

April, 1925

# RADIO IN THE HOME

Conducted by HENRY M. NEELY

*In this issue:*

**3XP'S**

**\$100 OUTFIT**

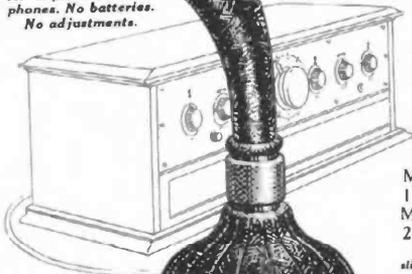


EM BECKETT

**Music Master**  
*Resonant Wood*  
*Insures*  
*Natural*  
*Tone*  
*Quality*



Connect Music Master in place of headphones. No adjustments. No batteries.

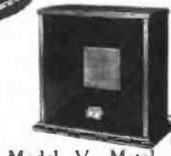


Model VI, \$30  
 14" wood bell  
 Model VII, \$35  
 21" wood bell

*(Prices of all models slightly higher in Canada)*



Model VIII, Mahogany Cabinet with full-floating wood bell, \$35



Model V, Metal Cabinet, mahogany finish, \$18 wood bell

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MUSIC MASTER transforms mere radio reproduction into artistic recreation—any set—your set—no matter what "speaker" you now use. Mere assertion? No. Statement of fact—and this is why:

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And lastly—supremely—this Music Master balance of resonant wood and metal unites to preserve, to produce, to re-create the overtones and harmonics that mold sound into music, give color and timbre to voice and endow an instrument with individuality.

Music Master is unique—the musical instrument of radio. There IS no substitute.

Buy Music Master and be safe—buy Music Master and improve your set—buy Music Master and exchange mere reproduction for artistic radio recreation.

**Music Master Corporation**

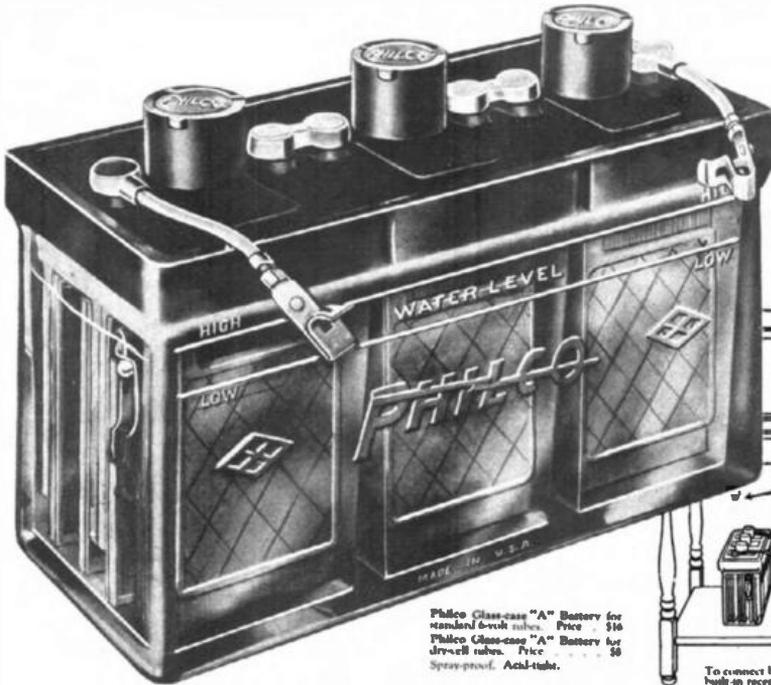
Makers and Distributors of High-Grade Radio Apparatus

Tenth and Cherry Streets

Chicago PHILADELPHIA Pittsburgh

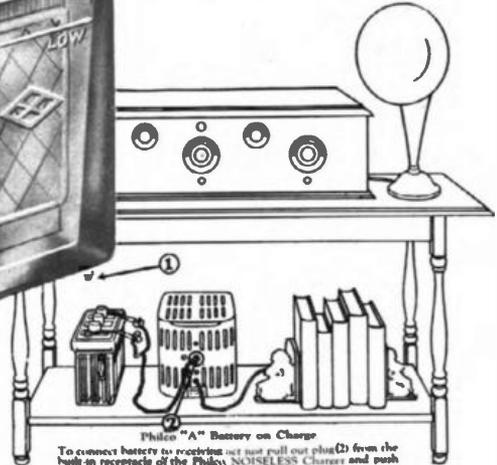
Canadian Factory: Kitchener, Ontario

**Music Master**  
 RADIO REPRODUCER



Philco Glass-case "A" Battery for standard 6-volt tubes. Price . . . \$16  
 Philco Glass-case "A" Battery for dry-cell tubes. Price . . . \$8  
 Spill-proof. Acid-tube.

Philco Double Charger for all "B" batteries and UDM "A" Batteries. Noiseless. . . . Price \$15  
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Philco "A" Battery on Charge  
 To connect battery to receiver set just pull out plug (2) from the built-in receptacle of the Philco NOISELESS Charger and push into receptacle (1). Simple as A B C.

## Recharge in your living room without changing a wire

Recharging a Philco Radio Battery with a Philco NOISELESS Charger means merely pulling a plug from your radio socket and pushing it into the charger socket. No changing wires. No moving the battery.

Philco Radio Batteries—both "A" and "B"—have other big advantages that make storage battery operation easy, convenient, and economical.

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Charge Indicators that tell you, at a glance how far the battery is charged or discharged.

No matter how expensive your radio set—whether it has one tube or many tubes—you must have the steady voltage and strong non-rippling current of a good STORAGE BATTERY for the best results.

Philco Radio Batteries deliver strong non-rippling current *without hum, roar or buzz*. You can buy them from your nearest Philco Service Station, Radio or Music Dealer.

Philadelphia Storage Battery Company, Philadelphia



Philco "B" Battery

Storage "B" Batteries are just as essential for clear and distinct reception as storage "A" Batteries. Philco "B" Batteries stay clean and dry. To charge without disconnecting a single wire, use a Philco Charger and "B" Charging Panel (\$2.75). "B" Battery in de luxe mahogany-finish case with cover (66 volts) . . . . . \$20  
 "B" Battery in handsome mahogany case without cover (66 volts) . . . . . \$16.50



Philco Mahogany-Case "A" Batteries

Two types—RAR and RW—for 6-volt tubes. Both in beautiful Adam-brown mahogany-finish cases harmonize with your radio cabinet. Price . . . . . \$14.50 up  
 Philco Charge Tester—permanently mounted in silver cup, avoids fumes with hydrometer. \$1 extra.

**MOTOR CAR OWNERS**—avoid the danger and humiliations of battery failure by installing high-powered, long-life Philco Diamond-Grid Batteries. With Philco Retainers, they are **GUARANTEED FOR TWO YEARS**. Philco-made automobile batteries range in exchange price from \$14.50 up.



DIAMOND GRID  
BATTERIES

# EDITORIALLY SPEAKING

BY THE time these words appear in print, the American Telephone and Telegraph Company will have completed its chain of eighteen stations linked up by land wire with Station WEAF in New York

## Broadcasting Enters a New Phase

for simultaneous broadcasting. This, to me, seems to be a totally new phase of radio and one which is fraught with the deepest significance for radio's future. These eighteen stations cover virtually the entire eastern half of the United States. Giving each station the very conservative

By HENRY M. NEELY

eight o'clock in the Central Standard Time belt. In the next belt west, it is seven o'clock and this is entirely too early to suit the majority of fans. Therefore, for the present at least, this time element will probably act as a natural bar against the further extension of these New York programs. The object of this tie-up of stations is frankly for "toll broadcasting." That is the name by which it is known among its friends; among its enemies it is called "Advertising by radio." The building up

I. So, also, does the A. T. & T. In fact, if you were a manufacturer trying to buy the facilities of these eighteen stations, that is about the first thing you would have told to you by the officials of WEAF, and they would tell it in a manner so little uncertain as to sound almost brutal.

