sets deriving their power from the alternating current house lighting circuit. There is a question, however, as to what method of AC drive is preferable from the viewpoint of the user."

Here he outlines the various arrangements such as the vacuum tube rectifiers to change AC to DC, A and B battery substitutes, storage batteries with chargers, and the AC tubes in which the electron emitting source is made active by some form of heater. He adds:

"So far experience has not clearly indicated which of these is the best method, nor whether any one form will meet the demand for all cases of AC drive.

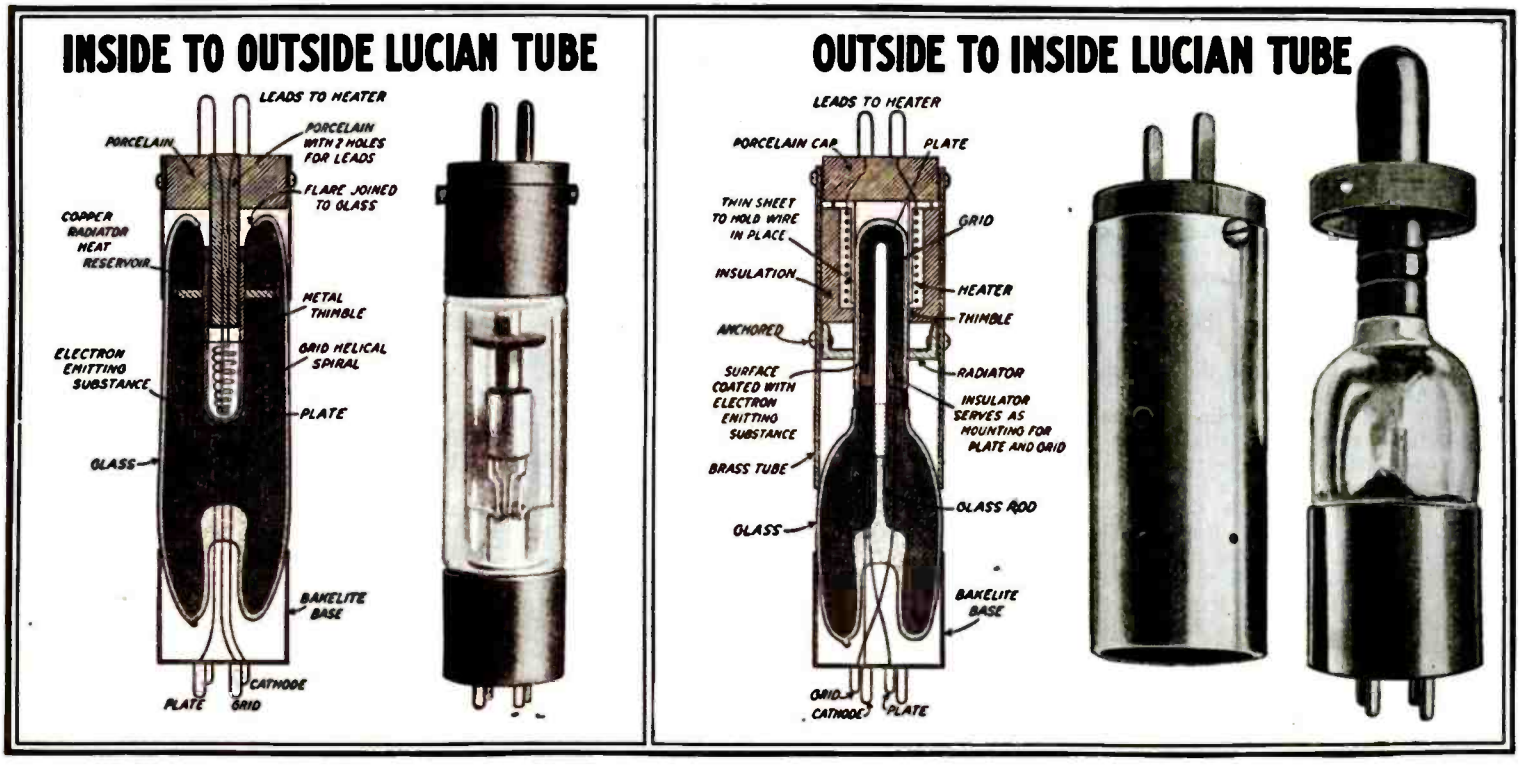
"Several forms of AC tubes have been proposed. In one form there is an external heater, the heat being conducted through a metal tube to cause electron emission on the vacuum side. Such a form does not with the present technique of design and manufacture seem practical, as it is difficult to maintain a high vacuum in a container with red hot walls.

"Although theoretically such tubes possess certain advantages in special circuits, they do not lend themselves to present methods of radio receiver design. In a few years, when more types of receiver circuits have been standardized, it may be possible to derive benefits by the use of such tubes. At present they would increase rather than decrease the cost of a good receiving set."

He concludes with the following thought: "All of the possible methods of AC operation are being actively worked upon *and it is certain that in the not distant future the best method or methods will become apparent and available to the radio public.*"

Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America, replies with the following statement:

"Your letter relative to equi-potential tubes, with enclosed or replaceable heaters, and with a multiplicity of grids and plates, opens up an interesting field for speculation. However, the subject is an extremely complicated one. . . . It is, furthermore, a field



still under extensive research and technical development in a number of directions and it is perhaps not timely to draw conclusions as to the future of these devices."

The attitude of the Westinghouse Electric and Manufacturing Company, who like the companies named above handle large quantities of tubes, is one of silence at the present time. The superintendent of radio operations, C. W. Horn, regrets to inform us that he is not prepared to make any comments concerning alternating current vacuum tubes.

Dr. A. Hoyt Taylor, superintendent of the radio division of the Naval Research Laboratory, replies:

"This Laboratory has not been authorized to undertake, or to make public, any information concerning the type of tubes in which you are interested. You can readily understand that since on battleships the main supply voltage is direct current, our interest in such tubes is not as keen as it might be if we were required to work with alternating current supply. We are, of course, interested in any kind of tube that has an exceptionally long life."

As you glance over these various statements, one thought perhaps stands out in your minds, namely: we have at our command different methods of securing power for the operation of our vacuum tubes. Time will show which one or ones prove to be the best.

Added to this fact the purpose for which a receiver is to be employed will also control the type of tubes and receivers and the source of power supply. The dry and storage cells will have their following and the AC systems will have theirs. In this respect it is interesting to note that although there is a trend toward AC products, *one very prominent dry battery manufacturer has found business increased more than 50 per cent over last year.*

We have not included the foregoing statements to dampen the enthusiasm prevalent in many quarters over the new types of AC tubes. Everyone should want to see new developments, particularly along the lines to be discussed.

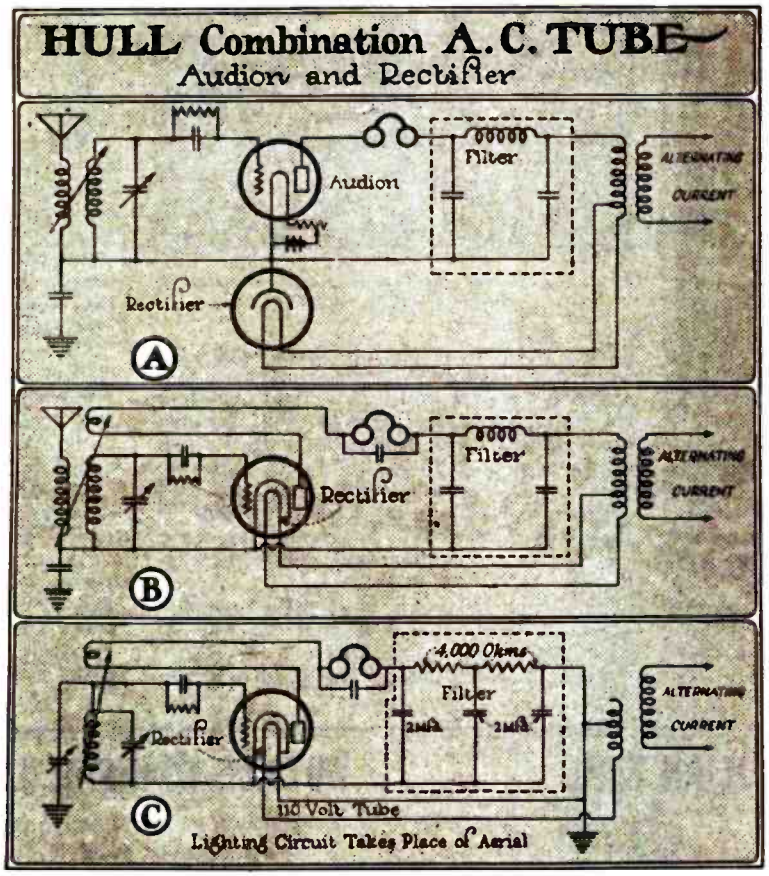
In the last article we found the regular wire filament of the vacuum tube did not take kindly to the application of the alternating current. Although in several cases AC has been and is applied to the ordinary filaments with a degree of success, nevertheless the field has been open for another construction.

The vacuum tube requires a source of electrons. In the ordinary tube this source is the heated filament wire. But a thimble cathode coated with an electron emitting substance designed to give off a stream of electrons at a comparatively low temperature has been used in place of the filament wire. The advantages of such a cathode over the usual wire were mentioned last time.

This "equi-potential" cathode by its nature lent itself to the application of AC for heating purposes. The cathode of thimble shape was coated on the outside with the electron emitting substance which was in the vacuum portion of the tube. The inside of the cathode was on the outside of the vacuum and hence wire-wound coils connected to the AC mains for heating purposes could be removed at will.

Since the heater of the vacuum tube is the vulnerable part and likely to burn out, the renewable heater has been considered a means of giving the tube a long life.

In a recent letter, C. V. Logwood, formerly associated with Dr. DeForest, calls attention to the fact that in the DeForest laboratories a rather crude form of equi-potential cathode was used for experiments as far back as 1916.



The accompanying drawing shows the general construction. The cathode of thimble shape could be heated by the usual electrical method or by an actual flame. The tube was not successful because of the difficulty of sealing-in such a large piece of metal.

An AC tube with a renewable heater which is attracting rather wide attention has been developed by Dr. A. N. Lucian of the University of Pennsylvania as a result of experiments conducted over a period of years with X-ray tubes. Without going into the details of his early work it is sufficient to say he desired to perfect an indirect heater for the X-ray tube.

As radio came into prominence he saw the possibility of applying this principle of indirect heating to the vacuum tube. After considerable experimental work in which he even had to blow the glass himself he has brought his tube to an actual working state.

The indirect heating principle can be applied in several different ways, two of which will be illustrated. These Lucian tubes require the regular B supply for the plates but the heaters, separate and distinct from the inside of the tube, are connected directly to the house lighting circuit, without resorting to step-down transformers.

One of these tubes in the accompanying layout marked "Inside to Outside" shows the heating element directly in the center of the equi-potential cathode which in turn is surrounded by the helical grid and then the plate. The drawing of the internal construction clearly indicates how the tube is built.

The metal thimble has a special construction suitable to hold the electron omitting coating. Barium, strontium and calcium oxides form the coating. The heater consists of turns of wire wound either inductively or non-inductively.

Since the thimble is of metal and the outer portion of the tube is glass it is necessary to find the metal and glass combinations which expand and contract at the same rate under heat or else the vacuum represented by the shaded portion cannot be maintained. Likewise it is of prime importance to use a cathode of material which will not become porous. To prevent heat from attacking the metal-to-glass joint, a heat radiator or reservoir has been provided. The diagram indicates how easy it is to remove or slip the heating element out of the tube.

Another form of tube marked "Outside to Inside" while retaining the same features as the first one has the elements in reverse order. The heater is on the outside of the vacuum portion and surrounds the cathode, etc., as shown in the diagram.

This particular tube can be operated with a flame from a Bunsen burner or other suitable source. However, Dr. Lucian has assured me he has no intention of designing tubes for gas stoves or open fire places.

Conduction of heat from the metal-to-glass seal is prevented again by means of the radiator which in turn is joined to a brass plate exposed to the air.

Dr. Lucian claims the life of the electron emitting substance on the cathode is extremely long and that the tube can be made with various amplification constants and also in the "hard" and "soft" varieties just as can be done with ordinary tubes. It is understood the Lucian tubes will be available sometime in the Fall months.

The tubes work in radio frequency as well as in audio frequency circuits and the working models have the same general characteristics as the power tubes now on the market. The heater consumes from 15 to 18 watts.

Very recently another tube of the "filamentless" type has been designed by E. B. Meyers in the laboratory. A section of this tube is shown in the accompanying photograph. This tube requires the regular B supply but its heater operates directly from the alternating house current.

Here again we find the equi-potential

cathode and renewable heater feature. The photographs of the various stages in the tube construction clearly show the essential parts.

On the left (1) is the special heat resisting material on which is wound the non-inductive wire heater. This in turn slips into the cathode. (2) The outside of the cathode is coated with the usual oxides which give a copious supply of electrons when heated to a comparatively low temperature. Instead of the usual helical wound wire grid Meyers has resorted to another form (3).

A large grid control surface was desired to handle the electron flow from the cathode to the plate of the tube without too large an increase in the internal tube capacity.

The grid is stamped out of a sheet of metal in such a manner that little flanges or flaps are arranged with their large surfaces on lines drawn from the center of the cathode. The grid somewhat resembles the radiators of certain automobiles. Hence when the grid is placed around the cathode the only parts exposed to the cathode and plate are the very thin edges.

The grid is supported by the little caps which are slotted (4). The plate which is placed around the grid is also held in place by the slots as shown (5). You will note the heater is threaded and can be inserted and removed at will.

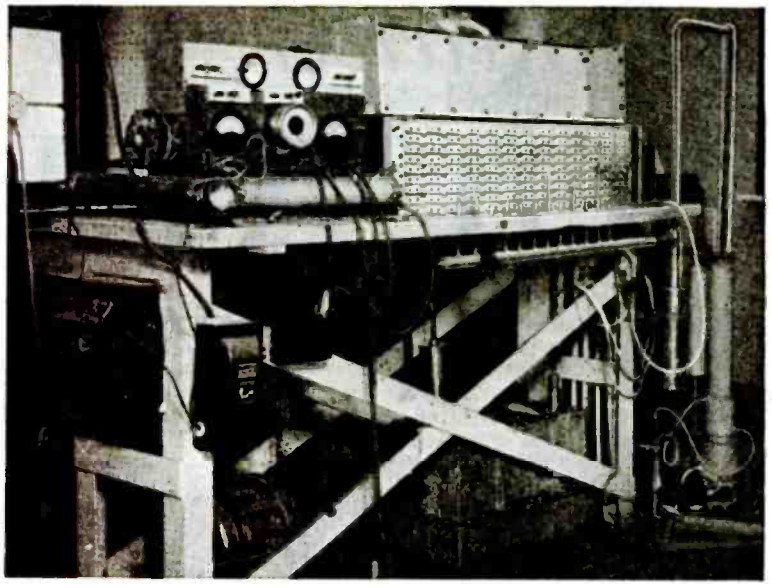
The tube with the glass broken and without the grid and plate in position appears (6) and the completely assembled tube is reproduced (7).

Meyers, in outlining the characteristics of the AC tube which he has designed for a well-known receiver manufacturer, stated that tubes having an amplification constant as high as 100 have been built. The cathode of the tube operates at approximately 630 degrees centigrade and the heater consumes 16½ watts.

So far we have described tubes having renewable heaters operating directly from the AC lines. They require the regular external B supply as other tubes do.

Now what would you think of a tube which requires no external B supply at all, this supply unit being incorporated inside the tube itself?

Yet such a tube is a reality and was built several years ago. When, if ever, it will appear on the market is not known. This combination tube consists of the regular three element audion and kenetron or two element rectifying tube.



Section of tube laboratory in which an AC tube was recently designed by Meyers.

These two tubes have been joined together, so to speak, and placed under one glass cover and in one vacuum. Instead of using five elements only four are employed, one element serving a double purpose.

This tube was described in the Proceedings of the Institute of Radio Engineers of April 1923 by Dr. A. W. Hull of the research department of the General Electric Company. Unfortunately this company does not care to release any information on this interesting tube.

Nevertheless we have the original circuits for a very compact one tube receiver, requiring no aerial, A or B batteries, etc. A really portable receiver requiring only a ground and house current connection is made possible with this novel affair.

In the circuit diagrams marked "Hull Combination Tube," the diagram A shows the fundamental circuit of the ordinary tube with its A battery and a plate supply unit consisting of a rectifier and filter operating from the alternating house current.

In the diagram B a slight change has been made. Here the two element rectifier has been placed inside the equi-potential cathode of the tube in A. We have combined the features of the two tubes and have made the equi-potential cathode serve as the anode for the rectifier and cathode for the audion.

Such a combination tube is extremely simple and compact. The filament or heater of the tube can be made for various voltages as can be done in the case of the other tubes and the construction of the tube in other essentials is also flexible.

The Hull tube does not have the renewable heater feature but neglecting the combination arrangement, the tube remains in other general respects, the same as those just considered.

The circuits in A and B call for an aerial, ground and house current connections. The circuit in C, however, dispenses with the regular aerial and the house wiring is allowed to function as the energy collector. The ground is used as shown.

Inasmuch as the resistance capacity filter has been included for smoothing out the pulsating direct current from the rectifier, and since the plate voltage is only 60 and the current 5 milliamperes, the filtering unit does not require a large space. The transformer connecting to the house current does not need to be large. The tuning coils with the movable tickler for regeneration and the two variable condensers will, of course, need the usual space.

Taking everything as a whole it can be seen the receiver can be put in a very small box.

The Hull tube has been made with an amplification constant of 27 and a plate resistance of 18,000 ohms.

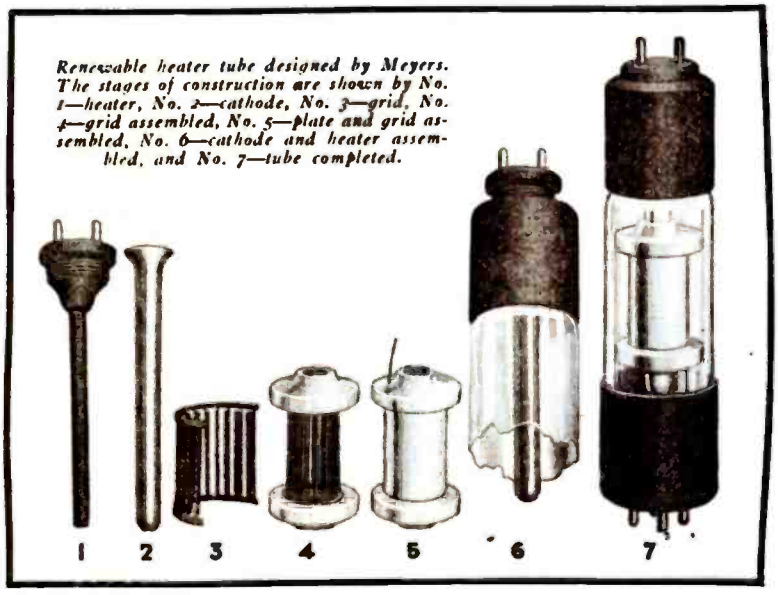
The cathode is of nickel and coated with barium oxide for the electron emitting substance. The heater is the filament of a standard tungsten helix such as used in the gas-filled tungsten lamps.

In the foregoing we have endeavored to present a general outline of important AC tube developments inasmuch as they have a bearing on the future and hence the radio fans' pleasure.

Tubes which are known have been discussed but it must be expected there are some developments still hiding in the dark files of the Patent Office, the laboratory, or other places and will be brought out when the parties concerned are good and ready to do so.