There is, however, a vast difference between the way link-toll broadcasting is done by this link and the way *direct advertising* is being done by some individual stations scattered every here and there throughout the country. I have frequently listened to some of the rawest kind of

## Gentlemen, We Thank You!

IN THE February issue of *Amateur Radio*, the clever magazine published by and for the hams of the Second District, we read the following:



This is mighty FB, OM. (For the benefit of you BCL's, this is ham language for "fine business, old man.") We knew about the whole thing at the time, but we didn't like to say anything about it because we somehow can't get away from the conviction that, no matter how good we are, we are only about one-quarter as good as we ought to be.

I am particularly glad that this little compliment was paid us in the department headed "M-I-K-E" because I consider that the cleverest department appearing in any radio magazine.

So there's a little bouquet in return for the one they handed us.

night range of 100 miles, the eighteen stations cover 37 per cent of the total population of the United States. This range, as every radio fan knows, is too conservative. Almost all of these stations will easily have a range of 250 to 500 miles on an average night and, with such a radius as this, the eighteen stations will cover at least one-half of the population of this country.

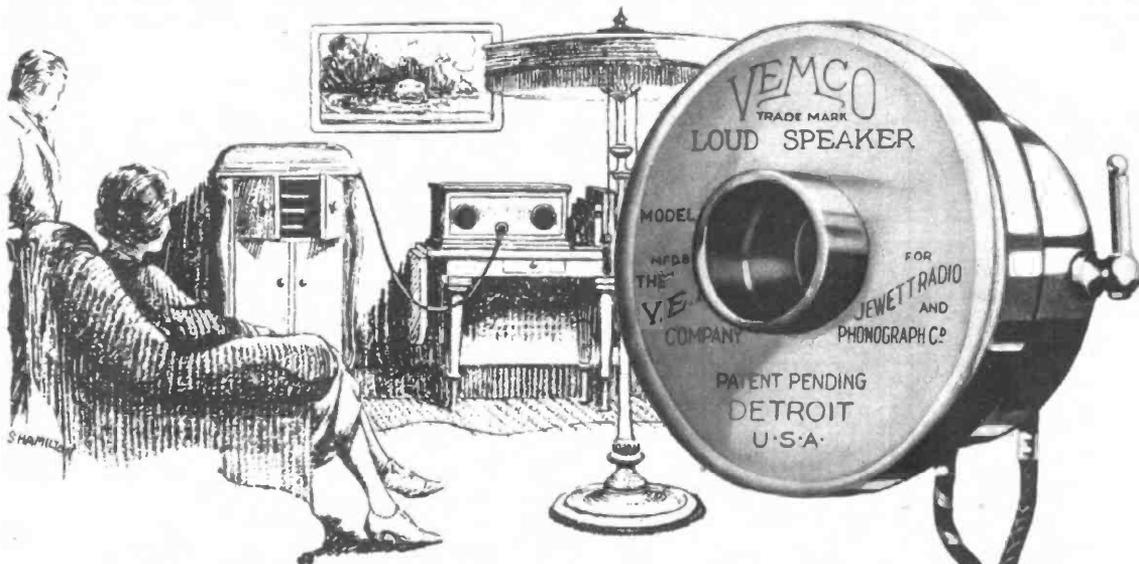
I have frequently been asked why it is that the A. T. & T. has not extended this range farther West. The principal reason is the element of time: To be of greatest benefit to the greatest number, the programs should not start later than nine o'clock, and when it is nine o'clock throughout the Eastern Standard Time belt it is

of this great system for the purpose of permitting manufacturers to get their names upon the air has aroused a great to-do among old-line advertisers and advertising agencies. Every here and there, as you pick up a newspaper or a magazine, you will see obviously inspired and biased articles designed to arouse sentiment against link-toll broadcasting. One might almost gain the impression that the A. T. & T. had deliberately set out to ruin the entire radio industry and to spoil radio for all of the millions of listeners-in.

Let us start a consideration of this subject with one axiom: *Direct advertising by radio will ruin the whole game and should not be permitted under any circumstances.* You will agree to that and so do

direct sales talks from the more poorly managed broadcasters, and I will admit that it was enough to make the blood of any radio fan boil.

You will hear lots of people say that radio is not a logical business because the fans get something for nothing. Now that toll broadcasting is developing, we make radio perfectly logical because, when you dig down deep under the surface of the subject, you will find that the fan is not getting something for nothing. *He is giving something that is of extreme value.* He is giving his attention to the broadcasting from a certain station and that attention of his is so valuable that great manufacturing or merchandising concerns are willing to spend money (Continued on Page 19)



## Radio—Through Your Phonograph!

In your own phonograph is hidden a horn of proved acoustical merit.

With a Jewett Vemco Unit, this horn can provide excellent Radio reproduction—reproduction so loud, so clear, and so accurate as to rival that of the best phonograph record you have ever heard.

But be sure that the Reproducer is a Vemco! That is the secret of accuracy, volume and tone.

No tools, no changes—Slips easily on or off the tone arm of a Victrola—We supply simple adapters for other Phonographs. Volume control develops distant broadcasting to amazing strength. Above cut shows actual size. The same Reproducer used in the famous Jewett Superspeaker. Price \$12; West of the Rockies, \$12.50. Adapter, when needed, slight addition. At your dealers or use the coupon.

*"There Is No Substitute for the Best"*

JEWETT RADIO & PHONOGRAPH CO  
5682 TELEGRAPH ROAD PONTIAC, MICHIGAN

# The Jewett Vemco Unit

"ANOTHER QUALITY PRODUCT"

SEND NO MONEY—  
Just Fill In The Blanks!

Jewett Radio &  
Phonograph Co.

5682 Telegraph Road,  
Pontiac, Mich.

Please send me, carrying charges prepaid, a Vemco Unit with adapter if needed. I will pay the postman. My Phonograph is a \_\_\_\_\_

(make)

\_\_\_\_\_  
(Name)

\_\_\_\_\_  
(Address)



**EVEREADY HOUR**  
EVERY TUESDAY AT 9 P. M.

(Eastern Standard Time)

For real radio enjoyment, tune in the  
"Eveready Group." Broadcast through

stations			
WEAF	New York	WFI	Philadelphia
WJAR	Providence	WGAE	Pittsburgh
WEEI	Boston	WGR	Buffalo

*Dry "B" Batteries  
are an economical  
dependable and  
convenient source  
of plate  
current!*

## Satisfaction Reliability Economy

You need three things in radio "B" Batteries—satisfaction, reliability and economy. You get them all in Eveready "B" Batteries. Satisfaction, because they produce all the current needed by your tubes, giving you the maximum results of which your set is capable. Reliability, because you can depend on them to work at full power. Economy, because they long maintain their strength, and because they are low in price.

Advances in the art of battery manufacture make Evereadys last longer than ever. You actually get much longer service for your money.

There is an Eveready Radio Battery for every radio use. Buy Eveready Batteries.

*Manufactured and guaranteed by*

**NATIONAL CARBON COMPANY, Inc.**

New York

San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

## EVEREADY Radio Batteries

—they last longer



Eveready  
Columbia  
Ignitor  
Dry Cell  
"A" Battery  
for all Dry  
Cell Tubes  
1½ volts

No. 766  
22½-volt  
Large  
Horizontal  
Price \$2.00



EVEREADY  
RADIO  
"B" BATTERY



No. 772  
45-volt  
Large  
Vertical  
Price  
\$3.75



No. 771  
4½-volt  
"C"  
Battery  
improves  
quality,  
saves  
"B"  
Batteries  
Price 60c

# RADIO IN THE HOME

Grimes-Flewelling-Harkness  
Associate Editors, Writing for No Other Magazine



By Henry M. Neely

Judge Stephen B. Davis  
Solicitor of the Department of Commerce and the man who has to disentangle the knots tied in the broadcasting wave lengths.