From a brief survey it appears the patent situation may be complicated. In the last article we mentioned the patents of Nicolson, covering the equi-potential cathode dating back to 1915. One year before this Round of England described in patent papers an equi-potential cathode and yet another year back Kelly described a cathode for an X-ray tube.

The multiple tube with a plurality of grids and plates has been known to the art for a considerable length of time. E. B. Meyers told the writer that a tube of this type was built and operated in the De Forest laboratory while he was there some years ago. Dr. De Forest was inclined to look upon the tube as a freak and for various reasons and perhaps an obvious reason, it was never placed on the market.



Renewable heater tube designed by Meyers. The stages of construction are shown by No. 1—heater, No. 2—cathode, No. 3—grid, No. 4—grid assembled, No. 5—plate and grid assembled, No. 6—cathode and heater assembled, and No. 7—tube completed.

A Receiver For QUALITY Reproduction

"Bass Note" Set is Designed For Those To Whom Pure Music and Speech are First Essentials to Radio Enjoyment.

By T. T. WILLIAMS

WHICH type of set is best to build? This problem perplexes most of us, and yet after looking over the many radio periodicals and newspaper sections the question becomes even more involved. Evidently, there never was a "bad" set described in print; at least so most articles lead us to believe.

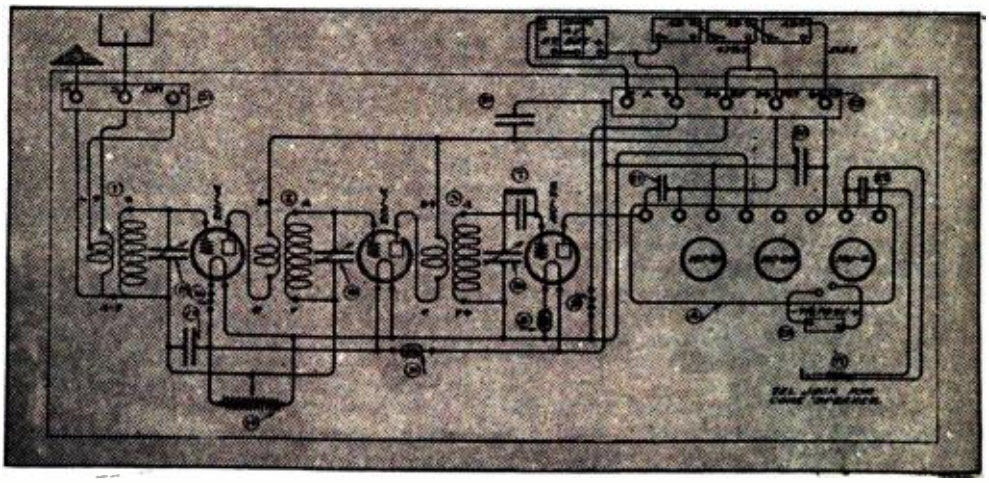
With this in mind the writer will deal with the construction design of a new set called the Daven Bass Note receiver. How it got its name is quite simple—the resistance coupled audio amplifier built according to modern engineering practice is especially designed to give perfect loud speaker reproduction including the evasive bass notes.

In this article truthfulness will be the watchword—all superlatives will be dropped since there is nothing gained by claiming every good thing under the sun, as many writers do in describing receiver construction.

During the past few years, "fifty-seven varieties" of fancy titled trick circuits have been published in endless numbers. The Daven Bass Note receiver is not to be placed within this classification. It is not something radically new or an instrument which will receive broadcast signals twenty-five hundred miles away every day in the year; rather, it is a high-class receiving circuit built up piece by piece according to the most modern practice of radio engineering. Each part is so designed as to accomplish certain ends so that the complete unit will give the utmost of all around efficiency and highest quality of loud speaker reproduction with volume easily controllable from a whisper to that which taxes an average high-grade disc speaker.

It is amply selective considering the bearing this factor has upon the final degree of loud speaker quality and is also easily adjustable for both local and distant station reception. In a sense it does this in a very efficient and economical way.

During the recent Trans-Atlantic tests, the writer near New York has logged one of the Spanish stations on two nights of the experiment. Another transmitter in South America was also heard, while Mexico City was likewise received with good volume considering its output power and distance covered. This shows what it can do as a distance getter during the more ideal winter months. Of course, summer reception will greatly diminish this characteristic.



Here is the usual schematic diagram.

And now for the type of circuit employed. The accompanying pictorial and schematic wiring diagrams tell us that it consists of two stages of tuned radio frequency working into a simple detector or rectifier which in turn is followed by a three-stage Daven resistance coupled audio amplifier. Thus, its fundamental circuit is quite simple. The various parts, however, call for the highest class of engineering design in order that maximum distance, selectivity, and finally—what is of paramount importance—the most perfect loud speaker quality become assured.

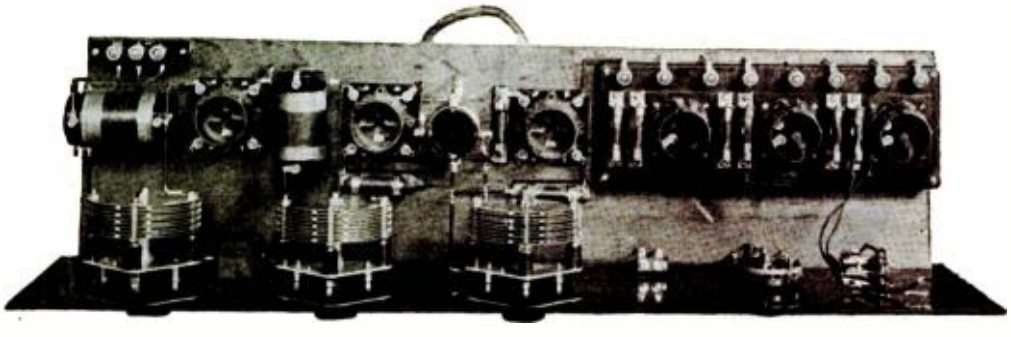
Quality of reproduction can never be any better than the R. F. amplifier and detector feeding the audio end. A few words on this score will therefore prove important.

We all have noted the great number of "dynes," "flexes," "supers," etc., which employ various forms of so-called "neutralization," "balancing" and the like. The number of schemes available for accomplishing this end are as varied as their fancy titles.

But what about these other "self-balanced systems" we see and hear so much about? Yes, almost any coil and condenser combination can be "balanced" in a radio frequency amplifier, but only in a very inefficient fashion.

Technically speaking, the various methods generally employ such schemes as

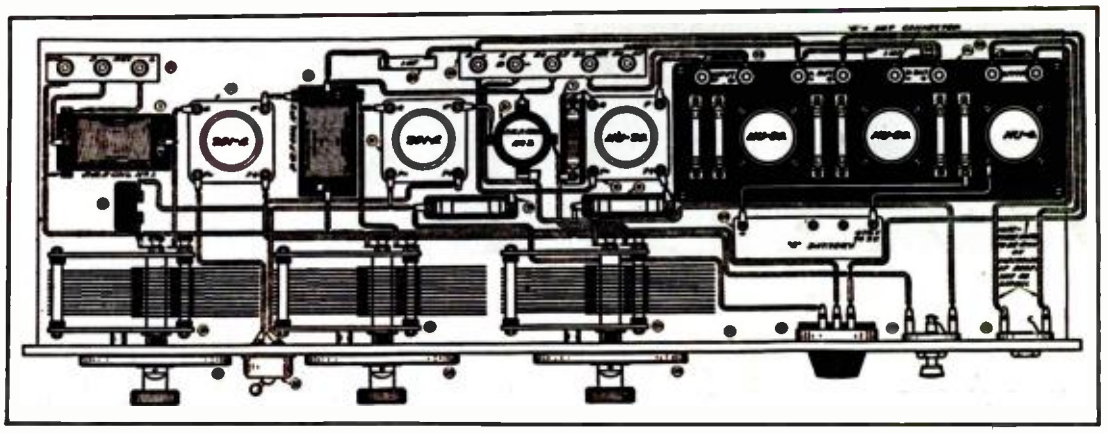
1. An insufficient number of turns for the primary windings of the R. F. transformers so that oscillation is stopped (balanced) at the shortest broadcast wave length; thus, a small number of turns are not sufficient to deliver enough energy to the coil system secondary windings;
2. The use of fixed resistances placed in series with either the tube grid or plate, or;
3. The use of an insufficient plate voltage, and;
4. Combinations of the several means.



Looking down on the base-board we see how the various instruments are arranged.

Since free oscillation is always most troublesome at the lower wave lengths, "self-balancing" must be done at those frequencies—this explains the poor efficiency at the higher wave lengths.

At any rate all of these are at best inefficient expedients for getting around the problem. This tells us why a simple regenerative detector often gives better results than many of the five tube receivers found on the market today.



A picture diagram which shows the set completely wired.

In a Daven Bass Note receiver, all three R. F. transformers or inductances are so designed as to give high efficiency, distance, and proper selectivity at all frequencies within the broadcast spectrum by means of potentiometer control. Of course, a variable resistance placed in series with the R. F. "B" lead will also prove reliable. In this way regeneration can be adjusted at will; first to vary the signal strength; second, to increase distance and third, sharper tuning, depending upon demands.

This control method has been so developed after research work that it becomes very simple to operate and with much greater freedom from "spill over" action than is usually experienced.

The arrangement was accomplished only after experimental determination showed that each of the primary or plate coil windings of the three transformers require a definite number of turns, reactance, etc., so as to accomplish the desired end. The problem was further complicated by the incorporated "Local and Distance Receiving Feature," which will be described in a later paragraph.

Like the fifty-seven varieties of circuits in use today, the same can also be said about the type of coil system we generally see. Competent radio engineers have long known that the plain cylindrical form of winding wound over a retaining section of high-grade insulation formed the most efficient type of coil. This takes into consideration such important features as high frequency resistance, copper losses, dielectric loss, distributed capacity, power factor, ratio of resistance to reactance, etc.

But evidently the public knew nothing about it—so they were given "something different." That is why we see so many coil oddities, but the Bureau of Standards has recently gone over the subject with a fine comb, only to reach again the old conclusion that a properly designed solenoid (cylindrical) coil is the most efficient.

But the coil alone is not the whole story. As a matter of fact the winding having the lowest high frequency resistance, copper and dielectric loss will not give the best practical result, that is, within the completed receiver. To attain this end it calls for large diameter coils and this in turn develops inductances having large external or stray electric and magnetic fields.

Such fields will then interlink not only between those generated by the several coils but also out through the set wiring, variable condensers, and other parts unless properly shielded in whole or in part. All this, of course, means that regeneration and self-oscillation must take place with resulting poor overall efficiency.

In the D.R.F. coils employed in this receiver, research and experimental work which extended over a number of months determined the proper size of coils to be employed so as to give maximum voltage amplification per stage with the least loss in the final performance. This, of course, also depends in a large way on the methods of placing and the distance separating the several coils and other components.

It will be seen from both the drawings and photographs that the inductances consist of small cylindrical coil forms which are 3 inches long and 1½ inches diameter and the correct windings for the primaries and secondaries.

The windings proper are of a special nature and in view of this the writer does not advise the fan to build them himself. A kit consisting of all three coils can be purchased for less cost than time and material can build them.

Straight line frequency or wave length shaped plate variable condensers are used to tune the several inductances; and when of the capacity shown will cover the entire broadcast wave band from a little below 200 to 550 meters.

The amplified radio signal voltage is transferred to a simple detector circuit operated in a non-inductive manner. A Daven 3S resistance coupled amplifier then greatly intensifies the signals so as to give maximum power for operating loud speakers of the disc or cone type, which is generally preferred by the writer. The quality of reproduction is, of course, well known in the radio engineering art since it can easily be shown that by a properly designed resistance coupled amplifier practically uniform amplification without distortion is gained of all audio notes from well below 25 cycles to inaudability. The loud speaker alone determines the final characteristics.

The designers of this set had long felt that many of the multi-staged receivers employing five to nine tubes which we see in general use today serve little or no useful purpose. Further it can easily be shown that the greater the number of tubes in a circuit the greater will be:

1. tube noise background.
2. circuit instability.
3. uneconomical A & B battery current (or power) consumption.

Then again there is a practical limit to the useful amount of radio frequency amplification which can be employed. In other words, nothing can be gained after the static or "noise background level" is reached.

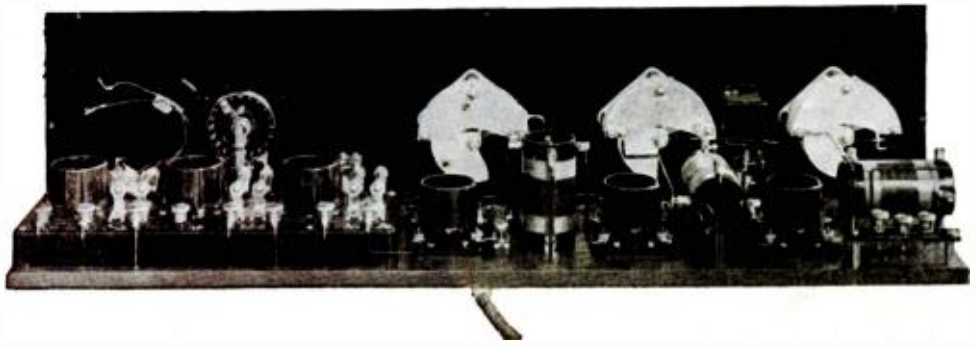
At this time of the year we already have ample reason for noting this noise effect, and during the summer months any receiver employing more than one stage of radio frequency amplification must of necessity produce extremely poor loud speaker quality, or else it calls for set operation of a most inefficient sort.

W. T. Taber has developed a very ingenious method not only for solving the above problem in the Daven Bass Note receiver but also one meaning less costly tube operation; at least in so far as A and B battery current consumption is concerned.

Glancing over the circuit we find the first radio frequency amplifier tube is so arranged by means of a toggle filament control switch that its filament can be extinguished at will. The two positions—that is, on and off—are called "local" and "distance."

Now, under this scheme, it becomes evident that it is possible to reduce the number of tubes in the circuit with a resulting reduction in consumed A and B power. This is accomplished without using a complicated switching scheme.

But the important feature is the fact that when the first tube filament is extinguished (the switch setting reading "local") then *selec-*



A view from the rear showing the instruments mounted on the panel and base-board.

When assembled, the panel makes a neat and attractive appearance.

tivity is at maximum. A little study shows us that this tube is then functioning not as a tube but simply as a series condenser by virtue of the capacity existing between its grid and plate.

Local stations then tune in with razor-like sharpness but not to such a degree as will mar high quality reproduction. This finally results in ample loud speaker volume; in fact, practically all local stations can be amplified up to a point of taxing the average disc speaker.

And for distance operation, a reverse throw of the switch gives us the use of an additional stage of amplification. Thus loud speaker quality with volume control is at one's finger tips, adjustable from a whisper to full blast. Selectivity with its distance and local control feature is indeed a method not heretofore known to the present writer.

In order to build this receiver, let us first purchase all necessary parts. The accompanying bill of required material lists all parts necessary for its construction and they should be obtained from any reliable dealer.

Drawings and photographs show a complete plan of top-view assembly. While the latter assembly can be arranged to suit one's needs, it is suggested that the plan shown on the drawing be followed. It is not only the easier to construct but is also laid out so that self-oscillation or regeneration is eliminated and finally, that maximum signal strength, distance and clarity are assured.

A 7 x 28 inch panel is first laid out for taking items (13), (14), (15), (16), (17), and (18). No detailed dimensions of the panel will be given since it can be laid out to suit individual taste according to the types of parts purchased, dials employed, etc.

After drilling, the assembly of these parts should be completed. In this connection it is important that high grade low loss variable condensers of the straight line frequency or wave length type be purchased. This will insure greatest efficiency. Vernier dials free from backlash will give excellent tuning adjustment.

The sub-base which is 27 inches long may be made of bakelite or wood and is now ready for assembly. All remaining items on the bill of material should be arranged as shown on the drawing for reasons above suggested. The major portion of all sub-base wiring can be done prior to attaching it to the panel front, to which it is held by several small brass angles.

There are two ways to complete the set wiring; for instance, the drawing shows one method using "spaghetti" or cambric covered buss wire arranged on the top side of the sub-base, and in the photographs we see a slightly different scheme. In the latter all connections are made through the use of Celatsite wire placed on the bottom side of the sub-panel joining the necessary parts. Under the last arrangement it will be seen that all A and B battery connections are brought to the receiver by means of a four conductor flexible battery cable. This eliminates battery terminal strip (23).

The schematic wiring diagram shows all external wiring connections. A ground wire is run to terminal GND, while an antenna wire less than 100 feet long is connected to the ANT—L post. If an aerial is of greater length, then ANT—S may be used. Much will depend upon local conditions, and at best, experiment will prove the more desirable of the two connections.

Bill of Materials

No.		
1	1	*D. R. F. Coil No. 1*
2	1	*D. R. F. Coil No. 2*
3	1	*D. R. F. Coil No. 3*
4	1	*Daven Super-Amplifier*
5	3	*MU-20 Tubes*
6	1	*MU-6 Power Tube*
7	1	*Daven Leakandenser No. 22*
8	1	*¼ Ampere Ballast*
9	1	*½ Ampere Ballast*
10	1	*Daven Special Type "A" Cond.*
11	3	*Shock-Proof Sockets*
12	2	*201-A Type Tubes*
13	3	*S. L. F. or S. L. W. .00035 Mfd. Var. Conds.*
14	1	*400-ohm Potentiometer*
15	1	*Push-Pull Filament Switch*
16	1	*Toggle Filament Switch*
17	1	*Open Circuit Telephone Jack*
18	3	*Vernier Dials*
19	1	*7" x 28" x ¼" Panel*
20	2	*1 Mfd. By-Pass Condensers*
21	1	*.0005 Mfd. Mica By-Pass Condenser*
22	1	*.002-.006 Mfd. Mica By-Pass Condenser*
23	1	*Battery Terminal Strip*
24	1	*Ant.-Gnd. Terminal Strip*
25	1	*7½-9 Volt "C" Battery*

A six volt storage battery of about 100 ampere-hour size is connected up to the battery terminal strip. For best results your battery should be recharged at least once every two weeks. Likewise, three heavy duty 45-volt B batteries are joined in the manner shown. Due to the low B battery current drain such heavy duty batteries should last from six to ten months. The correct voltage of the C battery will depend upon the total B battery voltage used on the Super Amplifier. If your B battery is not over 120 volts, use a 7½ vole "C" battery. If your B battery is 135 volts a 7½ to 9 volt C battery is advised.

Type 201 A tubes should now be inserted in RF sockets 1 and 2, while Daven MU 20 tubes are used in detector and first and second audio stages. A Daven MU 6 power tube is lastly inserted in the output stage or extreme right hand socket of the Super Amplifier.

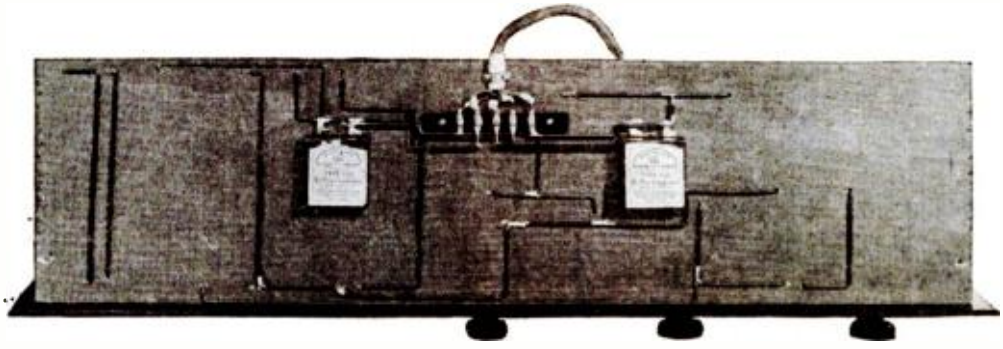
Closing your push-pull filament switch should place all tubes in operation, providing the set is correctly wired. To operate the set, turn potentiometer knob about half way around and pull out the battery switch. Throw over the toggle filament switch to the position which lights the first tube—set all three dials at approximately the same setting and then gradually move them equally to the right or the left until a station is heard.

After a station is received, move potentiometer to the right until a slight squeal is heard, then retune each dial until the maximum signal is brought in, then turn potentiometer to the left until music or speech becomes clear.

If volume is too great, even though the potentiometer is turned to extreme left, throw toggle switch to the other position and retune first dial slightly. This toggle switch opens up the filament circuit of the first radio frequency tube for local reception so that loud speaker volume may be reduced without cutting down the overall selectivity of the receiver and at the same time reducing the battery consumption. The DRF coils have been carefully adjusted and balanced, and if the dial readings do not correspond within one or two degrees the fault lies in the variable condensers; in other words, if they are of uniform variation in capacity, the dial readings should be practically uniform over the full range.

It will be noted that on distant stations where signals are very weak, the potentiometer or volume control may be turned over to the right, but when local or strong signals are being received, it is necessary to turn it to the left. It will also be found that the potentiometer can be turned further to the right on wave lengths over 400 meters than it can be on wave lengths below 400 meters.

The wave length range of this circuit is from a little below 200 to 550 meters approximately, and covers the entire broadcast range.



A view of the underneath part of the base-board showing the by-pass condensers.

Another Step Toward SEEING By RADIO

British Inventor Demonstrates Device Which Sends and Receives Image of Object and Promises Further Important Developments.

By Our
LONDON CORRESPONDENT

EVERY so often, the newspapers print most wonderful accounts of some new inventor who has at last solved all of the problems of "television"—or the transmission of actual vision by wire or radio.

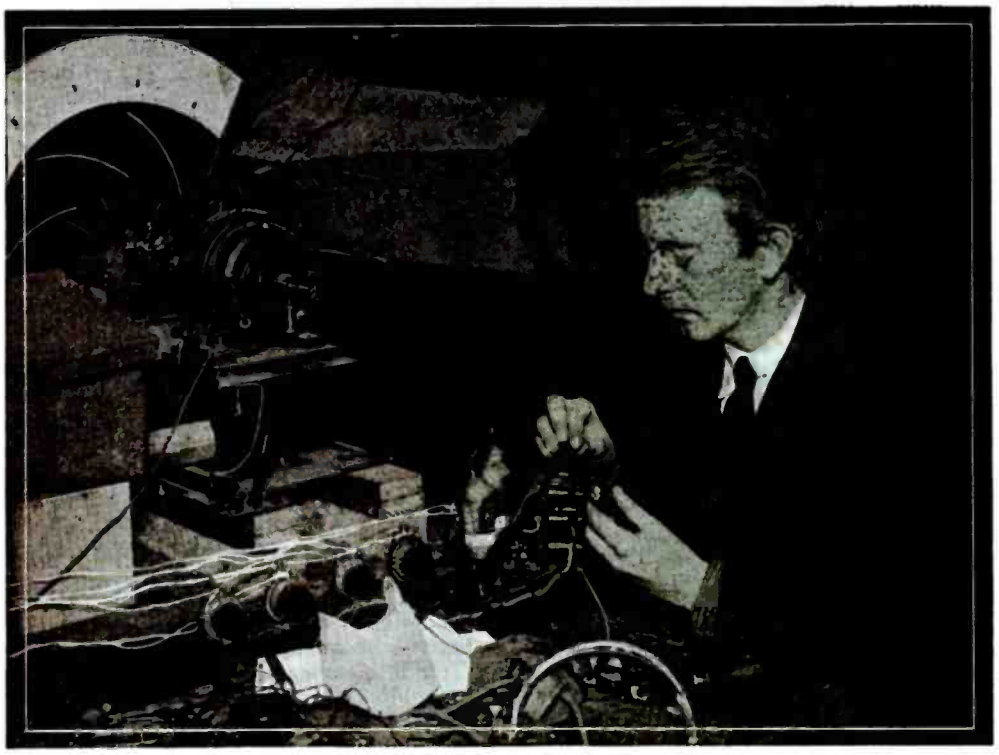
We have already stated very frankly in this magazine that we do not expect to see this problem solved on a commercial basis within our lifetime. However, it must be understood that our minds are wide open on the subject and that there is nothing that we would rather see than the practical and commercial development of this marvelous dream of the future.

A short time ago the American newspapers printed cable dispatches from London telling of a demonstration given by J. L. Baird which once more indicated that television was an actual fact and that the necessary apparatus was almost ready to be placed upon the market.

We immediately cabled our London correspondent to get us all of the available details and the accompanying article is the result. Incidentally, our correspondent is one of the most prominent men in radio in Great Britain and his connections there are so intimate that they might be jeopardized if we signed his name to his articles.

This account of Baird's apparatus and the very clear description of the principles on which it works is the best that we have seen on the subject of television. However, we still go on record as saying that even this development does not seem to us to present a practical and commercial solution of the problem, although it is a marvelously clever utilization of the limited means which science at present furnishes the inventor to work with.

H. M. N.



Mr. J. L. Baird of London, the inventor of the wireless vision, adjusting the transmitter.

London, June 4.

INTEREST in wireless television is undoubtedly world wide. In this country, British amateurs are generally familiar with the work of Francis Jenkins in America, and with that of Edouard Belin in France, but perhaps more particularly with the work of Dr. Fournier d'Albe, Thorn Baker, and J. L. Baird, in this country.

Of the three Britishers who are busy experimenting in the field of television, probably Mr. Baird is regarded as having the best chance, although Thorn Baker's experiments have also aroused a good deal of interest. Mr. Baird has recently received financial backing and has been able to progress with his experiment on a scale hitherto impossible owing to financial reasons.

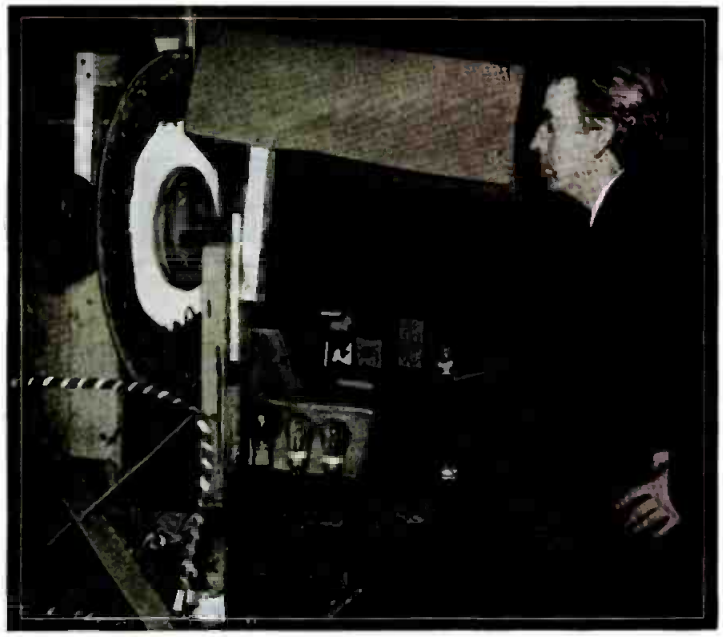
Before dealing in any detail with the Baird television scheme, it might interest my readers if I recapitulate a short talk I had with M. Belin in Paris a few weeks ago. Belin has been making exhaustive studies on the question of television and only recently gave a rather startling demonstration at the Sorbonne. In our interview, M. Belin said:

"I cannot with this machine transmit pictures or scenes from a distance, but I have actually in existence such an apparatus which lacks only, at the moment, a proper method of amplification to make it capable of transmitting pictures or images over long distances via wireless. This amplification difficulty will be overcome in a short time, I hope, but I cannot say just when. Perhaps it is only a matter of weeks, but when I have made that I will start tests which I believe will prove of the greatest interest to the world."

M. Belin pointed out that his apparatus had been built merely for the purpose of studying television and not with any idea that this was to be the final solution. The apparatus which he had on exhibit was very interesting.

Mounted on a wooden table, with a driving motor coupled to a vertical shaft below, it consisted of a regular slide projection machine with carbon arcs; a revolving drum with a series of flat mirrors, which was at an angle with and before the lens of the projector and other mirrors, etc.

We placed a picture slide in the projector which, of course, cast light and shadow as usual. The mirror drum is made to revolve at a very high speed, taking the reflections of this picture upon it and throwing it in a series of vibrations, due to the flatness of the mirrors, over to a mirror placed behind this slotted screen. The drum is not only revolving at high speed, but, by a special worm gearing, is made to swing back and forth laterally, commensurate with the angle at which it turns. The pictured image being cast back upon the small mirror behind the slotted screen is re-



Looking in at the receiving machine where the picture appears.

duced to a spot of light, and as the mirrors take only a part at a time, you get only parts of the photo reflected in this small mirror at once.

Now the light beam passes through the large lens at the side of the mirror drum, thus concentrating it into a regular spot. It is reflected from this lens back against the reverse side of the drum by the second small stationary mirror, and the revolving and swinging drum takes this little spot and throws it in a series of vibrations against a semi-transparent screen. As the lights are turned on, a small spot, the size of a pea, appears on the glass screen. The machinery is set in motion and the spot becomes rather a streak of light swinging up and down and back and forth. As the apparatus attains full speed, this light spot produces a square of light upon the screen, somewhat vibratory, but quite clear.

"Obviously," M. Belin pointed out, "when you place a picture slide between your light source and your first mirror, you get a series of modulations of pure light according to the shadows cast, and these are carried through until they appear as the same picture in the final reflection."

M. Belin then pushed the slide into place and immediately the light square took on the aspect of the photo.

"Now in place of the first small reflecting mirror," went on M. Belin, "a photo electric cell with potassium (not selenium, for that would not be fast enough) would react to those modulations; or I might place it elsewhere, but I am not ready to give the full details. Perhaps I shall fail after all, but as it stands now, I am waiting for the weeks to pass when I may know whether I have, or have not, solved the television problem."

This is a very brief summary of the last talk I had with the most prominent television investigator in France.

The Baird apparatus, which is of peculiar interest inasmuch as it has many similar features to the Jenkins apparatus, is also arousing much interest. J. L. Baird has been working on the television problem for the last five or six years. Mr. Baird explained to me that one of his main troubles had been finance, and he had been limited to the use of crude and uncorrected lenses, which caused a considerable amount of aberration.

"Let me show how my apparatus works," he went on.

He made some adjustments and a large disc, which is a great feature of the apparatus, began to revolve until it reached 200 to 300 revolutions per minute. Mr. Baird then placed a doll in front of the transmitter lens. We then went into the next room, where he switched on the receiving set and a driving disc similar to, but smaller than, the one in the transmitting set.

Then I was invited to look into the camera obscura-like attachment. There, quite plainly, was the doll, flickering away at me and moving its eyes and mouth in a realistic fashion.

Mr. Baird has had many problems to tackle, and he is, of course, fairly reticent about the many improvements which he has recently made in his apparatus—improvements which have been approved by experts and which caused considerable excitement. He has not only demonstrated his invention, but he has taken out many patents, some of which are still secret, as full patents have not been granted yet, and according to the laws of the British Patent Office, such provisional patents remain secret until the full patent has been granted. When a full patent has been granted, the inventor has to disclose the full details of his invention and copies of the patent can be purchased from the British Patent Office for one shilling each.

I have been able to collect the latest available information regarding his televisor, but my American readers must clearly understand that I am not acquainted with the very latest improvements which Mr. Baird has made. The photographs which accompany this article will give some idea of the crudeness of the apparatus which Baird has been using until lately, before his financial position had been improved by wealthy backers, and the accompanying diagrams will perhaps give a theoretical idea of his system.

But it must be remembered that this system has been considerably improved upon, and when I inspected his apparatus a few weeks ago I was astonished by the rapid progress he has made.

There has been a rumour in London that he hopes to step in with his apparatus when the British Broadcasting Company's license expires at the end of this year. This rumour is unfounded as the Government have already made arrangements for carrying on broadcasting, but it is true that Mr. Baird is hoping to place his invention very shortly on the market, as a wireless television apparatus for the use of British amateurs and experimentors at a price which should not work out at more than $100 in American currency, and probably less.

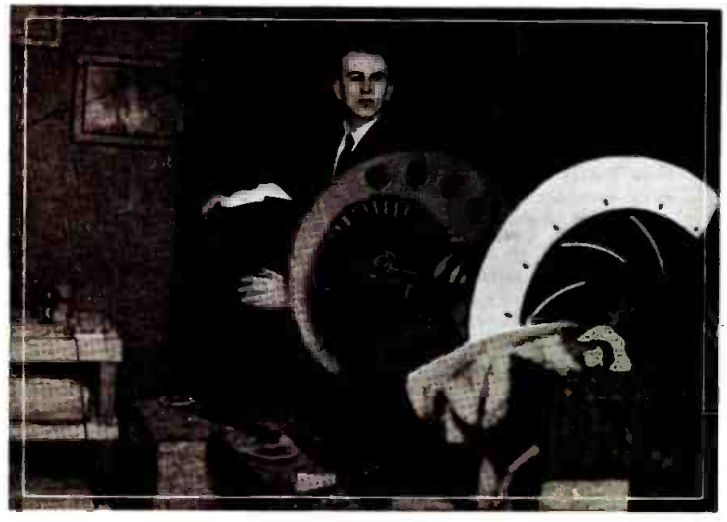
Television, of course, is an old problem and it might be said that what is required is an electrical system capable of performing the natural functions of the human eye. It is therefore of interest to examine exactly what is involved in ordinary vision.

In the first place it must be borne in mind that when we look at any object, we do not in fact perceive the whole of its area as one continuous surface. Actually we receive a simultaneous impression of a large number of dots or patches, each of a varing light intensity.

The eye may be considered as a lense which focuses some ten thousand different patches upon the retina, which in turn contains ten thousand separate optic nerves each of which is stimulated in proportion to the actual spot of light thrown upon it. Each optical nerve is affected simultaneously, although to varying degrees, and the various impulses are conveyed through separate channels directly to the brain, where they are combined and interpreted as a picture of the image viewed.

Now a selenium cell is sensitive to variations of light and shade in a manner that is analogous to the behaviour of the optic nerve. Actually the response of the selenium takes the form of varying resistance to an electric current, but the main parallel holds good.

A simple television apparatus could there-



Mr. J. L. Baird with his hand in front of the transmitting disc, showing the invention.

fore be constructed as follows: One would first arrange a mosaic surface built up of a large number of selenium cells and connect each cell by wires to a distant and similar bank of electric glow lamps. Any picture thrown on the selenium bank would then be transferred in the form of varying electric currents to the distant bank of glow lamps, the variations of light and shade impressed upon the selenium being repeated as corresponding fluctuations in the brilliancy of the electric bulbs. In other words the impressed picture would be instantaneously transferred through the medium of the connecting wires to a distant observer.

Unfortunately such a scheme is not practicable owing to the immense number of selenium cells and glow lamps that would be necessary in order to produce a coherent picture. Roughly speaking at least 1,500 of such units would have to be grouped within the space of an inch square to give a clearly recognisable image.

Instead of using such a massed bank of sensitive cells Mr. Baird uses but one, upon which the different light and shade effects of the picture to be transmitted are thrown section by section in rapid succession.

The key to his system lies in the use of the two discs shown in Fig. 1. The first is formed with a series of ten radial slots, whilst the second carries a number of small holes on lenses arranged in a spiral path as shown. The distance between the outermost and innermost lense corresponds to the depth of the radial slots in the first disc.

The two discs are arranged, as shown in Fig. 2 in front of the image to be transmitted, which is illuminated by means of a lamp and reflector. Imagine for a moment that the disc marked B is alone placed in front of the object and that it is rotated once in each second. The result would be that the selenium cell, arranged behind it, would receive ten complete images in each second, each image corresponding to the passage of one of the slots between the illuminated object and the sensitive cell.

If now the second disc, A, is also interposed as shown in the diagram, and if it is driven at such speed that it makes one complete revolution whilst each slot is allowing the light to pass through, we get the following result:—

As the slot in the first disc moves a short distance across the image, the effective hole through the two discs (formed as the spiral lenses coincide in rapid succession with the slot) moves across the picture from its outer to its inner extremity.

This rapid traversal of the object, section by section, is due to the spiral configuration of the lenses, and it results in a number of rapidly-succeeding impulses being thrown intermittently upon the sensitive surface of the selenium cell. The whole of the picture is thus impressed, portion by portion, upon the sensitive cell, the entire process being repeated ten times per second (corresponding to the number of radial slots in the first disc).

This repetition is sufficient to produce a true cinematographic or motion-picture effect, owing to the so-called "persistence of vision" by which separate pictures when repeated at a sufficiently rapid rate are merged by the eye into the appearance of smooth continuity without any noticeable breaks.

The grain of the transmitted picture can be made finer by accelerating the speed of the disc relatively to the first and increasing the number of holes or slots. The main purpose of the two discs is to allow the light from the object to fall upon the sensitive cell in a series of short flashes separated by quiescent intervals. This gives the cell time to recuperate after each impulse and so overcomes the well-known time-lag or inertia effect.

The fluctuations in current set up by the light impacts upon the selenium cell are impressed upon the grid of a vacuum tube modulator, which in turn causes corresponding variations in the amplitude of a radiated carrier-wave.

At the receiving end as shown in Fig. 3 the incoming carrier wave is first demodulated by a tube detector and amplifier, and the corresponding rectified currents are utilized to vary the illumination of a neon lamp. The resultant flickerings of the lamp (which occur at high speed and with varying degrees of intensity) are passed through two revolving discs similar to those at the transmitting end.

Instead of carrying a series of separate lenses or holes, however, the disc A at the receiving end is formed with a continuous open slot of spiral formation which coacts with the slotted disc in the manner already described.

The transmitted light impulses are thrown upon a screen placed coaxially with the glow-lamp, and the completed image is viewed through a funnel-shaped shield which screens the image from the surrounding daylight.

That, I think, is about the most-up-to-date summary of the available information regarding the Baird system of television, but it is expected that the inventor will shortly disclose further information which it is known he has gathered together, and which, of course, is essential before a really accurate and impartial estimate of his invention can be made.

It is not opportune to mention at this time the benefits of television to mankind. Already we have the transmission of photographs. It is unnecessary to call attention to the fact television is the ultimate for the eyes just as the telephone is for the ears. Fortunately we do not have to cater to the other three senses.

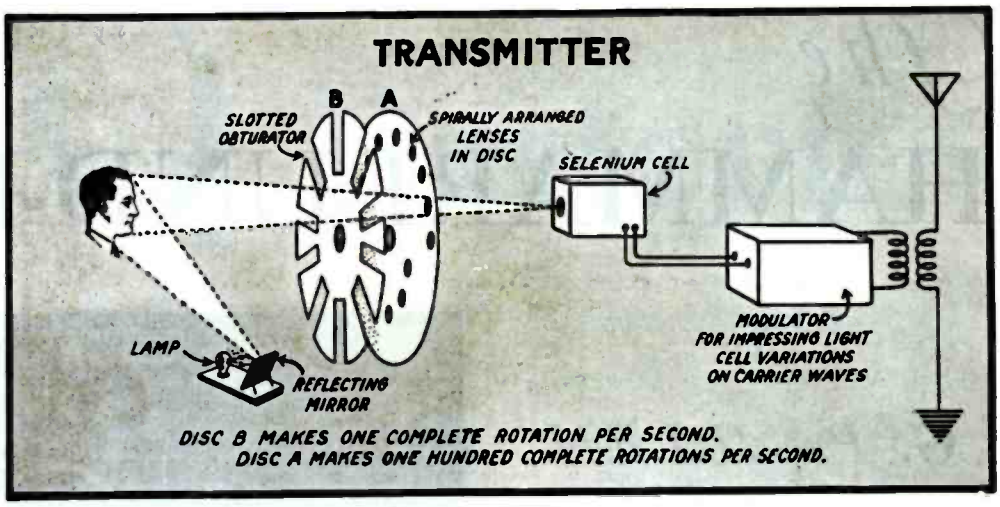


Fig. 2. Baird radio television transmitter.