## The Broadcasting Hotel is Overcrowded

IF YOU listeners-in could only get a close-up view of the Department of Commerce literally tearing its hair in despair over the question of finding accommodations for all of the broadcasting stations and at the same time giving you folks a satisfactory broadcasting situation, I think your hearts would go out in sympathy to Judge Stephen B. Davis, solicitor of the department, who is the poor unfortunate upon whom has been wished the beautiful task of untangling all of the knots which are constantly being tied.

I went down to Washington about the middle of February and stopped in to see Judge Davis to find out how under the blue dome of an arid sky he could look for help or hope in any direction. I found that he literally couldn't.

"Do you know," said Judge Davis, "I feel that I am now simply the room clerk in a big hotel.

"I have been registering guests all day long and you come to me and

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MERRILL NEELY..... Laboratory Assistants	G. P. ALLEN..... Laboratory Assistants

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demand a room. I don't even have to look at the hotel register. The last hundred or more people who came to me as you did and demanded a room showed me conclusively that all of our rooms are filled. So I say something like this to you:

"I am very sorry, sir, but all of our rooms are full. As a matter of fact, we have two and three people in a great many of the rooms.

"Of course, I will not turn you out of the hotel because we are not allowed to do that nor do we really want to. We are here to give what accommodations we can. But I am sorry to tell you that our accommodations for you are now very unsatisfactory.

"If you know any one in the hotel at present and if you can make arrangements with him which are satisfactory to both of you to share his room, I shall be very happy, indeed. If you cannot do that I will not turn you out of the hotel, but will permit you to sleep in the billiard room.

But I must tell you one thing; there are about 200 people sleeping in the billiard room now, so you won't be very comfortable there. Still, that is all I can do for you."

"Now that is the situation. What are we going to do about it?"

I confessed that I did not know. In fact, Judge Davis did not even pause to give me a chance to reply. He looked like a man who already knew that I did not know.

"We have worried ourselves gray-headed

trying to make a solution that would be satisfactory to every one, he continued, "but we have reached the stage now where it is absolutely impossible for us to do anything. Consequently, unless the new guests can make arrangements to share some of our rooms with other people, they will simply have to sleep in the billiard room."

"And," I asked, "what is the billiard room in broadcasting?"

"The billiard room," smiled Judge Davis, "is the band of wave lengths below about 280 meters."

I began to see light at that.

"In other words," I ventured, "you are not empowered under the law to refuse a license to any one. If I apply for a Class B license, you are compelled to give one to me, aren't you?"

The Judge nodded and smiled.

"And further," I continued, "you will hand me my license and say to me that unfortunately there is no regular Class B wave length available at the present time, and so, until there is, I will have to operate on a wave length below 280 meters along with about a million other stations. Is that correct?"

"Just about," admitted the Judge. "That is all we can do; if you can think of a better solution, you can have my job and welcome."

"This department is beginning to take the viewpoint that the applicant for a broadcasting license really has no inherent rights at all. We are beginning to view radio broadcasting as a public utility of immense importance and are therefore inclined to view every problem now from the standpoint of service to the broadcast listeners. There are increasing reasons for believing that this is the correct viewpoint and that this service to the public is the thing which will have to guide us in all our future decisions.

"At the present time we are painfully aware of the fact that the public is not satisfied with the service it is getting. There are constant complaints of interference and we have done everything in our

power to eliminate this cause of dissatisfaction but, with the continuing avalanche of applications for broadcasting licenses, we have reached the point where it is impossible for us to do anything except permit the guests to sleep in the billiard room.

"Radio experts have told us that two stations broadcasting on less than 10 kilocycles separation are bound to interfere with each other even in a very good receiving set. Therefore, it has been absolutely necessary for us to establish this separation

getting reports that other people are contemplating the erection of large broadcasting stations, thinking theirs will buy public good will to themselves. I personally trust that the addition of more stations will have exactly the opposite effect. When I hear now of a firm that intends to start another broadcasting station, I immediately picture in my mind a firm that is governed entirely by absolutely selfish motives and that proposes to crowd into a place *whether it is wanted there or not.*

At the present time, new stations are decidedly not wanted. Broadcast reception is becoming a *nothing* but satisfactory and every additional station simply robs us of some of the satisfaction which we can get now with our receiving sets.

The broadcast listener should take this viewpoint and should impress it in no uncertain terms upon every firm which attempts to add to the confusion in the air.

It is most devoutly to be hoped that at least one-half of the present broadcasting stations will die within a few months. They will not be

missed except through the much improved reception by the general public. Half of the stations operating today are putting out stuff which is not worth listening to, anyhow. They are small stations, poorly equipped, inadequately financed, badly managed, programmed with the crudest kind of taste and judgment and they are operated solely for the purpose of appealing to the personal vanity of the man who is putting up whatever money is necessary.

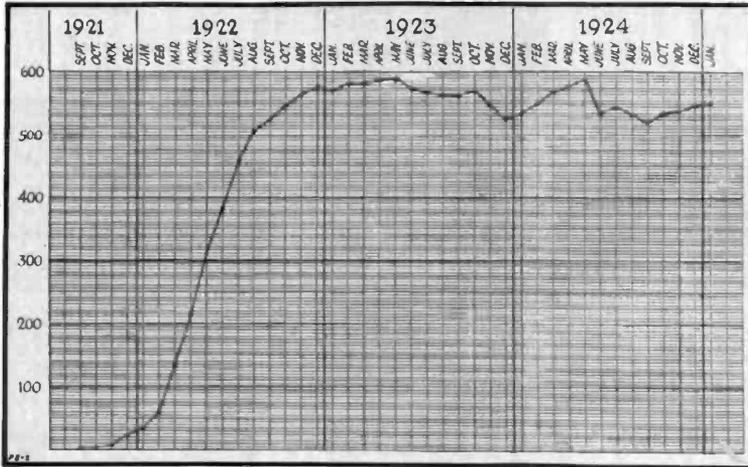
In such cases as this, such a station, even though of comparatively low power, will inevitably blanket all receiving sets in the immediate neighborhood. Such a station means that for a radius of about five miles it is useless for any man of good taste to own a radio set because he will by his very position be forced to listen to the undesirable programs that smear the air from this station.

*The sooner we are rid of the inefficient broadcaster the better it will be for radio.*

Not long ago, the General Electric Company, of Schenectady, New York, sent me a statement by Martin P. Rice, who is in charge of their broadcasting. In this statement, Mr. Rice, whose experience is as wide as that of any man in the country, pointed out the fact that a great many stations had been discontinued during the past three years. He added:

"Consideration of these data points to one conclusion—namely, that broadcasting is a serious undertaking, requiring not only a large investment and a proportionately large operating expense but also the ability to please the great radio audience more or less continuously.

"Strictly local insti- (Continued on Page 28)



This graph shows the number of broadcasting stations for each month since broadcasting began

of at least 10 kilocycles. We once tried to lop off a little bit of this but found that the experts were right and we have gone back to the 10 kilocycles separation.

"In the broadcasting wave lengths assigned to Class B stations—say from 280 meters up to about 550, there are only 53 possible channels with this 10 kilocycle separation. Last October we had 57 Class B broadcasting stations. Today there are 82. We have in sight at the present time applications which will bring the total number of Class B licenses up to 108. Yet we have exactly 53 rooms in which to crowd these 108 guests. What are we to do?"