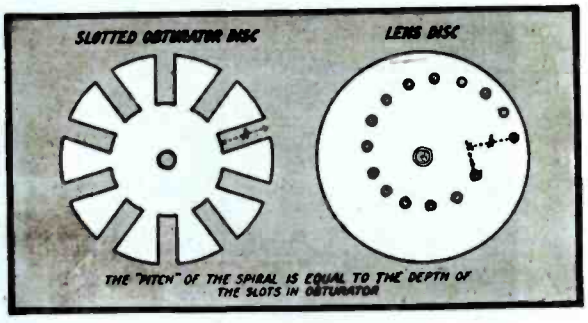


Fig. 1. Disc arrangement.

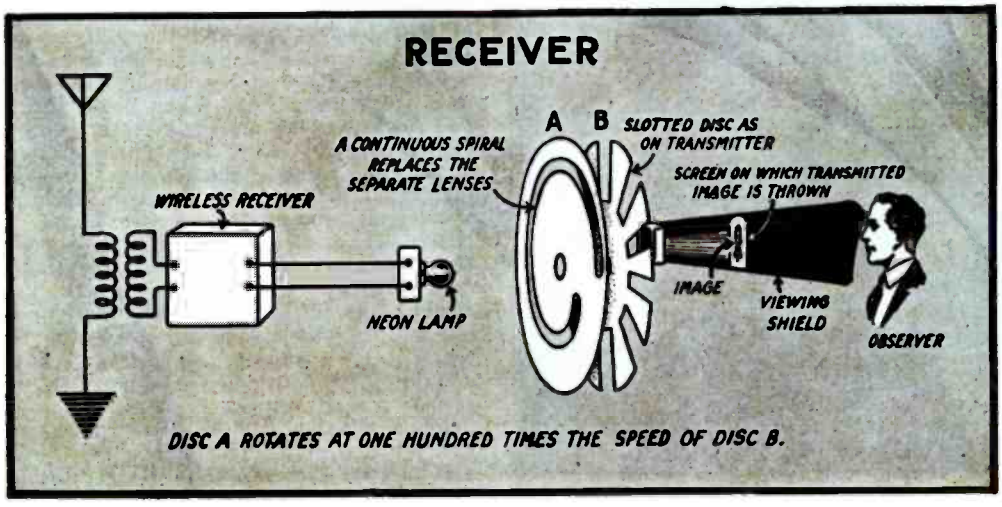
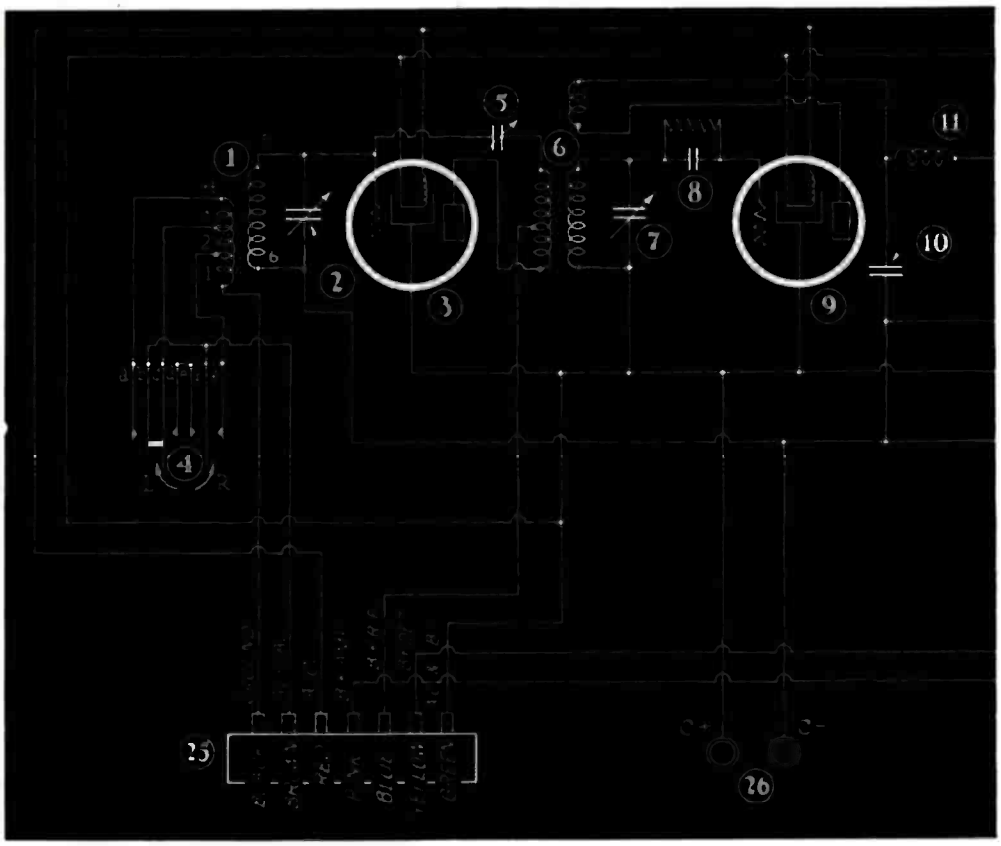


Fig. 3. Baird television receiver.

The HAMMARLUND-ROBERTS

By G. P. ALLEN



Below is a rear view of the completed set with the A. C. tubes in place. This shows the way the wires are run and connected to the top of the tubes.

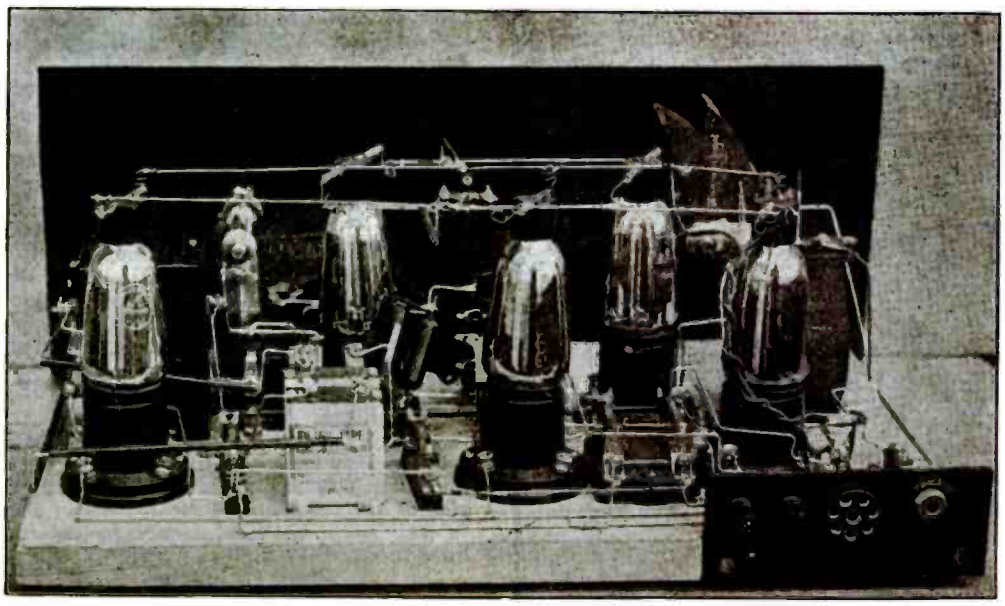
WHEN you take a McCullough tube out of its carton and examine the packing slip which is enclosed, you are liable to get the idea that you have something very complicated to deal with. Anything new is complicated until you understand it. Once you get this understanding, the McCullough tube becomes surprisingly simple.

Just because we are giving you the Hammarlund-Roberts with AC tubes this month, do not get the idea that the set you built from the article on Page 42 of our May issue is out of date. Far from it! The first two stages of this circuit are the same as the first two stages given in the May article. In this set, as in the previous one, we are using one stage of transformer coupled audio frequency amplification.

From there on, the two sets are slightly different. In this case, we are giving you two stages of resistance coupled amplification so that you can combine the advantages of both methods.

Your first impression upon examination of the photographs accompanying this article may be that we tried to use all of the odd parts that we had in the laboratory. We are not shy of resistance coupled amplifier units as the design of the set would at first seem to indicate.

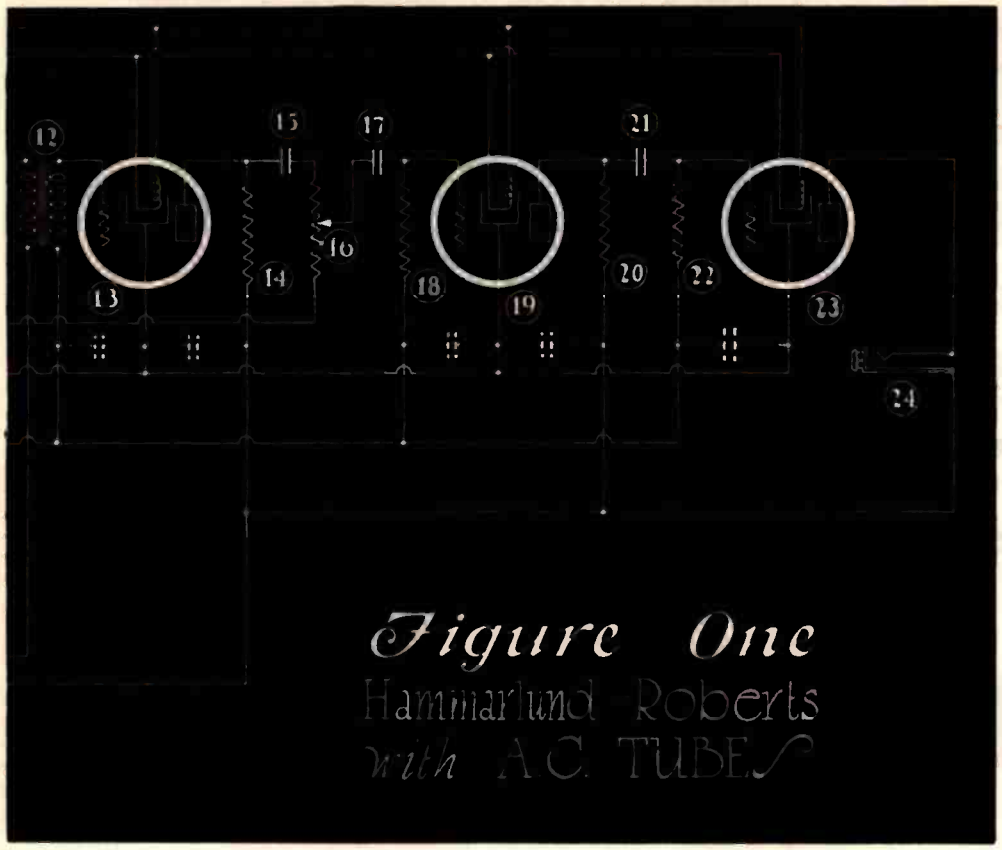
In the set which uses the storage battery or dry cell type of tubes it is possible to control volume by regulating the filament temperature. This is bad practice as you will understand when you read an article which I saw on H. M. N.'s desk. Even were it advisable to do such a thing, it is not possible in the case of the McCullough tube. Some other means of securing volume control must be used.



If you will notice the first stage of resistance coupling (which is the second stage of the audio amplifier) you will see that instead of the plate resistor and the grid resistor connected by a coupling condenser as is done in the third stage of the amplifier, we have used a different method. You know, that if two condensers are placed in series their resulting capacity is less than either of them alone. The value of the coupling condenser number 21 in figure 1 is .06 mfd. In order to have the capacity of condenser No. 15 and condenser No. 17 equal to .06 mfd. it would be necessary for us to use two condensers, each of which had a capacity of .12. This would be an odd size and difficult for you to obtain. In doing the experimental work, we found that we could use as high a value as .5 mfd. for condensers Nos. 15 and 17, so you see it is not critical.

In the ordinary method of controlling volume by a variable resistance, there is the disadvantage that you change the grid bias

With NO Batteries



Above is the usual diagram in the schematic form. Below is a front view of the panel which illustrates the neatness of the completed set.

Combination of McCullough Tubes and a Good B-Eliminator Works Very Well in This Well Known and Popular Circuit.

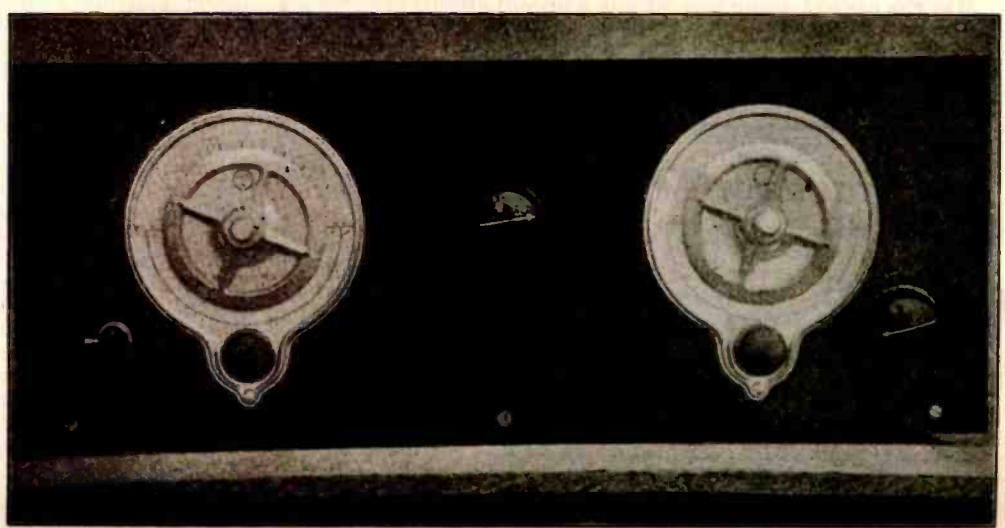
of the following tube even though you reduce volume by placing a resistance in series. This method which we show you here does away with this trouble because the series resistance is entirely separated from the biasing resistance on the grid.

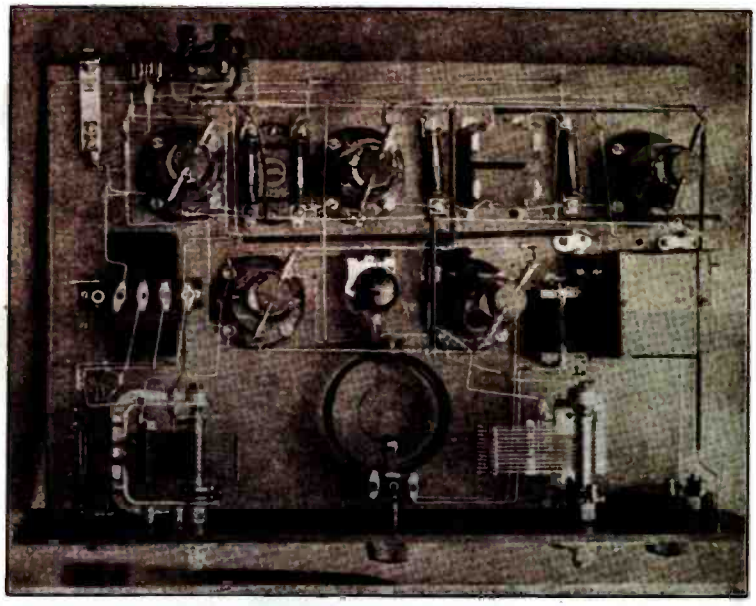
This set worked so well with a good B Eliminator that when we went to the Convention of the Radio Manufacturers' Association at Atlantic City we left it tuned to Mrs. H. M. N.'s favorite station. When Mrs. N. wanted radio all she had to do was turn the switch in the electric light socket, and when she was tired listening, turned the switch again to shut it off. There weren't any batteries to worry about. This is what radio is eventually coming to for all of us.

So much was said regarding AC tubes and the Hammarlund-Roberts in the previous number of this magazine that there is little to be said at this time regarding either. Let us look over the list of parts so that we may see what we already have on hand, and what we need to get. The list is numbered to correspond with the figures on the picture of the lay-out shown in Figures 3 and 4 and in Figure 6 on page 60. The schematic diagram (Figure 1) has been numbered in the same manner. Considerable latitude has been given you in the choice of parts. Such as you may have on hand may be used if you test them thoroughly before placing them in the set to be sure that they are in good condition. Do not blame us if the set does not work when the trouble is caused by old parts in poor condition.

LIST OF PARTS

1. Hammarlund-Roberts antenna coil.
2. .0005 mfd. S. L. F. Hammarlund condenser.
3. Vacuum tube socket.
4. Yaxley jack switch No. 104R. This switch is used in place of the customary three point tap switch. It simplifies the installation by making only one hole in the panel to drill in place of the four that would have to be used for a tap switch and three points.
5. Hammarlund Midget Variable Condenser of five plates.
6. Hammarlund-Roberts coil with rotor.
7. .0005 mfd. S. L. F. Variable Condenser.
8. Grid condenser, .00025 mfd. and 1.0 meg leak. These may be of any good make such as Dubilier, Sangamo, or Micamold.
9. Vacuum tube socket.
10. .002 mfd. fixed condenser. Dubilier, Sangamo, Micamold.
11. Samson, or any other good r. f. choke.
12. Jefferson concertone audio transformer, or any other good transformer.
13. Vacuum tube socket.
14. .1 meg leak with mount.
15. Condenser. We used a Tobe Deutschmann of .5 mfd. The condenser should not be larger than this, or less than .12 mfd.
16. Bremer-Tully or Centralab modulator,





Looking down on the completed set we see the arrangement of the various parts on both the base-board and the panel.

500,000 ohms; B-T No. VC-500.

17. Fixed condenser, same size as 15.

18. .5 meg resistor with mount.

19. Vacuum tube socket.

20, 21, 22. These three parts may be obtained in one unit such as the Daven, Brach or Micamold resistance coupled unit. If you wish to make them up of separate parts No. 20 should be a .1 meg resistor with mount the same as No. 14. No. 22 should be a .25 meg leak with mount and No. 21 should be a .06 mfd. condenser.

23. Vacuum tube socket.

24. Single open circuit jack, Yaxley, Carter, Pacent, or any other good make.

25. 1 Jones cable panel mounting. If possible use the type made for the Kennedy set. This has an extra wire for the minus B lead.

26. 2 Eby binding posts.

You will need in addition to the above, 5 McCullough AC tubes, type 400; 10 clips for McCullough tubes; 1 Radio Foundation step-down transformer for AC supply; 2 vernier dials; 1, 7 x 18 formica panel; baseboard 17 x 11½ x ⅞.

Just a word about the Jones cable. One of the reasons for the successful operation of an AC set is found in cabled leads. If you do not use the Jones cable, but use binding posts, be sure to bind your lead wires together with thread so that they form a cable. If you cannot get the Jones cable as supplied for the Kennedy set, use an ordinary cable, but connect the minus B of either your eliminator or battery to the post of the step-down transformer to which you have connected the green wire of the cable.