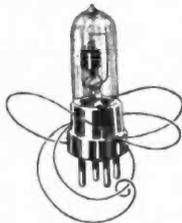
"The viewpoint of public service and of genuine value to the broadcast listener makes it necessary for us to give certain exclusive wave lengths to certain of the

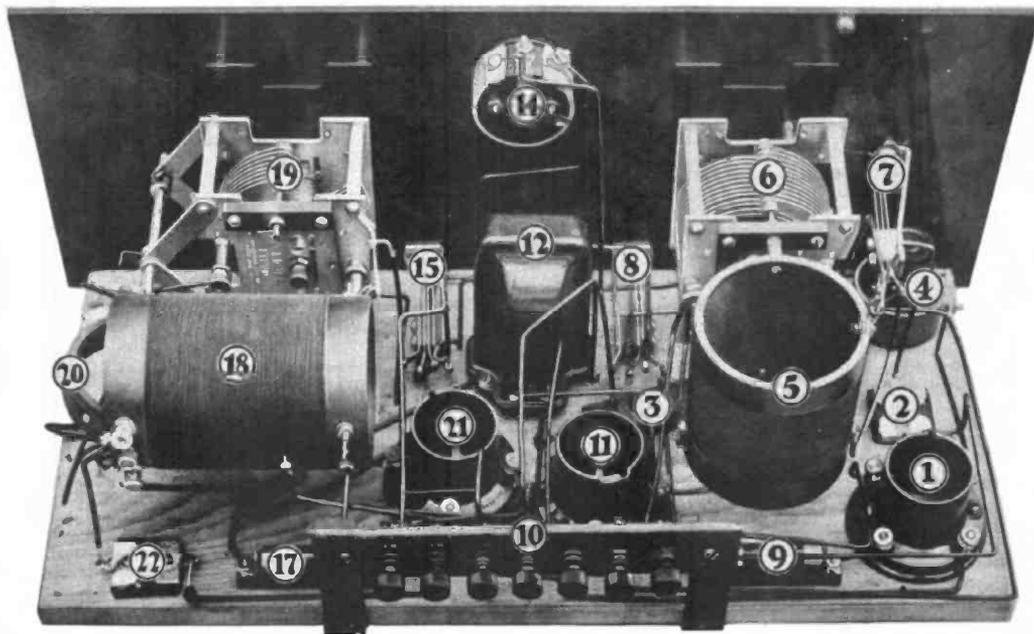
bigger stations which are doing important public and development work. We cannot ask them to share their rooms with another guest because this would be to the disadvantage of the public, without any consideration of its effect in hampering the development work which is being done. Therefore, with only 53 rooms, and some of them definitely assigned to only one guest, what are we going to do with the 108 guests who demand accommodations in this

broadcasting hotel?"

"The answer is—the billiard room. We haven't anything else in sight."

**Y**ET, in spite of this overcrowded condition of the ether, we are constantly





# The 3XP BROWNING-DRAKE

By G. P. ALLEN

Former New England representative of Radio in the Home, now a member of the laboratory staff of Station 3XP

*Above is a view of the set showing arrangement of the parts. The numbers correspond with the numbers on the diagrams*

*Below is an end view showing the grid leak and condenser mounted under the coil*

THERE is probably no demand which we receive by mail from readers oftener than the one for a good efficient radio set that can be bought complete for \$100. This sum of \$100 seems to be psychologically fixed in the minds of 50 per cent of our people as the limit which they want to expend for their first radio set. And this \$100 must cover everything. They do not want a set which will cost \$100 and then have to buy a lot of accessories in addition. They want the whole thing to come within that sum.

It has been rather difficult to supply directions and specifications for a set of this kind which would use nothing but the very best of material. Good material in radio costs money. And a good loud-speaker set usually uses quite a lot of good material, which in turn means quite a lot of good money.

When G. P. Allen came to Delanco to join the laboratory staff of Station 3XP after being our New England representative for some time, he brought with him a great enthusiasm for a circuit which has proved to be probably the most popular one throughout New England. This is the Browning-Drake circuit.

Mr. Allen also brought with him a new piece of apparatus in which we were particularly interested. This was the type 285 audio-transformer manufactured by the General Radio Corporation. The curve which General Radio publishes for these transformers shows that it has an amplification ratio of something like 20 to 1. Mr. Allen was told by one college laboratory that the true amplification is nearer 50 to 1.

A ratio of this kind has heretofore always been considered absolutely out of the question if we were to have any kind of quality at all. We at Station 3XP were frankly skeptical.

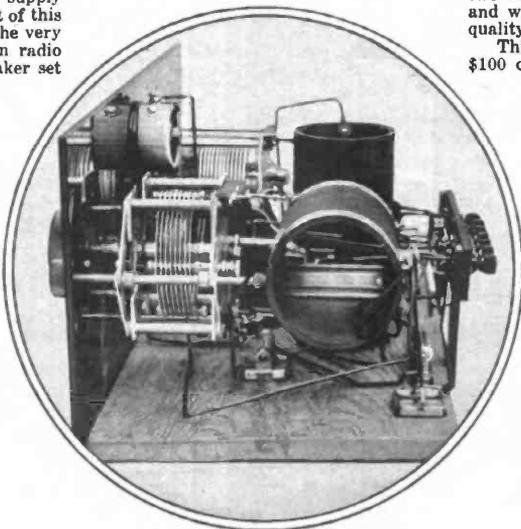
In order to make a test, we hooked up one of these type 285 transformers in a single step of amplification and rigged up switches so that we could compare it on the same set with the ordinary two and three stage amplifiers. The tests simply astonished us. We found that the type 285 produced very nearly as much volume as two stages of the ordinary transformer and we could not detect any difference in quality.

This pointed a way to develop the \$100 outfit, because it meant that it was necessary to have but one stage of audio-amplification, thus saving a considerable amount of apparatus and an extra tube.

The Browning-Drake circuit was developed primarily for the UV199 or the C299 tubes. Let me say that, for those who like to use these little tubes, they will find this circuit extremely efficient.

The diagrams given here can be used for these little tubes, but you must remember that the smaller tube has a socket whose connections are not placed in the same manner as they are in the standard socket. It will be very easy, however, to change the leads shown in these diagrams to suit the small socket.

We developed this circuit for use first with the Shicklerling S900 tube in order that we might be able to make it a strictly dry-cell circuit. This was done for



the purpose of saving the money necessary for the storage battery and charger. Ordinarily we very strongly recommend the storage battery and charger because there can be no question that a great deal more volume and a great deal more efficiency can be obtained with the UV201-A tube or the C301-A than with any other tubes on the market. But we had in front of us the limitation of \$100 for complete cost, and that meant dry-cell operation.

After we had developed the circuit, the S900 tube was withdrawn from the market and the Schickerling Company substituted a new tube which is now just making its appearance. This is the S1600. It is a standard-size tube, drawing only .16 ampere in the filament. This, while a greater drain than the old S900, is still well within the limit of dry-cell operation, providing you use three sets of dry cells in series-parallel.

Do not use the UV201-A tube or the C301-A tube in this circuit. It will not bring out the full efficiency of the tubes because the regenerative kits which are necessary in this circuit are not wound for that

dry cells. However, nobody buys everything at full list price, so the additional price for four dry cells will undoubtedly be saved on some of the other apparatus.

There are only two articles in this set which it is absolutely essential that you use. One is the regenerative kit and the other is the type 285 transformer. So far as concerns the sockets and jacks, rheostats and so forth, any standard make will be perfectly satisfactory.

And now I will let Mr. Allen tell his own story about this set and how to hook it up.