BASEBOARD WIRES, FIGURE 3

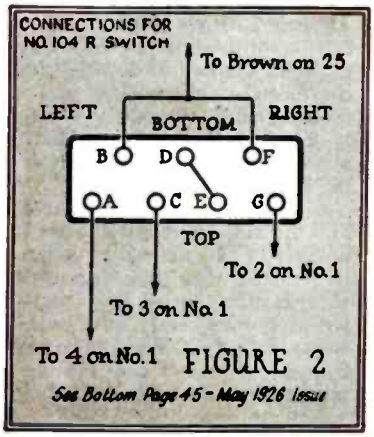
Now for the set itself! There is nothing complicated about the panel, or baseboard layout. You should have no difficulty in locating the parts from the photographs. Before starting to wire up your set be sure that the condenser blades are going to clear the parts on the panel and baseboard when the condensers are fully opened.

The first wire goes from the Blue connection of the Jones plug No. 25, and should be long enough to reach Post #3 on coil No. 6 when the panel is mounted on the baseboard. Put a piece of paper over this lead and mark it so that you will know where it goes when you join the panel and baseboard.

Connect F. minus on No. 23 to F minus on No. 19, and from there, run a wire to F minus on 13.

Connect F minus on 3 to F minus on 9.

Connect F minus on 3 to F minus on 23.



A detailed diagram of the jack switch #4. This gives a clearer idea of how the connections are made than the photographic diagram #6 on Page 60.

Connect the yellow on Jones cable on No. 25 to B on transformer No. 12.

Connect the pink on No. 25 to the frame of jack No. 24.

Black on No. 25 to post No. 1 on coil No. 1.

This completes the wires on the first step-by-step diagram. If you are in doubt as to the proper connections to the coils, refer to the photograph at the bottom of page 45 in the May issue.

BASEBOARD CONNECTIONS, FIGURE 4

Connect G of 3 to rear of 5.
Bottom of 8 to G of 9.
Rear of 11 to P of 12.
Front of 11 to front of 10.
24 blade to 23 P.
23 G to G of block 20, 21, 22. This is the resistance coupled unit.
P of block 20, 21, 22 to 19 P.
19 G to 18 front.
18 front to 17 left.
Rear of No. 14 to 15 right.
14 rear to 13 P.
13 G to 12 G.
From F of block 20, 21, 22 to rear of 18.

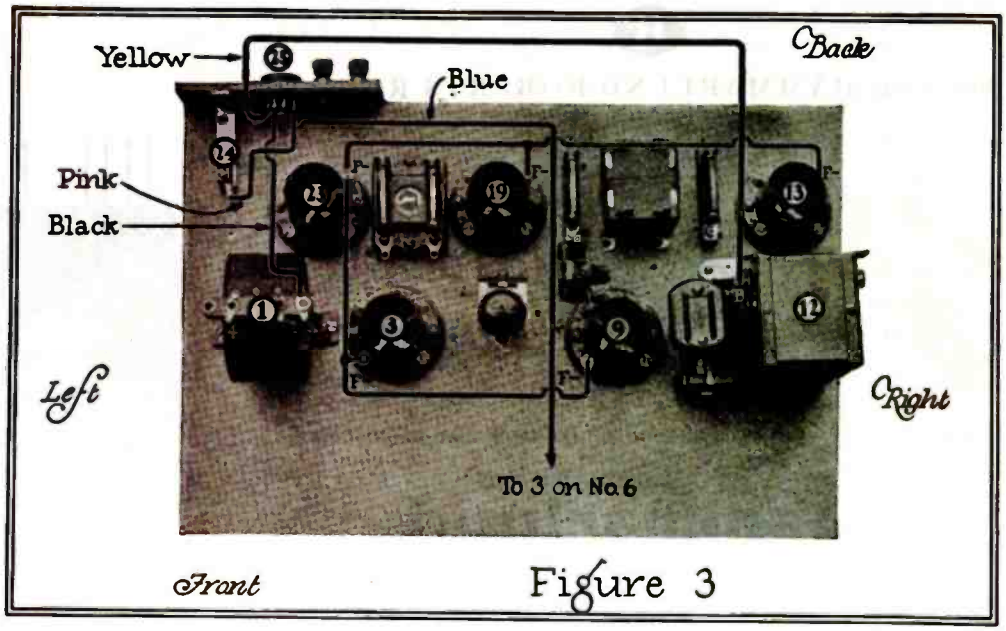


Figure 3

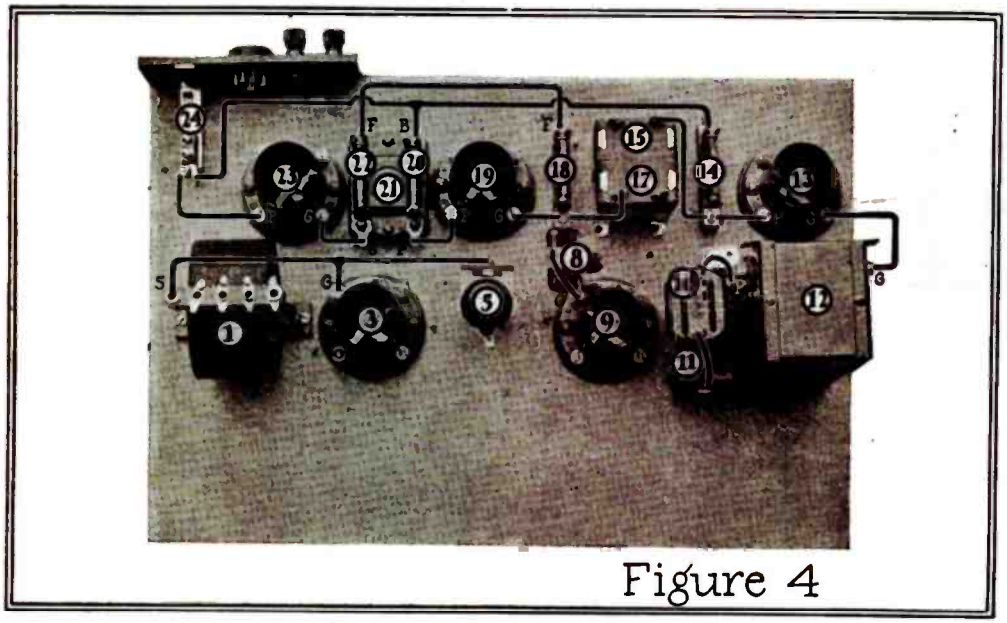


Figure 4

From B of 20, 21, 22 to rear of Mount No. 14.

From G on 3 to connection No. 5 on coil No. 1.

From B of block 20, 21, 22 to frame of 24.

CONNECTIONS ON THE PANEL. FIG. 6.

In placing the wires on the panel it will be well for you to adopt the method we have used in other hook-ups in previous issues of this magazine. That is, after you have fastened the end of the wire that is connected to the panel, place a slip of paper, or a tag on the wire and write where it is to be connected at the other end. In this way, you will know just what to do when you mount the panel on the baseboard.

In making the connections to the Yaxley switch, which is given the number 4 in the list of parts, use Figure 2 which is drawn to a larger scale and you will find the work much simplified.

From lower left (b) on 4 to lower right (f) on 4.

From lower center (d) on 4 to next right in upper row (e) on 4.

Flexible lead to go to connection No. 4 on coil No. 1 from the upper left (a) on part No. 4.

Flexible lead to go to connection 3 on coil No. 1 from the left center blade (c) in the upper row on part 4.

Flexible lead to go to connection No. 2 on coil 1 from the upper right blade (g) on part 4.

From the wire which connects (b) and (f) on part 4 a wire is to go to the antenna connection (brown) on 25.

From R of No. 2 to connection 6 on coil 1.

From S of No. 2 to connection 5 on coil 1.

From connection 1, on coil 6 to top of 8.

From connection 2 on coil 6 to top of 5.

From connection 5 on coil 6 to the line joining F minus on 3 and F minus on 9.

From connection 6 on coil 6 to P of 9.

From connection 7 on coil 6 to front of 11.

If you built the Hammarlund-Roberts in the previous issue you will note that these last two connections are the reverse of those in the set that you built. This has the effect of reversing the current through the tickler coil. As it makes the leads much shorter we have done it in this way, but you will find that it does not affect the operation of the set.

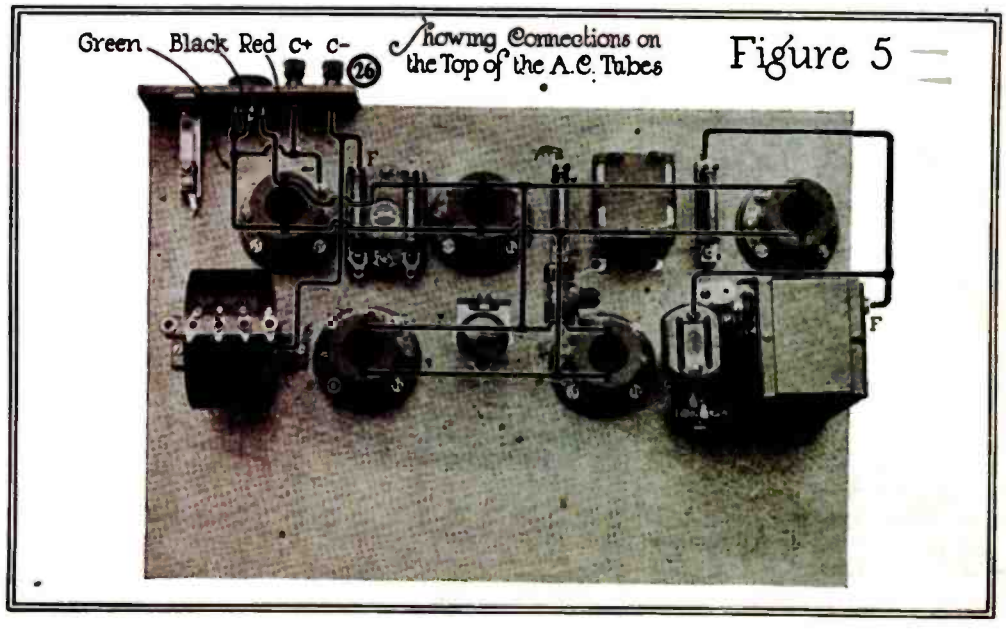
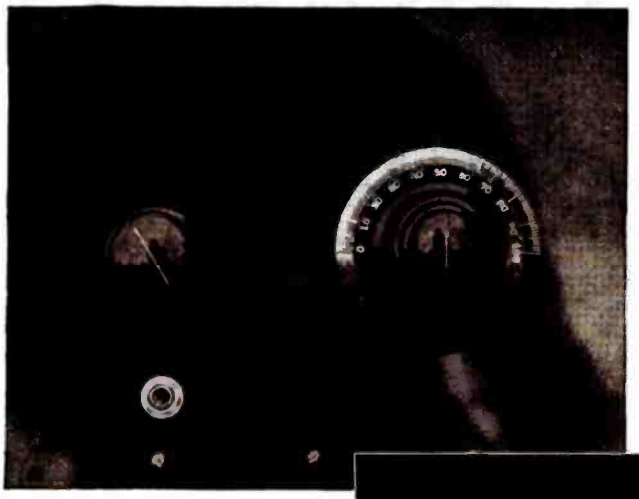


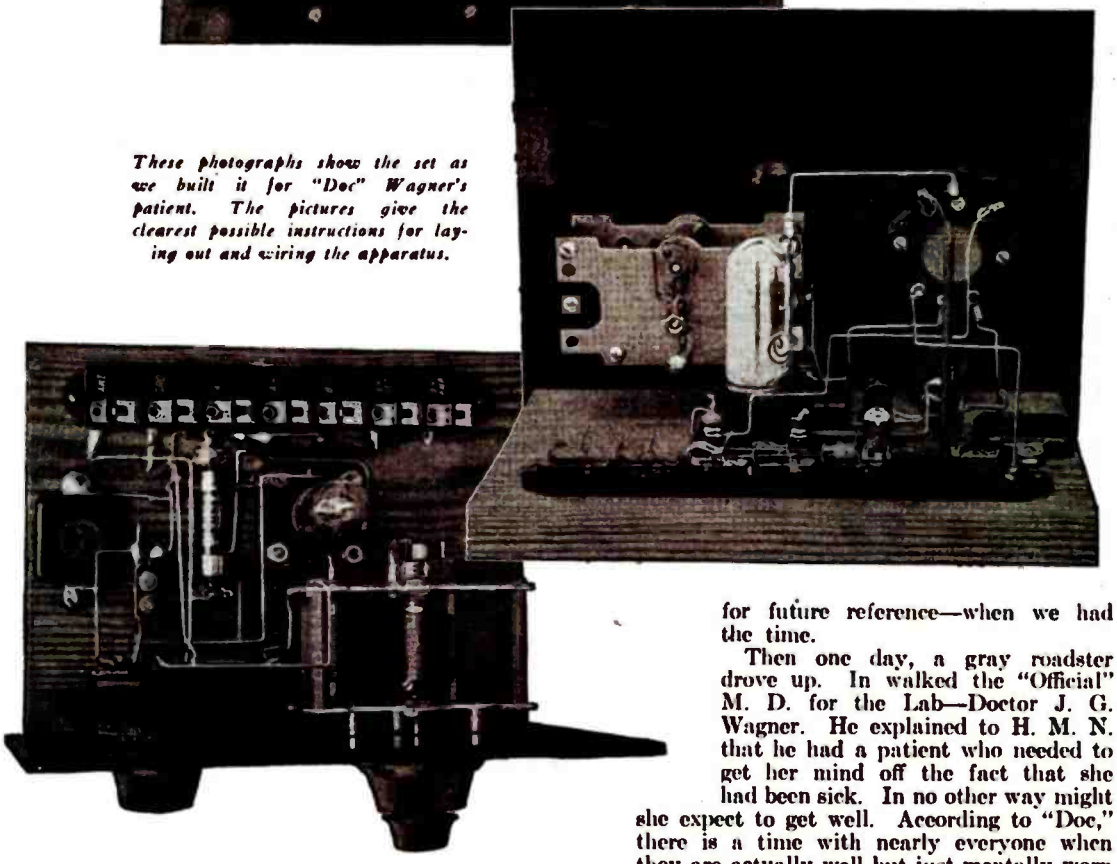
Figure 5

ANY NOVICE Can Build THIS SET

By ULMER G. TURNER, Jr.

Latest Types of Apparatus on the Market Greatly Simplify the Job of Introducing Yourself to the Fascinating Sport of "Rolling Your Own" in Radio.





These photographs show the set as we built it for "Doc" Wagner's patient. The pictures give the clearest possible instructions for laying out and wiring the apparatus.

SHOW me a fellow who has just contracted a dangerous case of Radioitis from Bill Jones, or the next door neighbor, and I'll tell you what question is foremost in his filing cabinet. It is, "What is the easiest set for an absolute beginner to build?"

Simple as that question might seem, to answer, it is a very complex one. First, we must take into consideration the limitation of technical language when talking to a non-technical man. Imagine yourself trying to explain to an Oriental (who spoke nothing but his native tongue and didn't know the ways of the Occident) all about who the Grand Sachem of Tammany Hall is—and why the Dems didn't get a real Indian for the place—and you'll have a fair analogy of the fix we're in when asked to answer that question.

You can easily see that the greatest factor in success or failure of the attempt is in telling the fan just how to do it. If you draw pictures, a lot of the fellows will want to know what's on the other side of each picture (you can't blame 'em!). If you put the thing down in nothing but words, hardly any would get it right. Hook-ups are not understood by the beginner—so there you are! No, I don't get tired of helping them—because I think of the time when I used to ask the very same question that I now have to answer.

We've been on the look-out for a good one-tube set which could be hooked up by a real, honest-to-goodness beginner—and we have found it. All in a funny way, too.

You've heard of the Indian who lived for over fifty years in a little tumble-down shack but who became rich overnight when the white stranger found oil on his land. Well, no one has walked up to us with a black satchel—not yet—but we did find out how to explain the construction of a very good little set.

A package came to the Laboratory and in it, among other things, was a little coil arrangement which, the instructions said, made a very nice little tuner of the three circuit, regenerative type. It was placed on the shelves for future reference—when we had the time.

Then one day, a gray roadster drove up. In walked the "Official" M. D. for the Lab—Doctor J. G. Wagner. He explained to H. M. N. that he had a patient who needed to get her mind off the fact that she had been sick. In no other way might she expect to get well. According to "Doc," there is a time with nearly everyone when they are actually well but just mentally worn out. In such cases there is no doubt that radio is the one cure which may be depended upon day or night in nearly all sections of the country. Cross word puzzles may become tiresome, the green meadows might become dry and Little Irma might grow up and not like to talk to poor, sick Aunt Enna—but radio is there all the time. So "Doc" wanted a radio set—just a small, one-tube affair that would work from dry cells, you know. One that could get New York and Philadelphia from here.

The first thing we found was, of course, the little coil arrangement that the New York concern had sent us. It is called a "Clarotuner"—being a mixture of their patented word, "Clarostat" and the word "tuner." The

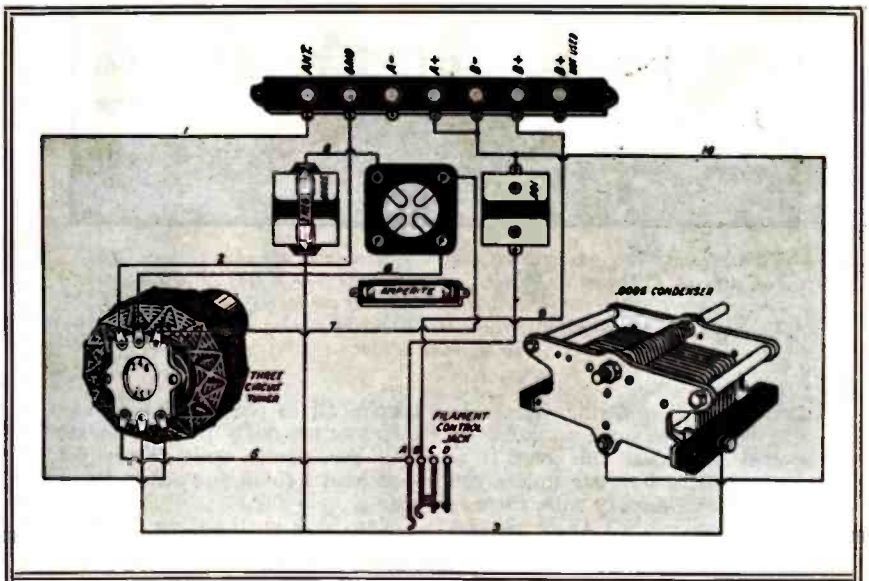
coil comes ready mounted and ready to hook up. There is no movable coil and only six connections to be made to the coil, itself. A nice set of instructions—well made up—comes with the coil, but we decided to give another set, too, as it may prove a little easier to some.

The list of parts will cost around $20—complete. That means ready to listen in. Headphones, of course, are used with the set, as it has but one tube. The range may vary anywhere from 50 to 200 miles, all depending upon local and air conditions. Frankly, I would be willing to bet that I could do better than that any night when reception is good—but I'd rather state the range conservatively.

The circuit, or hook-up, used is an old reliable one—the three circuit, regenerative. Yes, I will be perfectly frank and say that it might, under certain conditions, cause a little whistle in your next door neighbor's set—but that is unusual. Just keep it below the oscillation point (explained further on)—and your signals will be louder and clearer, too. The oscillation is easily controlled. (By oscillation, new readers and beginners, I mean the way in which a tube is made to be more sensitive, but carried too far—that's enough right now). No freak connections or ideas are used in the set, and it is reliable to the last word—if you don't expect too much of it, considering size.