H. M. N.

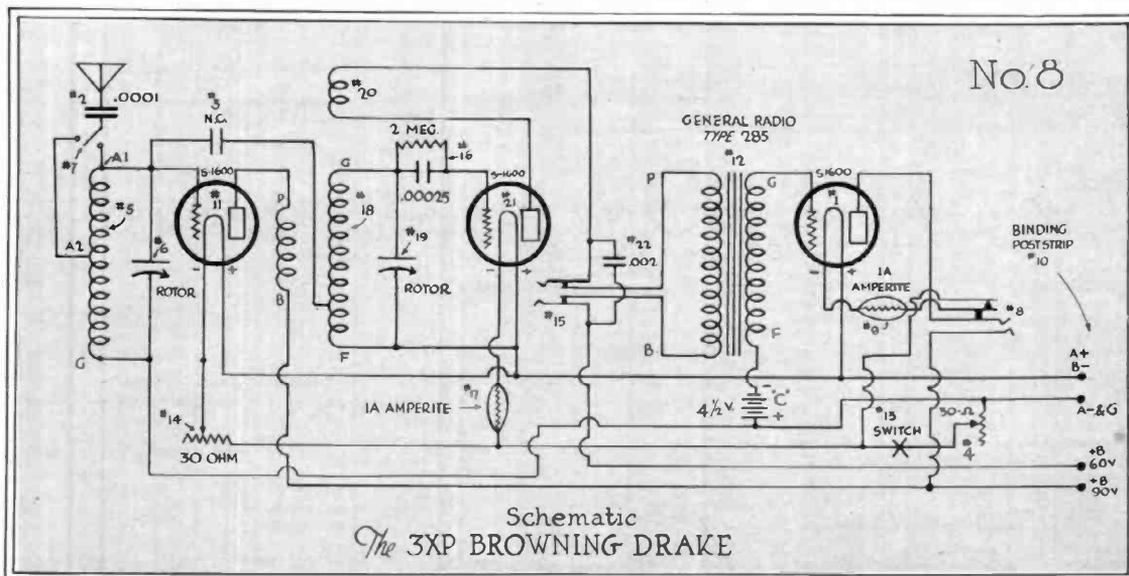
FOR a long time the readers of *Radio in the Home* have been asking for a regenerative detector with a stage of radio-frequency ahead of it. Last summer a circuit of this sort appeared, and, although it was a mighty fine one, it was not in just the form we wanted to use it. We have been playing with it at 3XP and now have it in the shape that you have been asking for. The circuit is known as the Browning-Drake. By use of the Schickerling S1600 tubes it is possible to keep the set within

pearance of the new Schickerling tube made it possible for us to use a different tube and still neutralize the circuit.

Our foundation is laid on the Browning-Drake regenerative put out in kit form by the National Company of Cambridge, Mass. I am not going to tell you how to make these coils, for, in the first place, Browning and Drake deserve what little profit they can get from the sale of the parts for the time and labor they put in developing their idea. In the next place, the construction of the regenerative would be beyond most of us mechanically.

And now let me mention the other remarkable part of the circuit, the audio-frequency transformer. This is made by the General Radio Company of Cambridge, Mass. At 3XP we are quite prepared to find their stuff will do all that they say it will, but we were not prepared to find the remarkable amplification that it does give. One is all you can use in a circuit, and one is all that you need!

Before giving the list of parts and the panel layout, I want to caution you not to



tube. Please do not ask me for winding directions for these regenerators. They are a special development of the Browning-Drake partnership and are beyond the ability of any but the most advanced worker in radio to make.

This set gives us one stage of radio-frequency amplification, a tube detector and one stage of audio-amplification, which is almost equal to the ordinary two stages. Consequently it is an extremely efficient set both in distant-getting ability and in loud-speaker operation.

Parts and accessories cost as follows:

Parts necessary for set . . .	\$46.40
Aerial outfit . . . . .	5.00
Three tubes at \$3.00 . . . . .	9.00
Loud-speaker . . . . .	30.00
Dry cell "A" battery . . . . .	3.20
Dry cell "B" battery . . . . .	6.00
One "C" battery . . . . .	.40

Total . . . . . \$100.00

This was for the S900 tube, but for the S1600 tube it is necessary to add four more

the range of dry cell operation and still get very satisfactory results. The three tubes use only 0.48 of an ampere.

Although 7x18 makes a rather large panel, it does not take a trunk to hold it. Combining this with the fact that the set will work with a small antenna, it comes within the requirements of a portable set, although we did not start out to make it one. I say "we" advisedly, for, although I did the mechanical work, "H. M." and Merrill supplied most of the ideas necessary to bring it to a successful completion.

The circuit as designed by its inventors called for the UV199 or C299 tube. Unlike many, this hook-up was the result of painstaking mathematical calculation on the part of its designers. They knew what they wished to do—and by means of formulae figured what they would have to do to get it. The resulting set was a check on their mathematics rather than anything else. So well did they do their work that the hook-up functioned only with the small tube for which it had been designed! The ap-

try to substitute other parts for those I have just named. If you do, please don't expect an answer to your letter if you run into trouble. Although I have given the makes of parts that we have used in the hook-up for the benefit of those that are "buying the whole works," it is possible to use other standard parts in their places. Just one more word.

We do not guarantee this set to give seventeen quarts of milk a day, and beat all the rugs in the house, but we do think that it is at least the equal of any three-tube set now in sight, and it will give some others a run for their money.

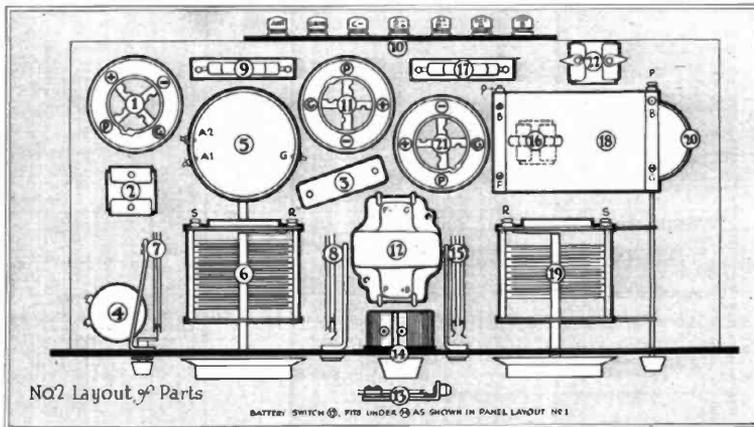
**Diagram No. 1** This is a 7x18 radion panel. All the holes have been measured in from

the left, short side, of the panel; and up from the bottom, long side. The holes are laid out for the apparatus specified. In drilling the holes it may be necessary for you to change the location and size of some holes if you do not use the same

apparatus. For instance, if you do not use a General Radio rheostat you may have to change the spacing of the holes numbered 14a and 14c. Now think of the most emphatic language you can, and then let me tell you in terms stronger than that—if you change the spacing of holes numbered 6a, 6b, 6c, 6d and 19a, 19b, 19c and 19d you will run into all kinds of trouble; for you will not be able to neutralize the set after you get it done. We have gotten this into the smallest thing we could, so please do not ask for directions for putting it on a postage stamp. And, also, we know we did not give you any holes for attaching the panel to a baseboard. We have left that up to you.

Well, go to it! You have 18 holes to drill—ten for the 1/8 inch drill, two for the 1/4 inch drill, four for the 3/8 inch drill and two for the 1/2 inch drill.

Hole No.	Distance in	Distance up	Size Drill
7	2 3/8	2 3/8	3/8
6a	4 1/8	4 1/8	1/8
6d	4 1/8	2 1/2	1/8
6c	5	2 3/8	1/8
6b	5 1/2	4 1/8	1/8
6e	5 1/2	2 1/2	1/8
8	7	1	3/8
12	9	1	3/8
15	11	1	3/8
14a	9 3/8	6 3/8	1/4
14b	9	5 3/8	1/4
14c	9 1/8	5 3/8	1/4
19a	12 1/2	4 1/8	1/4
19d	12 1/2	2 1/2	1/4
19c	13	3 1/8	1/4
19b	13 1/2	4 1/8	1/4
19e	13 1/2	2 1/2	1/4
7a	15 3/8	3 3/8	1/4

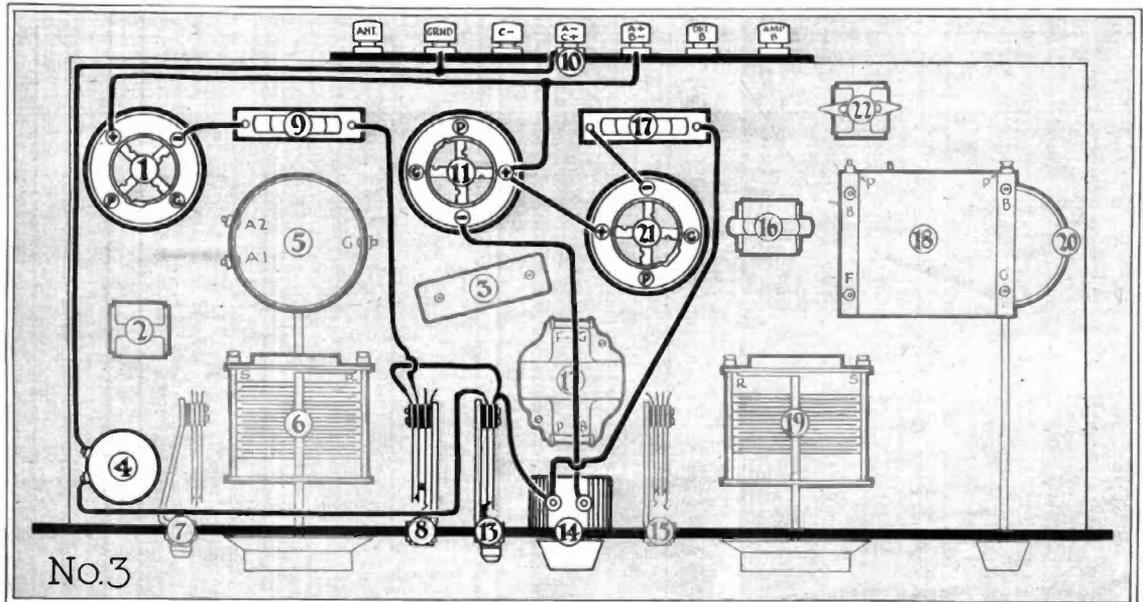


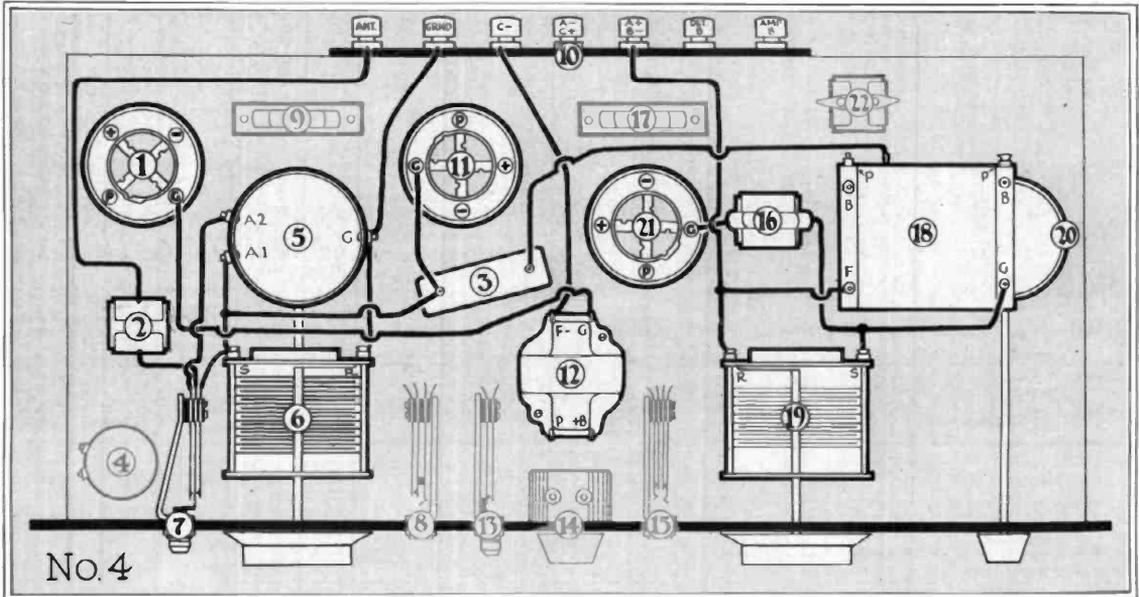
Layout of the apparatus

Diagram No. 2 Layout of Parts Now for the list of parts whose location is shown in diagram No. 2.

1. Na-ald or any standard 201A socket.
2. .0001 Dubilier fixed condenser.
3. X-L neutralizing condenser, Marco or Sterling.
4. 30-ohm rheostat.
5. Browning-Drake antenna coil mounted on
6. National .0005 variable condenser. (No other part can be substituted here.)
7. No. 30 Yaxley, Pacent or Marco, two-circuit jack switch.

8. No. 3 Yaxley, Marco or any good single-circuit, filament-control jack.
  9. Amperite 1A with mount.
  10. Radion binding post strip with 7 Eby binding posts.
  11. Na-ald or any standard 201A socket.
  12. General Radio Company audio transformer, type 285. (No other part can be substituted here.)
  13. No. 10 Yaxley midget battery switch. (On account of the limited space I do not think you can get a different make in here.)
  14. General Radio, type 301, 30-ohm rheostat. (Any small diameter standard make will do.)
  15. Marco, Pacent, No. 4 Yaxley or any standard interstage jack.
  16. .00025 grid condenser and 2 megohm leak.
  17. Amperite 1A with mount.
  18. Browning-Drake regenerative transformer attached to
  19. National .00035 mfd. condenser which also holds
  20. Tickler which is inside coil 18. (For 18, 19, 20, no other parts can be substituted.)
  21. Na-ald or any standard 201A socket.
  22. .002 fixed condenser, Dubilier mica.
- You will also need two National velvet





vernier dials which are included in the regenerative kit.