A list of the parts necessary and the approximate price of them is given below:

1 Clarotuner, Model TCH $4.50
1 *Straight line frequency* condenser of .005 mfd. size. Any good make... 5.00
1 Dial for above.... .50
1 UV 199 tube or a C 299. (If a new UX-199 tube is used get a UX socket. Either is O. K. Both burn same amount of current) 2.00
1 Mucher binding post strip or suitable set of engraved binding posts mounted on strip of panel....
1 Vacuum tube socket to fit the 199 tube ..... .75
1 Automatic filament control *for 199 tube on 4.5 volts* and mounting block. (Daven, Brach, Amperite, etc., are O. K.).... 1.50
1 .00025 mfd. fixed condenser with mounting clips for grid leak. (This is grid leak-condenser unit spoken of) .60
1 2 or 3 megohm leak for above.... .40
1 Single open circuit, filament control jack. (Ask for it by that name—see Figure 3) ..... .70
1 .001 mfd. fixed condenser ..... .40
1 7" x 10" panel. Formica, Bakelite, Hard Rubber, Micarta, etc. 1.00
5 lengths bus wire to wire set ..... .25
2 lengths "spaghetti" to aid in crossing wires without their touching ..... .20
1 9½" x 5½" baseboard of material about ¾" thick. (Not quite as long as panel, as we wish to leave a slight space at each end. See photo. This is to allow the panel to fit a standard 7" x 10" cabinet—if you wish) ..... .25
3 Dry cells of the "No. 6," or regular "ignition" size. A "hot shot" will not do unless the cells give a total of 4½ volts. Neither are they economical 1.50
1 Eveready or other good make "B" battery of the 45 volt size. Do not let the salesman argue you into getting a large size—as it is not economical for such a small set. Get something like the Eveready No. 772—or its equivalent.
1 Headset. Brandes, Crosley, etc. Get the "2,000 ohm" kind, or about that. Antenna equipment consisting of 100 feet aerial wire, ground clamp, lightning arrester, two insulators and a little rubber covered wire for coming into the house, etc. The same rubber covered wire is used for connecting the batteries to the binding post. Get a plug with them 5.00

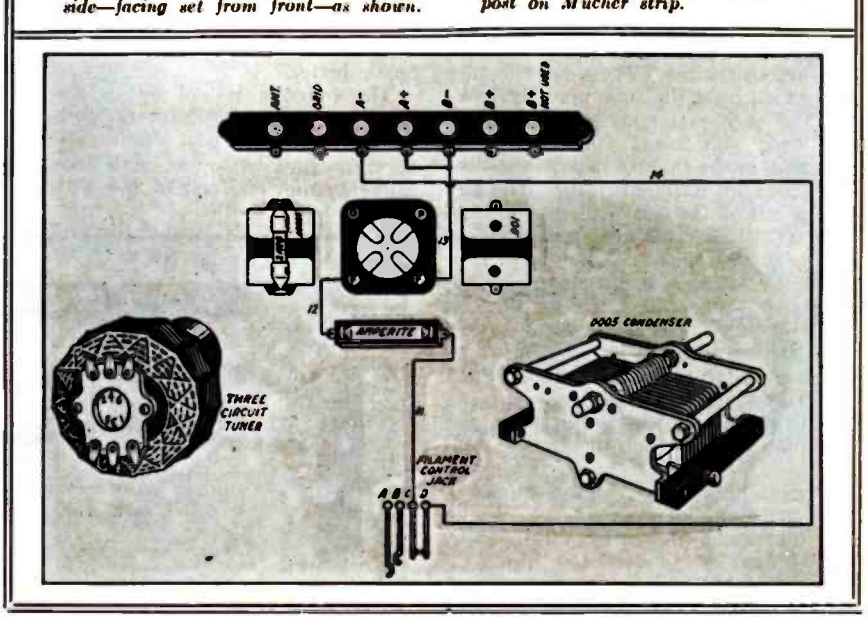


CHECKING LIST FOR CHART NO. 1

1. *Wire from Ant. post on Mucher strip, or binding post strip, to terminal 1 on Clarotuner.*
2. *Terminal 2 on Clarotuner connected with wire to Grd. post and Mucher strip.*
3. *From terminal 3 on Clarotuner to stator plates of tuning condenser.*
4. *A wire tapping the above wire at any point and running to the front of grid leak and condenser unit.*
5. *From terminal 5 on Clarotuner to point "A" on jack. Then to front of bypass condenser. (.001).*
6. *From terminal 4 on Clarotuner to F plus side on the tube socket. (This is the post which connects to the wire from the "A" post on the Mucher strip).*
7. *From terminal 6 on the Clarotuner to the P Post of vacuum tube socket.*
8. *From back of grid leak and condenser unit to G post on vacuum tube socket.*
9. *From point "B" on jack to the "B" + det post on the Mucher binding post strip.*
10. *From rotor plates of tuning condenser to back of the .001 mfd. bypass condenser. Solder, leaving a few inches of wire—then run this wire to the "B—" and "A+" posts—thus joining them.*

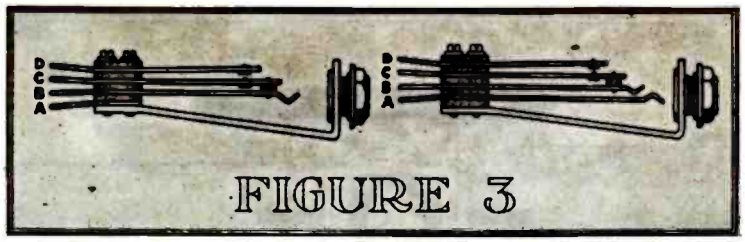
CHECKING LIST FOR CHART NO. 2

11. *From point "C" on jack to one side of automatic filament control unit (Amperite, Brach, Daven, etc.).*
12. *From other side of automatic filament control unit to F terminal on socket left side—facing set from front—as shown.*
13. *Connects from the "A+" "B—" junction on Mucher strip to the other F post on socket. (This, incidentally, is the "plus" side of filament spoken of in Chart 1.)*
14. *From point "D" on jack to the "A—" post on Mucher strip.*



The first thing to be done is to mount the apparatus just as I have it mounted on the original set. The photos as well as the diagrams will show this very clearly.

Then take Chart No. 1 before you. Get the bus wire and tools before you—ready to start. Among these tools should be a



Two types of single open circuit filament control jacks are shown above. The only difference between these jacks is that one has four prongs while the other has only three. The one to the left makes use of the frame as shown by "A." The sleeve of the plug must scrape this frame in making contact, so there is no objection to that.

good electric soldering iron. As long as you're going to hook up several sets after this one, it is economical to buy one unless you can borrow. At any rate, there is a lot to be learned about the art of soldering. It really is an art—that word isn't a bit misplaced. In the April issue there appeared, on page 72, a wonderful article on the subject. I advise all fans to read that. It deals particularly with the use of "flux"—the most important thing. The only criticism I can give the article is that it's too short.

Well, you may now proceed to bend and put the wires in place. Find wire number "1" on the chart by looking beside it and seeing the numeral 1. Put it in position. Now put No. 2, etc., etc. That is a special system we developed for the absolute beginner, here at the Laboratory. Learn to use it and you'll find it is standard with even the large sets described herein. This little set affords excellent practice.

Now, when you have finished all the wires you see on Chart 1, check over them—using the checking chart. Where one wire connects to more than one place, be sure to follow this out, too.

Thoroughly satisfied that you have all the wires in Chart 1 in place, proceed to do Chart 2. You'll find that it has considerably less wires on it. The reason is that this last chart deals only with the *filament* wires. Those are the ones which light the tube up. By looking at it you may see just how—when you insert your headphone plug in the jack to listen—the tube lights up *automatically!* The two points on the end of blades "C" and "D" of the jack are apart when no plug is inserted in the jack, thus not allowing the current to pass between them—then to filament of the tube. (The filament, as Mr. Nakken told you in last month's issue—is what makes a tube *light.*) However, when the owner desires to listen, and inserts his headphone plug into the jack to hear the concerts—point "C" is pushed up to meet point "D." Simple enough if you know how—isn't it? You'll find radio that way all the way through it.

Chart 2 having been finished, just check the wires to see that they're all in place. If they are, then you are ready to hook the set up. Yes, you've built a radio set—at least I *think* you have—let us see.

Now hook up the three dry cells as shown. This will give you 4.5 volts. The tube requires but 3—but the automatic filament control unit takes care of that. Run the wires from this set of batteries (as shown in Figure 4) to the Mucher strip—connecting them to their proper place. Leave the 45 volt battery alone for a minute.

Having done this, put your tube in its socket. Plug in the headset and see if the tube lights. If it doesn't—you've either connected a wire to the wrong place or left one off. Check it over again. If it does light—and the chances are nine to one that it will—then you are safe to apply the "B" battery, or the 45 volt one. Reasonably safe, I should say.

If you want to be a little safer, then follow the wire from the "B+ Det" post. See that it goes *nowhere* but to the point marked "B" on the jack—and that not even a drop of solder allows it to touch the points next to it!

Now connect the 45 volt battery as shown in Figure 4, also. The antenna and ground may be connected next—to their proper posts.

That brings up another question. How long should the antenna be? Well, from 60 to 125 feet. Height from 20 to 40 feet. The latter is much better.

The antenna is put up in the usual form—an insulator at each end to keep the actual wire, itself, from touching trees, etc. A lead is brought from one end of the long stretch of wire between the insulators to the set. Do not let this wire touch a metal roof, gutter, etc. It is called the "lead in." Any of your radio friends will tell you how to put up a good one-wire antenna.

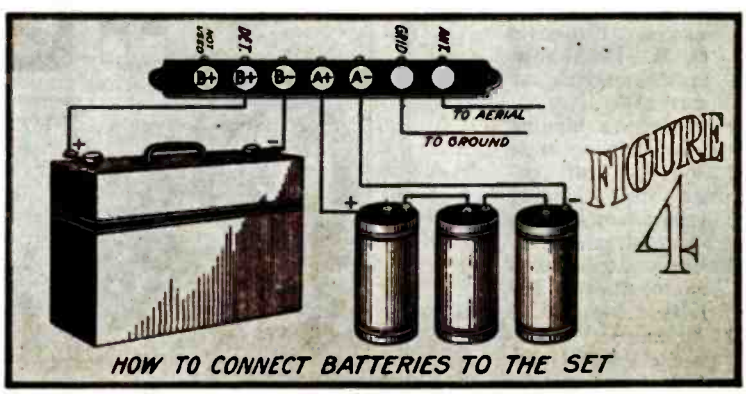
The ground should be made to a water pipe, if one is handy. Otherwise, to a pump that is sunk deep into the ground or to a four or five foot iron rod or pipe driven in moist earth, etc. A wire buried a foot under the ground—as long as and directly under the antenna—also makes a good ground. In *all* cases, whatever system is used, a good connection to the pipe or wire is necessary. Get a regular ground clamp made for the purpose—filing the surface of the pipe clean—or solder the ground wire directly onto it. This wire then goes to the set in the house.

Lightning danger is practically nil. The insurance companies allow antennae to be put up—provided they are protected with arresters. The arrester costs but $1.50—so better be on the safe side.

In operating, plug in the headset to listen. Screw the knob on the Clarotuner out almost as far as it will come. You can't hurt it. Now turn the dial that controls the tuning condenser. When you hear a whistle (which is the first sign of a station) you should stop, and, holding your right hand on the condenser dial, begin turning the knob on the Clarotuner to the *right*, several turns sometimes being necessary. Keep the dial tuned right on the whistle. A point will be reached where the whistle disappears. Then is when your set is receiving best and when you will not interfere with other sets. Now carefully adjust the dial and knob—and you have your first station!

I will now leave the set with you. You can learn more about tuning it in a night than I could teach you in a year—that's a fact. No, you're not the "dumb" one—I am. I simply cannot describe just how to go about it in a way that all can understand. If you have any difficulty—we'll be glad to help you out of it if you'll write us, giving full particulars.

Only one "don't" is given you along with it—*Don't* go off and forget to take headphones out of plug.

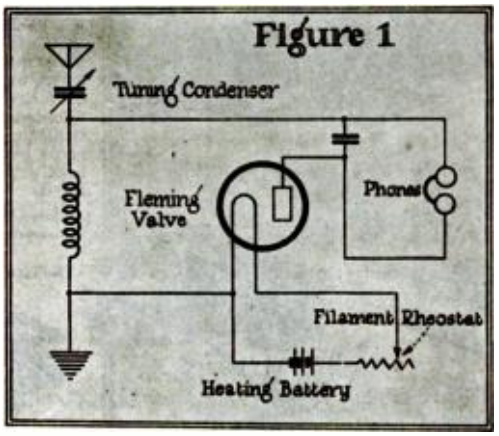


How to Understand RADIO

By THEODORE H. NAKKEN

Dealing With Detection and Regeneration

PART THREE

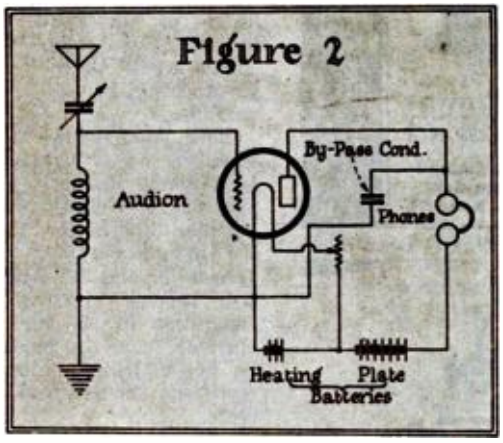


A simple detection circuit using the Fleming Tube as Rectifier.

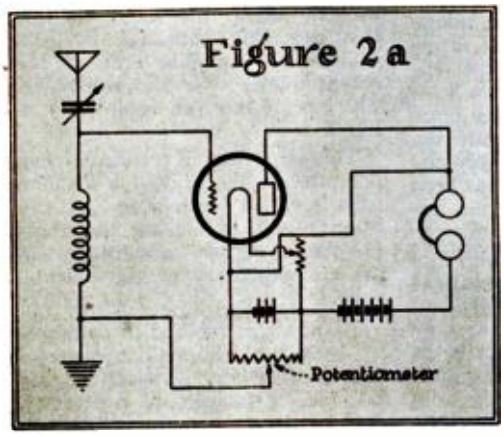
IN THE preceding chapter we described an exceedingly simple radio receiver, after it had been explained how radio signals can reach the antenna and then can be caused to influence a vacuum tube.

It was mentioned there that in order to hear the signals as actually received on the antenna and amplified by the tube it was necessary to "detect" the signal, for which purpose a so-called detector must be employed. In order to accomplish this we added a small condenser shunted by a high resistance, called the grid leak, stating that these two elements caused the vacuum tube to function as the detecting instrument. We will now endeavor to get a clear understanding of the why and how of the process of detection.

When we listen to any sound, we actually seem to function more or less as what might



The simplest circuit using the Audion as a detector.



The same circuit with a Potentiometer.

be called a wireless sound receiving station. When we hear sound, the following is, in simple terms, what happens:

Somewhere in our vicinity some body is caused to vibrate and from this vibrating body, which may be a violin string or a steam hammer or anything else, there emanate what we call sound waves. The reason is that the body, being surrounded by air on all sides, imparts its vibrations to the air particles directly adjacent to it, so that these air particles vibrate in sympathy, and at exactly the same rate. The vibrating air particles then in turn transplant their vibrations upon the next air layer, which again repeats the process, and the consequence is that the original vibrations are transmitted as air vibrations in all directions, and finally reach the listener's ear drum.

Air vibrations, reaching the ear drum, excite it into motion, and our brain registers a faithful impression of the original vibrations that started the sound wave on its way toward the ear.

We know that hearing is caused partly by the action of a mechanism in our ear, and as every mechanism has its inherent limitations to vibrations, the range of tones we can hear is limited by this fact. It is for this reason that we do not have the sensation of hearing with vibrations below 16 a second in number, while the higher limit of vibrations that can be heard depends on different circumstances. Some investigators have stated this upper limit lies around 20,000 vibrations a second, others place it at about 40,000. For our purpose this upper limit is immaterial, because it has been proved that vibrations higher than 10,000 per second invariably are disagreeable, and therefore play no part in our musical instruments.

It may be stated with fair certainty that for most people vibrations above 18,000 lies beyond hearing range.

Now the radio waves which serve as the carrier for our radio programs have frequencies which run far above 100,000 vibrations a second, and thus, even if we could cause them to agitate the air in our vicinity, this would not cause any sound sensation at all: they are, as it is called, "super-audible." This separation between frequencies that can be heard, and those that are too high to be audible, serves more or less indefinitely as the dividing line between what are generally called *audio* frequencies (those that can be heard) and *radio* frequencies, which are super-audible.

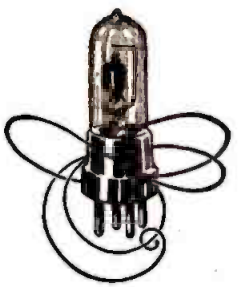
Not only can these radio frequencies not be detected by the ear; they also fail to cause telephone diaphragms and the like to respond, again for mechanical reasons. But even if they would cause such a response, we would not be interested at all: what we want is not sound from the carrier frequency: it is the *modulation* of the carrier, the program.

Right here we should state that the modulation of the carrier wave primarily means that the magnitude of the individual carrier alternations is controlled: We vary the amplitude of the oscillations in accordance with the modulating program. This causes the magnetic waves radiated to vary in intensity, and so in turn governs the amplitude of the oscillations generated in the receiving antenna and associated instruments.

If, then, we would make a graphical picture of the gradual increase and decrease of the successive amplitudes of the modulated carrier waves, we would get a curve which would be an exact picture of the modulating program. Such a line, which is represented with the individual oscillations, is generally

called the *envelope* of the radio wave and it is in this envelope only that we are interested when receiving a radio program.

If the high frequency currents cannot possibly influence the telephone diaphragm (and, even if they could, would not be detected by the ear) it becomes apparent that we must devise some means to separate the modulation from the radio frequency currents. Accepting for a moment that the latter could affect a diaphragm, the diaphragm would move up and down in accordance with the alternations and create a super-audible note. But if it were possible to make only the one or the other half of the alternations effective, the diaphragm would only receive impulses in one and the same direction and the consecutive impulses would then be cumulative in their effect on the diaphragm. The diaphragm would therefore vibrate as if only the envelope were present: In other words it would execute such motions that its vibrations would be representative of the program and the radio signal would be recreated and become audible.



Now, when we remember what was said about the action of the Wehnelt rectifier tube or the Fleming valve (pages 56 and 57, April issue) it will become apparent that this separation of the high frequency currents from the modulation can be accomplished quite easily by *rectifying* the received signal currents.

How this can be done is shown in Fig. 1, which represents a Fleming receiving circuit in its very simplest form. The valve allows currents to flow in only one direction: and therefore a current representative of the modulation flows through the telephones in the plate circuit. We will not indicate the possible improvements in this circuit, as the Fleming valve has been completely superseded by the audion circuits for detection.

The Fleming circuit with its valve gives fairly good results—but it is not particularly sensitive. The audion, which, as previously stated, was designed primarily as a sensitive detector, gives much more sensitive detection, because it can act not only as a pure rectifier, but it amplifies at the same time.