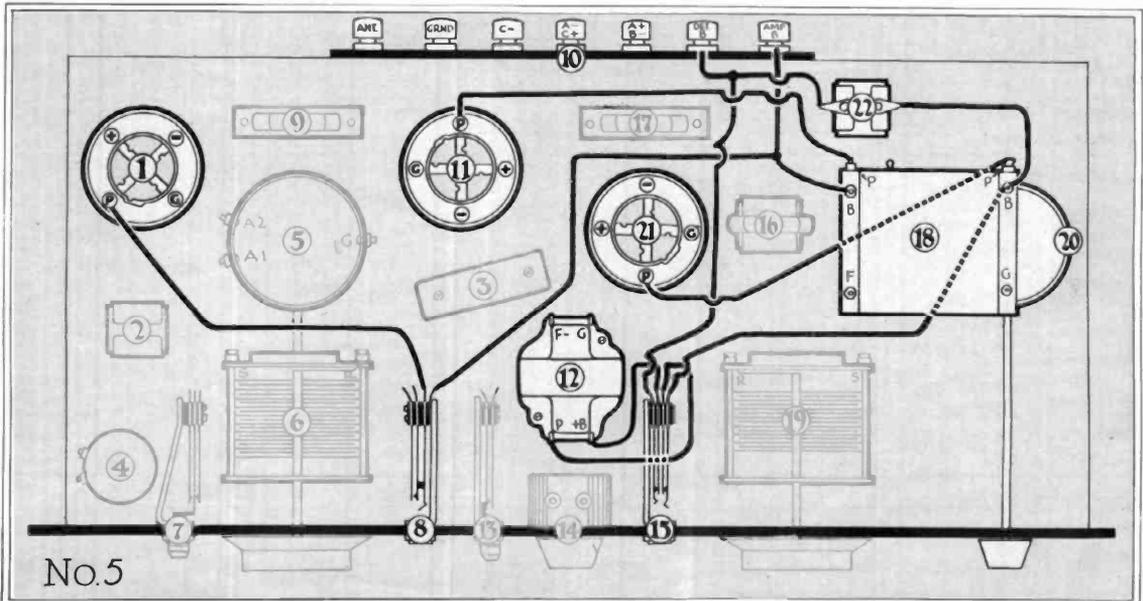
For tubes we used the new Schicklering tubes, S1600. This tube uses 0.16 ampere at 5 volts, with from 45 to 90 volts on the plate. Once again, we used Celatsite wire.

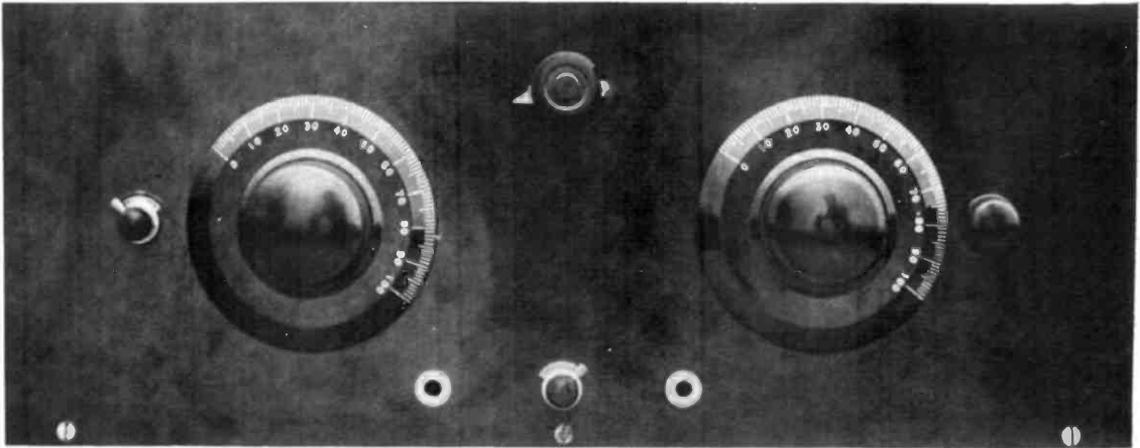
Now please do not write in and ask us, "Can I use this tube or that," because if you could we would have published this last summer instead of waiting until now. If you think you can, go to it, but don't tell us that you cannot neutralize your set.

**Diagram No. 3**  
**"A" Battery Leads**

From ground binding post (second from left) on strip No. 10 (do not solder), to negative A post on block No. 10 (fourth from left). Do not solder.  
From positive A post on block No. 10 (fifth from left—do not solder) to positive filament terminal on socket No. 1.  
From positive A on block No. 10 (solder now) to positive filament on socket No. 11.  
From positive filament on socket No. 11 to positive filament on socket No. 21.  
From ground binding post No. 10 (do not solder—a third wire coming here) to

one side of the rheostat No. 4.  
From the other side of No. 4 to the bottom blade of switch No. 13.  
From the top blade of switch No. 13 (do not solder—more wire coming) to left-hand binding post on rheostat No. 14.  
From the other binding post on rheostat No. 14 to the minus filament post on socket No. 11.  
From top blade of switch No. 13 (solder now) to top blade of jack No. 8.  
From next to top blade, jack No. 8 to one side of Amperite No. 9.  
From the other side of Amperite No. 9





Here is a view of the panel as we made it. The dimensions are given in the layout below

to minus filament post on socket No. 1.

From left post rheostat No. 14 to one side of Amperite No. 17.

From the other side of Amperite No. 17 to minus filament terminal of socket No. 21.

**Diagram No. 4**  
**Antenna and Grid**  
post (first on left) of block No. 10 to fixed condenser No. 2.

From the other side of condenser No. 2 to middle of switch No. 7.

From bottom blade of switch No. 7 to terminal marked A2 on antenna coupling coil No. 5.

**NOTE:** In case your coil is not marked A1 and A2—A1 is the terminal that has no wire coming to it from the inside of the tubing on which the coil is wound. See diagram No. 2. At the other end of the coil, on the opposite side, there is a connection that has no wire coming to it from the inside of the tubing, but is marked G.

From top blade of jack No. 7 to terminal marked A1 on antenna coupling coil (do not solder—more wires coming).

From A1 (still do not solder) antenna coil No. 5 to stator of condenser No. 6.

From A1, coil No. 5 (solder now) to grid terminal on socket No. 11.

From ground post on block No. 10 (solder now) to connection marked G on coil No. 5 (do not solder).

From connection G on coil No. 5 (solder now) to rotor on condenser No. 6.

From grid terminal on socket No. 11 to one post on neutralizing condenser No. 3.

From the other post of neutralizing condenser No. 3 to loop on winding near left-hand end of coil No. 18.

From C minus post on block No. 10 to

A minus connection on transformer No. 12.

From connection G on transformer No. 12 to grid connection on socket No. 1.

From A plus post on block No. 10 (solder now) to post marked F on coil No. 18 and from there to rotor post of condenser No. 19.

From stator post of condenser No. 19 to post marked G of coil No. 18.

From post marked G of coil No. 18 to one side of grid leak and condenser No. 16.

From the other side of grid leak and condenser No. 16 to grid post of socket No. 21.

22 to detector B (60 volts) on block No. 10 (do not solder).

From detector B post on block No. 10 (solder now) to bottom blade jack No. 15.

From lower connection to coil No. 20, on coil No. 18, to plate of socket No. 21.

From next to the bottom blade of jack No. 15 to post marked B plus on transformer No. 12.

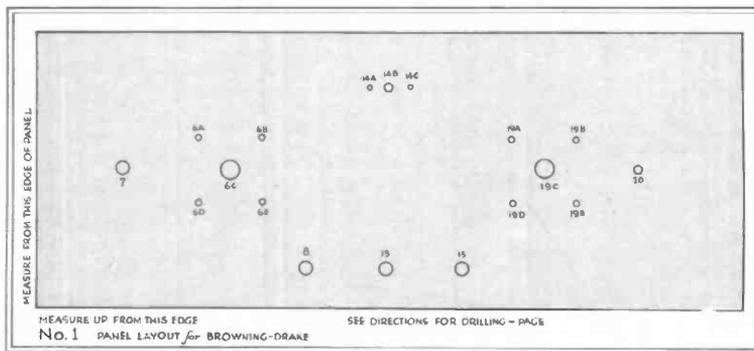
From post marked P on transformer No. 12 to the next to the top blade of jack No. 15.

From top blade of jack No. 15 to upper connection on coil No. 18 which goes to coil No. 20.

**Operation of the Set**

Now, if your wife has not told you that it is 3 o'clock and time for you to be in bed, you are ready to start. "What do you mean, start? I have just finished!" Let's see.