How this is possible is shown in Fig. 2, which represents a simple form of detecting circuit. In this circuit, the grid will function in exactly the same way as the plate in the Fleming valve: But it is not the rectified signal current in the grid that is led through the telephones, but the plate current. This plate current will represent the signal in amplified form and this can be explained as follows:

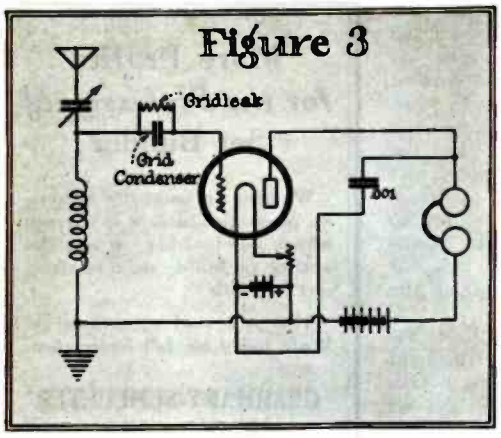
As stated, the audion is so adjusted that no plate current passes in the plate circuit, yet in such a way that the slightest increase in grid potential causes plate current to flow. When the signal makes the grid more positive, plate current will flow: but when the signal causes the grid to be more negative, it cannot decrease the plate current, because no current is flowing at normal grid potential. Therefore only one half of the signal voltage is effective, and because the signal impulses in the plate circuit are unidirectional, the signal is detected, and because the plate current always represents the grid impulse in amplified form, the circuit is several times more sensitive than the one using the Fleming valve.

In order to enable the user to adjust the grid potential for the best detecting potential, the circuit was often used with the addition of a potentiometer. A potentiometer in radio consists of a high resistance, which is placed across a battery. One terminal of the resistance is then positive, the other one negative, while across the resistance we find all potentials between these two extremes. If, therefore, a contact is arranged in such a way that it can slide across the resistance, we can give this sliding contact any desired intermediate potential, and thus, if we connect the wire which connects the grid to the filament to this slider, we can impart any desired potential to the grid. Thus we can adjust the latter for the best detecting potential, by just sliding the movable arm of the potentiometer over the resistance. The circuit is given completely in Fig. 2-a.

This imparting of a certain mean potential to the grid of a vacuum tube is called *biasing*, and we will often revert to biasing potentials to attain certain advantages in other applications of the vacuum tube.

Besides this method of detection by means of the audion there is still another way in which it may be made to function as a detector. This method is more difficult to explain, but as it is the one most commonly used we will attempt to give a clear picture of its manner of operation.

Evidently, as already stated in the very first chapter, the grid can act more or less in the same manner as the plate and attract electrons itself as soon as it becomes positive with respect to the filament. Upon this fact is based the



Arrangement for detection with audion, as in most general use.

second method of detection of radio signals.

In Fig. 3, we have repeated the same circuit of the last chapter, where this method of detection is employed. It is seen that the grid return lead is attached to the positive terminal of the filament or A-battery. This means that the grid has an initial positive voltage and therefore attracts electrons so that a small current flows in the grid circuit. However, this current must flow over a very high resistance, the so-called grid leak, of the order of several millions of ohms, or megohms, as they are generally called. Across this resistance we also find the grid condenser, which is of rather small size.

Through the influence of the grid leak, which does not allow all electrons to flow off with the same speed as the grid can attract them at its initial voltage, electrons accumulate on the grid and the condenser. This accumulation lowers the grid potential, and the result apparently is that the grid current is wholly negligible. The slightest increase in potential, however, causes the grid to attract more electrons, while a decrease in potential can not materially diminish the number of electrons attracted by the grid, because this number normally is almost zero.

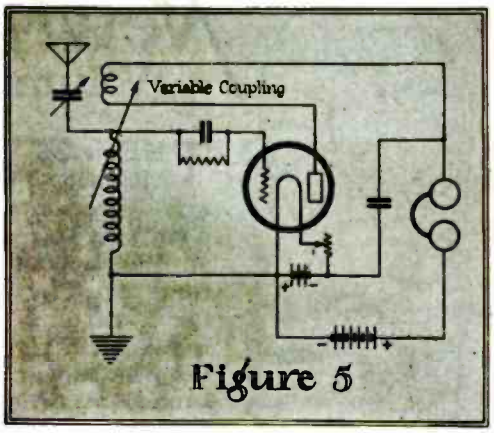
This means that on the positive half of the signal impulses, the grid will attract a large number of electrons, while the negative half of the signal cannot materially affect the grid current. But while the grid attracts electrons when it swings to a more positive value, these electrons have to flow off to the filament over the high resistance grid leak: and this flow can take place only at a very slow rate compared with the radio frequency impulses. Thus these positive impulses due to the signal cause a negative charge to be accumulated on the grid and the condenser attached to the grid, which charge leaks off at audio frequency.

But, when the grid becomes negatively charged, its lower potential causes the plate current to decrease proportionally: and thus the plate current varies in accordance with these fluctuating charges. These charges represent the envelope of the radio frequency currents causing them, i.e., the program, and therefore the plate current varies in accordance with program, and can cause a telephone or such instrument to reproduce the latter.

Simultaneously with this fluctuating of the plate current in accordance with the charges accumulated on the grid, the original signal impulses cause the grid potential to fluctuate, and thereby vary the plate current at radio frequency. In the plate circuit the signal is thus also present in amplified form at radio frequency: but we cannot use these frequencies to actuate the telephone diaphragm. For best results in the telephones it is useful to give these radio frequency impulses a path to travel over other than the telephone and for this purpose a small condenser is provided which connects the plate directly to the filament. Such a small condenser, while an effective barrier for direct current and audio frequency alternating currents, is an easy path for radio frequency currents. The size of this so-called by-pass condenser, is generally held smaller than .002 microfarads, a measure for capacity in electrical circuits. We will at a later time say a little more of these electrical measuring terms.

If the by-pass condenser were made larger, there would be great danger that the higher frequencies of the audio currents would also be by-passed by this condenser, which of course would result in bad quality of reproduction, or, to call it by its current name in radio, distortion. A safe rule in detector design is to keep the value of the by-pass condenser at about .001 microfarad in order to prevent possible distortion.

It seems rather a waste to utilize only the audio frequency currents as present in the plate circuit through the detecting action, and to do nothing whatsoever with the amplified radio frequency currents that are as truly representative of the program as the detected or rectified signal. In fact, due to certain limitations, it may very well be possible that the vacuum tube entirely fails to operate as a detector, but all the while functions merely as an amplifier, so that an amplified signal current at radio frequency is present in the plate circuit, going to waste in the systems



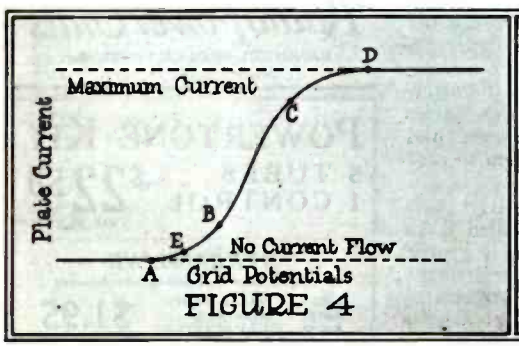
Regeneration by inductive feedback.

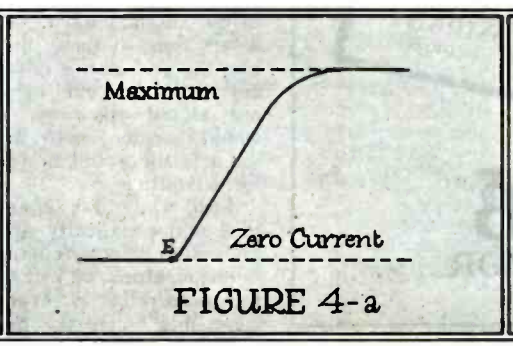
under consideration up to this point.

Nothing can be more logical than the desire to utilize this amplified signal current in some way or other, in order to obtain a signal of greater intensity than was possible with the simple detecting action. The more so because, as a detector, the tube is not perfect in its action. The reason for this deficiency lies in the fact that it is not entirely true that when either the plate or grid is kept in such a state that no current is flowing in its respective circuit, a positive impulse on the grid will start a proportionate current flow.

In Fig. 4 we have pictured a typical characteristic curve of the plate current of a standard vacuum tube. It is seen there that this curve has a straight part, from B to C, but also a curved part, from A, where the plate current is zero, to B, where the curve goes over into the straight part. A similar curved line is seen as the saturation current is approached, from C to D. If we would plot the grid current curve we would see that this curve would show the same characteristics.

In Fig. 4-a we have represented a non-existent plate current characteristic, which would give perfect rectification. There it is seen that the slightest increase in grid potential would cause the plate current to start flowing at once, at the same rate as the plate current increases for a certain change in grid potential in the straight part of the characteristic in Fig. 4. But in this figure the very gradual curving upwards shows that the increase in plate current on the actual tube at the zero point for a small signal is so insignificant that the tube fails to detect. The fact





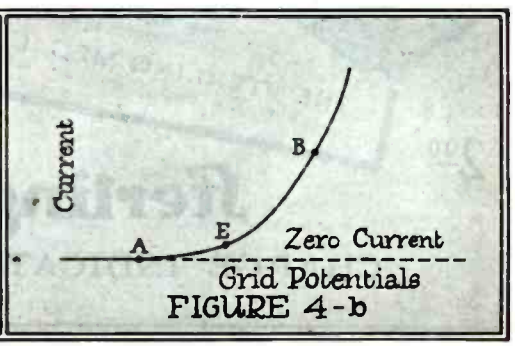


Fig. 4 shows how plate current increases when the grid potential gradually is increased. In Fig. 4-A we see how the current characteristic should be for ideal detection—a sharp bend at "E." Fig. 4-B is an enlarged view of the lower bend of Fig. 4.

is, that the tube will function as a detector on any point between the points A and B of the curve, because the increase in plate current is always greater for a given positive grid impulse than the decrease is for a negative impulse. But the rectification is not complete, and there is a certain value of impulses, below which the differences are so insignificant that the tube seemingly does not respond as a detector at all. This value is called the "threshold" value.

Now it may happen that the signal is below this threshold value, so that the detecting action of the tube is absent—and yet we would have in the plate circuit radio frequency currents, representing the amplified signal, which might be so intense that if they were used as input, the tube would start acting as a detector as well as it acts as a signal amplifier.

Not only this, but when we look at Fig. 4-c, which represents the curved part A-B of Fig. 4, we will see another thing. When the grid potential is held say at point E, and we cause the potential to vary slightly, it should be clear that the comparative changes in plate current are relatively smaller than if the fluctuations are of greater magnitude. This matter works almost in such a way, that if the signal intensities, and thus the grid fluctuations, are doubled, the resulting detected signal grows four times in intensity. If the signal intensity is tripled, the response is nine times as large: and for this reason the detector is often called a "square law" device. This is meant to express the fact that the detected signal in the plate circuit is proportional to the square of the original signal intensity. Of course this applies only in the curved part of the characteristic. But it proves that if we can just barely detect a signal, it would become much louder if we were able to add even the slightest amount to it.

This added amount we already have available in the radio frequency component of the plate current. When we remember that the vacuum tube responds practically instantaneously, we understand that the signal currents in the plate circuit are varying simultaneously with the signal currents in the antenna itself. If we could divert some of these plate currents into the grid circuit in such a manner that they would help the original signal impulses, the latter would become more intense, and the detector would function to better advantage.

Just who first conceived this idea and practically applied it to an audion detector circuit is a moot question which we will not attempt to solve. It is even doubtful when and where the first receiver which showed this action was conceived. This will become clearer when we consider more advanced designs of receivers. There have

been several receivers built, even before anyone thought of applying this principle knowingly, which possessed it in full measure. Only after the action was clearly recognized as a seeming reenforcement of the signal, as *regeneration*, as the phenomenon is always called, it started a scramble for the first honors.

Foremost among the contenders in this country are Armstrong, De Forest, and Langmuir. Abroad, the principle was discovered by Meissner, Strauss, Reisz, and von Lieben, while Schloemilch and Von Bronk built a reflex receiver, which was most certainly regenerative. But before the principle was recognized, uncontrolled regeneration—*oscillation*—must have been one of the chief worries of all experimenters in the field of audion-receivers.

It would be quite impossible here to deal with all systems used for regenerative purposes. There used to be a time, before the advent of efficient audions, when a reputation could be made by inventing such a system. We know now that regeneration is one of the chief characteristics of vacuum tubes, because even the slightest coupling between grid and plate circuit will cause it, very often in an uncontrollable manner.

We will therefore deal with the different systems in a very cursory manner.

First of all comes the system in which the plate circuit is coupled inductively to the grid circuit. This means that any current fluctuation in the first will cause a current flow in the latter, as was explained before. But this current flow in the grid circuit results in a potential fluctuation in the grid, so that the grid in turn again reacts on the plate circuit. The process can be easily seen by studying Fig. 5. The circuit is almost identical with the one of Fig. 3, with only a slight addition.

In Fig. 5 we see that a coil is placed in the plate circuit, and coupled inductively to the grid circuit. If a signal arrives on the antenna, it will cause the tube to respond by virtue of the action of the signal currents on the grid potential. Thus the plate current is varied, and the plate coil induces an additional current in the grid circuit, which, when the winding of the plate coil is in the right direction, is added to the original signal current. Thus the potential fluctuation of the grid is increased. This in turn results in a further change in plate current, which once more reacts on the grid circuit, and so once more influences the grid potential, again to result in increased plate current flow. Thus the process goes on, seemingly to an infinite extent, so that, theoretically at least, it is possible to build up very large signals from even the slightest starting point, the faintest signal. In practice this is not true, as we will see presently.

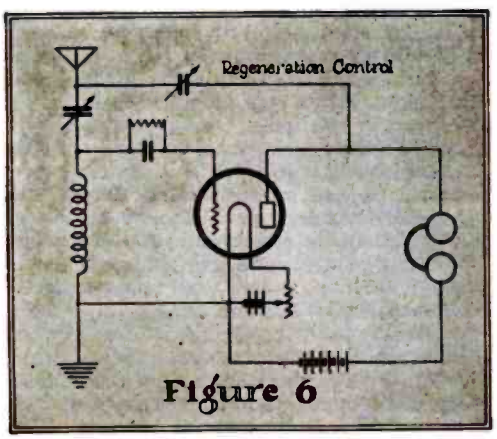


Figure 6

Regeneration controlled by a variable condenser. No by-pass condenser is used.

Fig. 6 shows an entirely different way of causing energy to be fed back to the grid circuit. We see here that the plate of the audion is connected to the antenna over a variable condenser. Remembering that it was stated that alternating currents can flow over a condenser, we will see that the amplified radio frequency currents will easily flow over this variable condenser. It now happens that these amplified signal currents flow in the same direction as the original signal currents, so that their effect is added to the latter ones, and once again it appears as if the original signal is re-enforced, regenerated.

The last way of obtaining regeneration is very important in view of some circuits with which we will deal later on, and is called the "tuned plate" method of regeneration. It is represented in Fig. 7.

We see there once more the familiar circuit, but now we have added a tuned circuit in the plate lead. Instead of this particular tuned circuit we might have used an instrument which is known as a variometer and which consists of two coils of wire of which the one, the rotor, can be rotated within the other one. Also we might have used a simple coil of wire, which is connected inductively to a separate tuned circuit.

Now we remember that when a current of a certain frequency flows over a tuned circuit, it develops large potential fluctuations across the tuning units. Therefore, if a signal is being received in this circuit, and the plate circuit is tuned to the frequency of that signal, there will be comparatively large voltage fluctuations across the tuned circuit and thus the plate potential will vary accordingly.

We know, that the plate and the grid are placed concentrically within the vacuum tube and so can be said to form a very small condenser. If the plate potential varies, it will cause fluctuations in the grid potential, and once more these fluctuations happen to be the same as the ones caused by the signal, so that again it seems as if the signal is reenforced. The size of the condenser formed by plate and grid is so small, however, that it is only effective at very high frequencies, but it is of extreme importance at broadcasting frequencies.

Now it would seem, that in all these different systems we should be able to bring any signal, however weak, to any desired intensity, because it is apparent, that when we feed back a small amount of energy into the grid circuit, the resulting grid fluctuations in turn influence the plate current, which again reacts on the grid, and so on. At first sight, then, it seems that the obtainable regeneration has no limits, and theoretically this is true.

However, in practice it is impossible to attain the theoretical limit, because, when this feeding back of energy into the grid circuit is carried too far, the tube starts acting as a *generator* of alternating currents: The tube acts as an oscillator.

And right here is the great drawback of all regenerative receivers: They always act as oscillators when not tuned with the very greatest care.

Now we stated once that in the broadcasting station, an oscillator was used to furnish alternating currents to be fed into the antenna to be radiated into space. If the receiving tube is brought to oscillation, it will also start to generate currents that are radiated into space in the form of radio waves. Why the tube should act as an oscillator we will explain at a later time in detail, but it is the reason why the regenerative receiver is such a general nuisance, because for greatest sensitivity it has to be on the verge of oscillation. The result is that in the hands of the general public it acts as an oscillator every time it is used to tune in a station and the waves radiated when it is oscillating interfere with the signals being received in a large area by other sets.

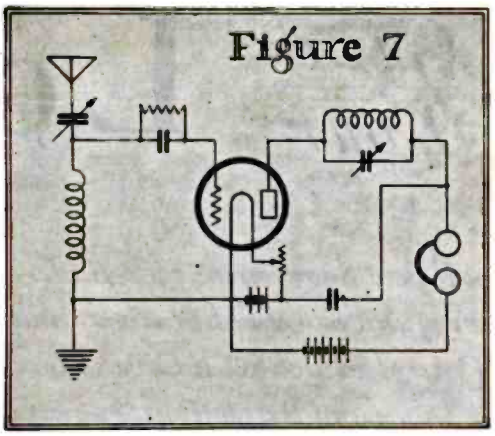


Figure 7

Regeneration by means of tuned plate. This is only effective at shorter wave lengths.

Hence the unflattering terms used to designate the regenerative variety of receiver, of which the terms "blooper" and "squealer" are among the mildest ones.

And hence also the legislation in most countries outside of the U. S. A. prohibiting their use; hence the general failure of transatlantic tests: thousands of regenerative receivers make the reception of distant stations a practical impossibility.

Yet—when all is said and done, in the minds of the old-timers in radio, the regenerative receiver still stands supreme. After all, as a radio manufacturer once wrote the author, the regenerative receiver is the one that delivers the goods. The name: "The old Reliable," signifies its ability to get the signal.

For this reason the author has designed a type of regenerative receiver which has all the characteristics of the best regenerative sets, but its "teeth" have been pulled: it may oscillate, but it can not radiate. This receiver will be fully described in the next number of *The Radio Home* as a separate feature from the continuation of "How to Understand Radio."

When operated by an expert, the regenerative receiver causes little if any trouble to neighboring receivers. Furthermore, in keeping the tube under control, the violent howls from the speaker or phones do not deafen the operator.

Although we have been confining our attention to the detector tubes, it is also important to realize that tubes acting as radio frequency amplifiers can also generate or oscillate and cause annoying radiation.

For instance, many attempts have been made to employ a tube between the aerial and the regenerative detector for the purpose of preventing currents generated in the detector circuit from passing out into the air. Although the extra tube is supposed to act only as a stable radio frequency amplifier, nevertheless, it often happens that the tube starts to generate. When this takes place the blocking tube is a greater annoyance than the much maligned regenerative detector.

Give Your Loud Speaker A CHANCE!

A Few Suggestions for Audio-Frequency Amplification and Control Which Will Give More Volume and Better Tone Quality.

By AUSTIN C. LESCARBOURA

IT is one of the anomalies of radio—and radio is just full of such inconsistencies—that the cheapest receiver is likewise the best for tone quality.

The simple crystal receiver, with its pair of ear-phones, provides a remarkably faithful reproduction of the broadcast program. Indeed, here is a standard which radio engineers have been trying to match for the past year or more, with the most elaborate amplifiers and loud-speakers.

Today, at last, we have loud-speaker rendition virtually on a par with the rendition of the crystal receiver and its ear-phones. And thereby hangs the following tale.

Three factors go to make quality reproduction with the loud-speaker receiver:

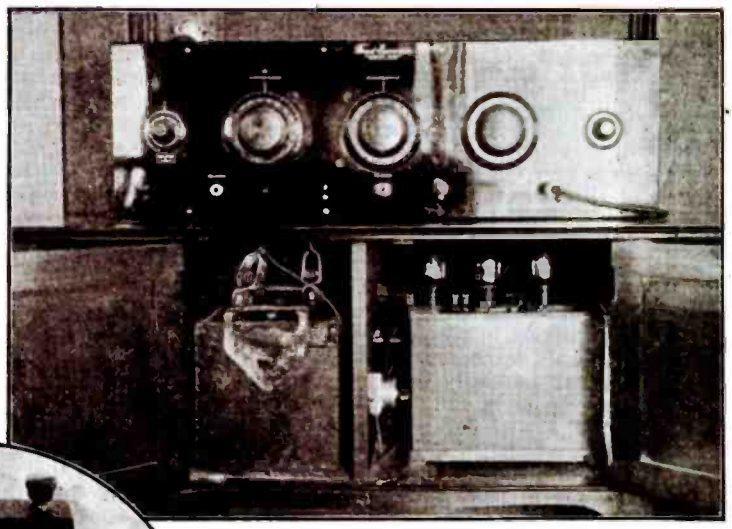
First, the receiver must be tuned in on a good station, the carrier waves of which carry all the latent sound values so necessary for full tone;

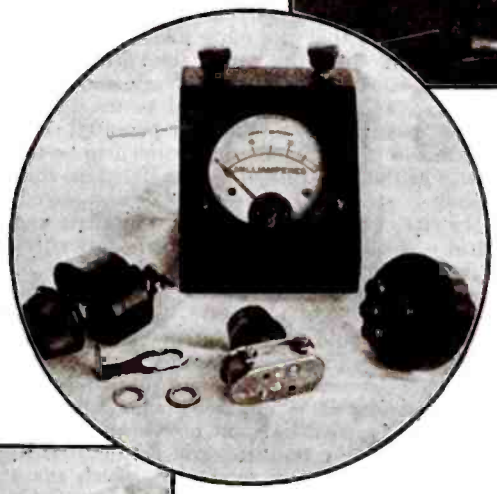
Second, a loud-speaker must be employed which is capable of reproducing the wide range of musical frequencies represented in the carrier wave.

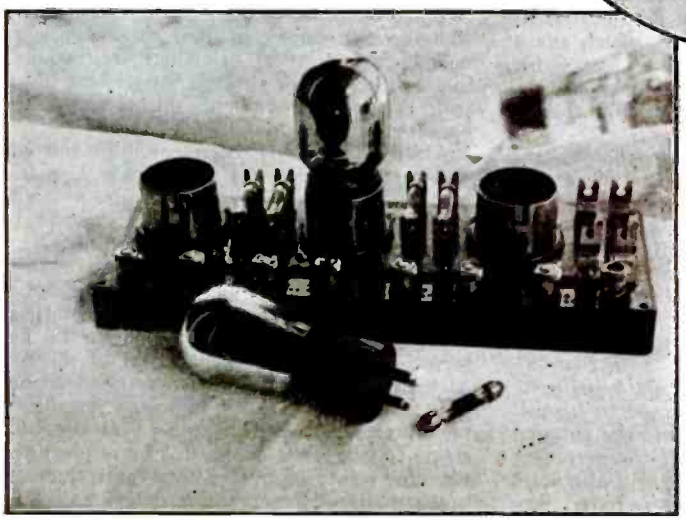
Third, an amplifier must be employed which is capable of handling the wide range of musical frequencies with equal amplification, showing no partiality for some frequencies to the slighting of others.

Only too often the radio novice, seeking tone quality, purchases a better kind of loud speaker, known for its excellent rendition, in the belief that he will now get the best there is to be had in tone quality. Much to his surprise and disgust, this radio novice is sadly disillusioned the moment he turns on the loud-speaker. If anything, the tone quality is positively worse than that with the cheap loud-speaker that has been momentarily replaced.

To the right is the author's attempt at quality amplification and revamping an old receiver. It is an old neutrodyne, the detector output of which goes to a resistance-coupled amplifier. There is a "B"-Eliminator storage battery with trickle charger, "C" battery, and at the other end of the living room, a loud speaker.





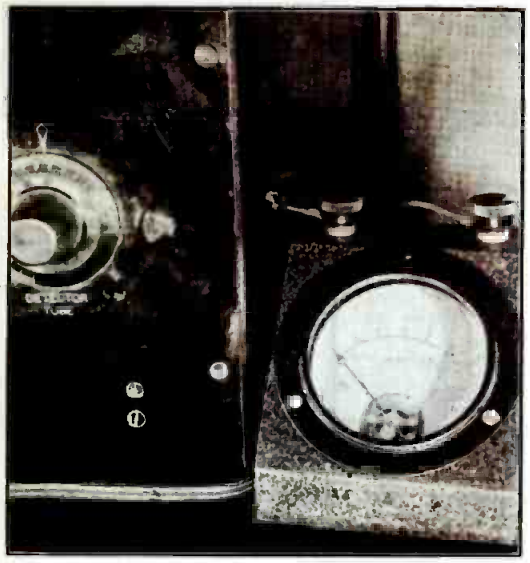


The above types of variable resistance units serve to good advantage in the radio frequency circuits when the ammeter shows signs of oscillation. To the left is one of the various types of resistance-coupled amplification units which produces excellent loud speaker tone, especially with a cone speaker.

And to make matters still more complicated, the radio novice is too often apt to blame the loud-speaker, not realizing that the best loud-speaker can do more than reproduce faithfully and clearly the very energy which is fed to it by the receiving set. If there is distortion in the audio frequency amplifier of the receiving set, the loud-speaker will render that distortion in all its ugliness. Indeed, a poor loud-speaker, already full of distortion on its own account, does a far better job in connection with a poor amplifier, as far as the average ear can judge.

Today there are numerous cone speakers available which can reproduce a wide range of musical frequencies such as are encountered in regular broadcasting. However, these cone speakers must be employed with distortionless (a purely relative term, as used here!) amplifiers in order to produce good tone quality.

Ever since radio listeners began to demand real quality in their loud-speaker performance, rather than a crude approximation which called for such liberal exercise of the imigination, radio engineers have been hard at work on improved audio-frequency amplification. Fortunately, this activity has come at a time when there is a lull in basically new tuning circuits, hence the engineers can turn their



The milliammeter is the stethoscope of the radio doctor. It tells him vital things about plate voltage, grid biasing and oscillation, which mar the loud speaker tone.

undivided attention to more needed refinements.

Thus three methods of amplification have come to the fore, namely, the standard transformer-coupled, the impedance-coupled and the resistance-coupled amplifiers. The author is too wary at this time to go on record as stating, in positive terms, that this or that or the other is preferable. Each method has certain advantages and disadvantages, although, if properly designed, each method today is capable of excellent tone quality together with plenty of volume.

Personally, and after extensive tests on the three methods, the author inclines to the resistance-coupled method—but he does not claim it is the best!

Transformer-coupled amplification today is capable of giving excellent tone quality, including a good share of the bass notes which have proved so elusive in the past. However, *good* transformers must be employed—those big fellows which seem like giants alongside the puny things of a by-gone day. The transformer-coupled method gives perhaps maximum volume for two tubes, to which it is usually limited. Furthermore, it is easiest on the "B" battery.

Impedance-coupling and resistance-coupling have very much in common. Both require three tubes for satisfactory volume, and both run somewhat higher in "B" battery drain than transformer-coupling. Furthermore, both these methods call for a high "B" or late voltage, which accounts for the high current drain.

As for quality, it is largely a matter of careful and fortunate balance. In either case the theoretical ideal is rarely approached in practice, which accounts for such wide divergence of opinions. Certain it is that some of the commercial resistance-coupled amplifiers, using high-mu (or high amplification) tubes, produce excellent results and plenty of volume at remarkably low first cost.

Assuming that transformers are to be employed, there is much that can be done to gain far better tone quality.

In the first place, the best transformers should be used, of which there are various kinds available today, if the radio listener seeks a practical job rather than a laboratory experiment. Thus with the small, old-fashioned transformers, and even some present offerings which are the product of the old rule-'o-thumb rather than engineering and research, there are many inherent faults which advertise themselves especially after the second stage of audio frequency amplification. It is common practice to employ high-resistance units and condensers across the windings, so as to smooth out certain tones and strengthen others. Yet if good transformers were employed in the first place, these improvisations, which help but little, would not be necessary.

Good transformers are generally distinguished by sheer bulk, although this is by no means a universal guide. Indeed, if one were to buy transformers by weight only, some serious mistakes might be made, since an excellent make for instance has special steel which makes extra bulk unnecessary. However, the better grades of transformers are for the most part considerably larger than the old-time offerings, with plenty of iron and windings. Buy a transformer with a well-known and long-established name, and you can't go wrong!

Assuming, then, that good transformers are employed, no accessories are required across the windings, with the exception of a small condenser across the primary of the first transformer, for the purpose of by-passing the detector plate current. This, however, is intended for the detector function rather than the amplifier, hence should not be charged against the latter.

Good transformers alone will not give tone quality. In fact, the most frequent cause of distortion in any amplifying circuit is the overloading of the second tube, as well as insufficient grid biasing or none at all. By grid biasing, the radio engineer means the tendency of the grid charge to become positive with relation to the filament, thus hampering the action of the tube.

To avoid this possibility, the usual method is to use a so-called "C" or grid battery, consisting of a few dry cells of very small size in a suitable block, which last indefinitely since no real work is expected of them.

At any rate, for good amplification a power tube is always necessary in the second stage. True, a 201-A type tube may be used, but it cannot handle the full volume, hence may introduce distortion.

Plenty of voltage is necessary for quality amplification with full volume. The first tube, for instance, should never have less than 90 volts, and while a "C" or grid-biasing battery may not cause a noticeable difference in the performance, it is really desirable. From 3 to 4½ volts should be applied as a grid bias. If dry-battery operation is desirable, a 199 type tube may be used in the first stage, although the volume will be noticeably less, of course. It takes the same grid-biasing potential, as well as plate potential.

The second stage should employ a power tube, such as the UX-112 type for storage battery operation, or the UX-120 type for dry-battery operation, as well as UX-210 type where power amplification is desired. Either the UX-120 or the UX-112 type requires 135 volts of "B" or plate potential for full operation, with 6 to 9 volts on the grid. With the UX-112, the plate voltage may even be raised to 150 or 165 for increased volume, with a corresponding increase in the grid-biasing potential.

When it comes to power amplifiers, using the UX-210 type, the plate potential should be of the order of 250 to 400 volts, with 25 to 30 volts for the grid bias.

The reason for power tubes is generally obscure to the layman, yet perfectly obvious to the radio engineer. Perhaps this presentation of the matter will clear up whatever mystery may persist:

When you use the usual 201-A tube as an amplifier, you are using a one-watt tube. This tube is capable of delivering just one-tenth of a watt of *undistorted* output. Note, this *undistorted* output, gauged by practical standards, for theoretical standards would set the figure even far lower than this.

When you use the 210 type power tube, on the other hand, you have a 7½-watt tube, with an *undistorted* output of .75 watt, or still less than a watt which is mighty little energy. According to tests conducted by engineers, the real *undistorted* output constitutes a very small portion of the total output, in some instances as little as one-sixtieth!

The use of power tubes, therefore, vastly increases the energy delivered to the loudspeaker, without being forced so as to introduce distortion. In summer-time reception, power amplifiers permit of sharp tuning so as to intercept a minimum of signal with an absolute minimum of static background, and then amplifying the signal to the desired volume. With lower amplification, on the other hand, the tuning cannot be so sharp, a greater signal strength must be intercepted and consequently more static background.

This is the day of by-pass condensers. In truth, as one well-known engineer put it, radio reception is rapidly getting down to a matter of choke coils and by-pass condensers. Perhaps that radio engineer was selling just those two items, which accounts for his enthusiasm; but at any rate, there is much truth in his statement just the same.

By-pass condensers should be employed where necessary. For quality amplification, for instance, a 1 or 2 microfarad condenser should be used across the "C" battery, and another across the "B" battery, especially when these batteries become somewhat run down. The by-pass condenser performs the double function of providing a direct path for radio-frequency energy, without detouring it through high resistance batteries, and of evening up the palpitating output of batteries approaching exhaustion.

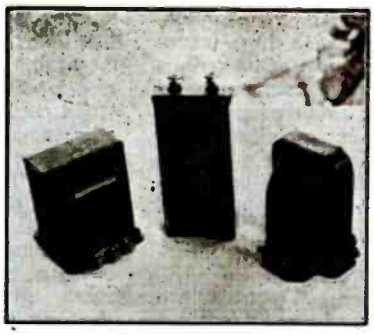
Still another use for a by-pass condenser is in the connection with coupling the loudspeaker to the amplifier output. Because of the high potentials, especially when of the

The variable high-resistance devices now available solve many a tricky problem. Here is an application of the author's own neutrodyne.

order of 200 volts and over, it is bad business to lead this output direct to the loud-speaker. The high voltage current may result in demagnetizing the loud-speaker, but at best it places the diaphragm or the armature, whichever it may be, under strain at all times, thus making the action sluggish since it is the modulated component that really results in sounds.

The best practice, therefore, is to keep the direct-current component out of the loud-speaker, and only allow the modulated component to go through.

This is accomplished in one of two standard ways: first, by shunting an impedance or choke coil of suitable value across the output of the amplifier, and then connecting the two ends to the loud-speaker with a by-pass condenser of 1, 2, 3 or 4 microfarad capacity (this is subject to individual experimentation) in one lead, or inserting a 1 to 1 ratio coupling transformer between amplifier output and loud-speaker. Both methods are good.



Choke coils, impedances and by-pass condensers seem to be the order of the day in obtaining tone quality. Here are two impedances and a by-pass condenser in the center.

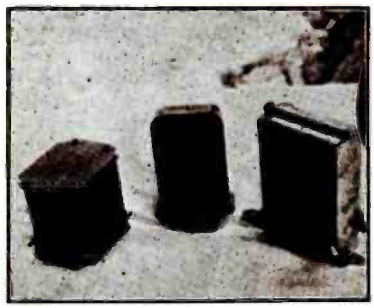
In the old days—and that means a year or two ago in fast-moving radio history—the main trouble was insufficient volume from the loud-speaker. Today, it is usually too much volume, hence the need for volume control.

And that is not so simple as it sounds. Volume control must not introduce distortion. Different receivers will require different treatment as regards volume control, but a universal method is to shunt a variable high resistance across the loud-speaker terminals. Another method, which must be individually worked out, is to apply a variable high-resistance unit somewhere in the radio-frequency end, which, after all, is the logical place for distortionless volume control. The author secures excellent results by using a variable high resistance in the positive "B" lead to the radio frequency stages. Still another method is a variable coupling between antenna circuit and first radio frequency stage.

Obviously, many of the foregoing remarks apply equally well to the impedance-coupled and the resistance-coupled amplifiers. Both these types have been described at length in previous issues of this journal, hence it seems quite unnecessary to go into details regarding the arrangement of these devices themselves.

If there is one instrument that is invaluable in achieving quality amplification, it is the milliammeter. Fortunately, inexpensive milliammeters are now available. One with a scale of 1-25 or 1-30 is suitable for use with an entire set of tubes.

A milliammeter may be connected in the "B" minus of the set, making sure that there is no short circuit to cause the meter to burn out. Then a local signal is tuned into the desired loudness, and the fluctuations of the needle are observed.

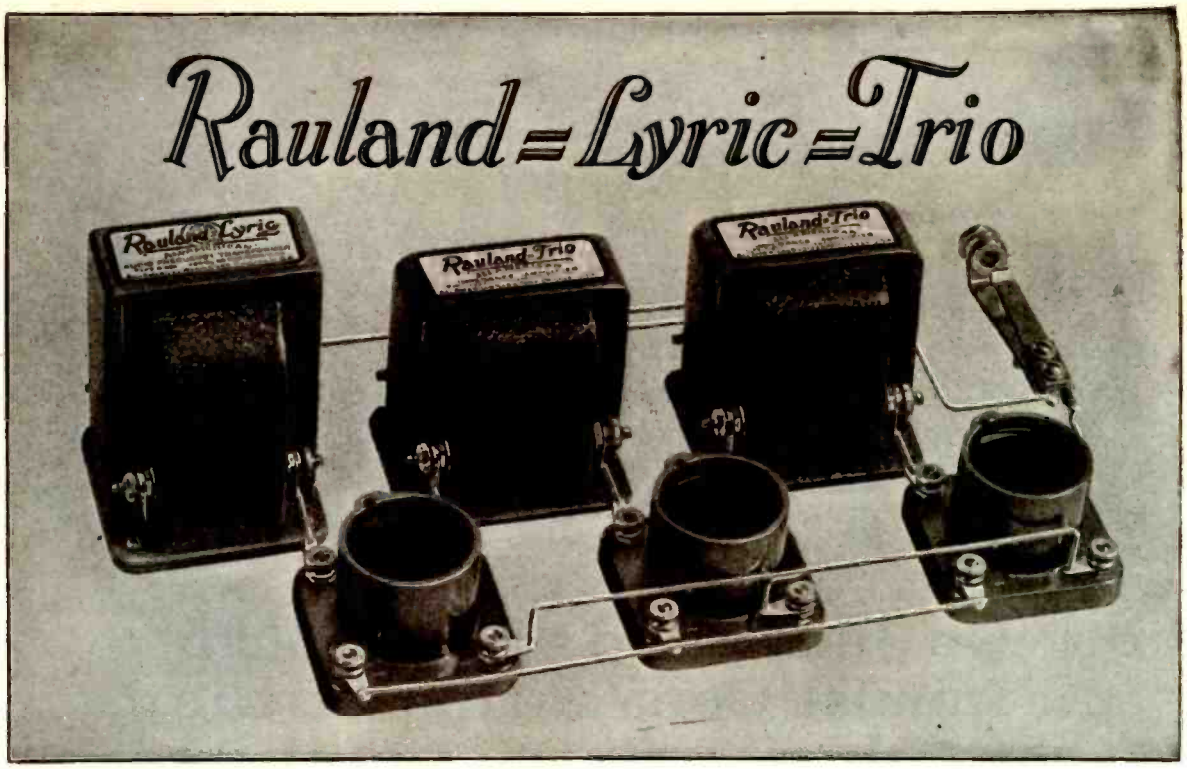


Three typical present-day audio-frequency transformers. They are virtual giants when compared with the old time transformers.

The needle virtually beats time with the music, swinging violently whenever there is a loud note. The needle should swing downward, as a normal thing, with loud signals. If, on the other hand, the needle swings upward from its normal position, there is too much "C" battery or grid bias, and harmonics are being introduced, especially in high notes. This causes distortion which may not be distinguished by the ear as such yet nevetheless mars the flawless performance.

In this connection it is preferable to increase the "B" potential of the last tube until the needle no longer swings upwards with loud signals. If the needle swings downward excessively, it indicates too little "C" battery or grid bias, and the "C" battery on the last tube should be increased.

In normal use the radio frequency tubes, detector and audio frequency tubes, not counting a power tube, should run about 2 milliamperes per tube. The power tube will take from 5 to 8 milliamperes. The usual 5-tube set, with power tube, therefore, need not take over 14 milliamperes, and excellent results may be had with 11 or 12, thus keeping within the practical bounds of economical "B" battery operation.



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