Set rheostat or resistance No. 4 so that the full resistance is in the circuit. Insert an old tube in the detector socket No. 21 and connect



**Diagram No. 5**  
**Plate Leads**  
From plate terminal of socket No. 1 to next to the bottom blade of jack

No. 8.

From the bottom blade of jack No. 8 to the last post on the right of block No. 10. (Amplifier B 90v). Do not solder.

From 90v B post on block No. 10 (solder now) to connection B on left end of coil No. 18.

From connection P at the same end of coil No. 18 to plate terminal on socket No. 11.

From upper knurled nut on coil No. 18 which makes connection to rotor coil No. 20 to fixed condenser No. 22.

From other end of fixed condenser No.

your "A" battery to the minus B and plus 60B on block No. 10 to test for possible "shorts." Turn on switch No. 13 and the filaments should not light. Now change the connection from the 60B to the 90B terminal on block No. 10. Insert the tube in sockets No. 11 and No. 1. On account of jack No. 8 being a filament control jack have a plug inserted in it. The tubes still should not light. If they do there is something wrong with your wiring and you will have to find the mistake. It is much cheaper to spend a few moments doing this than to buy new tubes. If everything is all right disconnect the battery and you are now ready to make the proper battery connections to block No.

(Continued on Page 36)

# Radio Preacher is Paid "Country Style"

By W. O. WISEMAN



*Pastor Brown visualizes his invisible radio audience when he preaches before the microphone. He is shown here in the WOAW station studio, snapped just as he usually appears, with his Billy-Sundayish gestures*

WITH burning messages, accompanied by Billy-Sundayish gesticulations, the Rev. R. R. Brown offers salvation to a sinful world. Each Sunday morning he preaches to the World Radio Congregation of Station WOAW from the topmost floor of Omaha's tallest skyscraper, the Woodmen of the World Life Insurance Association Building.

Uptownish and citified—eh what?

Well rather! But when it comes to receiving pay for his services "Pastor Brown," as he has come to be known, might well believe that the clock of time had been turned back a century or so. He might well believe that he is tilling a pioneer portion of the Lord's own vineyard.

For fresh eggs, country butter, honey-in-the-comb, chickens, fresh fruits and meats roll into the studio for him just as preachers' pay came in years gone by.

And now there comes a new sort of preacher's pay, and, says Pastor Brown, "a kind that will be used to spread the Gospel more than ever."

This time it's an automobile, and it comes unsolicited, by voluntary contributions from his unseen congregation.

It all came about this way.

Every time Pastor Brown shouts into the microphone, "Hey, you guys, take off those hats, put down those cigarettes and bow your heads with me in prayer; I mean you, over there in California in that pool hall," he brings forth a multitude of requests for him to address audiences in person.

Just such a request he got from Boone, Ia., where they were looking for an evangelist. He complied with the request and sallied forth in his rattle-trap "Lizzie" of a model almost

obsolete. Played out from many like trips around Iowa, Nebraska, Kansas, Missouri and the Dakotas, the superannuated "Lizzie" failed to function and Pastor Brown spent the night with a radio-acquaintance farmer twenty miles from his destination.

The second night he addressed the Boone meeting and told it the story. That was enough.

The Boone folk got busy. Many of them were old friends of Pastor Brown, even though they had never seen him before.

Merchants, farmers, bankers, laborers—Jew, Catholic, Protestant and Gentile—rallied. A week later Orson Stiles, director of Station WOAW, got the following telegram and a draft for \$516:

"Please use this toward the purchase

*Pastor Brown's new automobile, presented to him by his radio audience.*

*Photo shows Pastor Brown and his new car. Mrs. Brown and their two children are shown with him*



of a high-powered automobile for Pastor Brown. He needs it to spread the religion of Jesus Christ."

It was signed by "A group of Pastor Brown's admirers."

The telegram was read to the Sunday morning audience by Colonel Patterson at Station WOAW. No solicitation for funds was made.

That, too, was enough—plenty.

The station was flooded with contributions—nickels, dimes, quarters—\$10, \$20, \$50 in checks and bills. Came contributions from almost every State in the Union, and many from Canada.

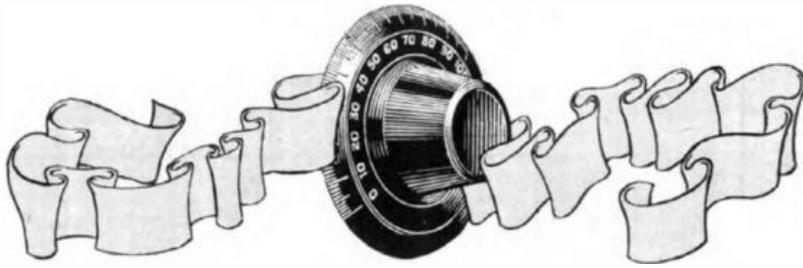
The car was purchased, presented—a shining blue Nash sedan.

Then came forth from Waterloo, Ia., F. A. Holmes, manufacturer of the five-tube radio set of that name, and presented Pastor Brown with a receiver. Mr. Holmes said his aged mother is a member of Pastor Brown's congregation.

"She wanted you to have a set," he explained.

Now there's nothing freer than the radio brand of salva-

(Continued on Page 34)



# The Question of "Low Loss" and "Bunk"

H. M. Neely, Editor,  
Radio in the Home.  
Dear Sir:

Will you kindly arrange to send us twenty-five copies of the February issue of *Radio in the Home*, billing at the regular retail price?

We could purchase these on the newsstands here, but we do not wish to deprive any possible patrons of yours of the opportunity of reading your attack on us through inability to secure this issue through the regular channels. If your editorial in this issue is your honest conviction and you are sincere in wishing to advance radio, and also protect the interest of your readers, as well as the interests of reliable, legitimate manufacturers of radio apparatus, it would seem that, before attacking us, you would have first investigated our side of the question, and endeavored, if possible, to have put us right if you found us so absolutely wrong and misguided, before striking a foul blow without warning. However, since you have made this attack on us, and given it a very prominent position in your magazine, the square thing to do now is to give our reply equal prominence, so that the radio fans, who are the most interested, can judge for themselves just who is the nearest right. We are willing to abide by their decision, for it has been proven many times that the public, as a whole, cannot be fooled all the time.

In the first place, you are mistaken in stating that we are attempting to discredit increased efficiency in radio apparatus, or "low loss," as it is popularly known. If you read our "ad" again, carefully, you will find that in no place do we call low-loss "bunk."

What we are doing is cautioning the readers not to be fooled by bunk on low-loss, and, as an example, take the quotations reproduced in our "ad" which were taken from the "ads" of metal end plate condensers, as follows: "No-loss," "lowest loss," "loss too small to be measured"; also other expressions such as: "Our condensers will increase your distance, volume, selectivity, clearness," etc., etc. Do you contend that these statements are facts, or bunk? If they can be proven, then they are facts; if not, then they are bunk, or its equivalent (if you can find a softer word than bunk).

You give dielectric construction the benefit of the doubt (which has been proven) in admitting that in the laboratory

*IN THE February issue of this magazine, I had an editorial dealing with a widely published advertisement headed, "Are You Fooled By This Low-Loss Bunk?"*

*Of course I did not mention the name of the advertiser in that article and I had no intention of doing so, but the editorial brought forth some correspondence which I think should be published in fairness to all concerned. The correspondence is printed here exactly as it took place and with no further comments from me.*

H. M. N.

tests now made they show up just as efficiently as the metal end plates, yet it was in the laboratory, under the now obsolete 1000-cycle test, that the metal end plate condenser was perfected. While the 1000-cycle test for condensers is acknowledged obsolete, the results obtained by it are mainly what metal end plate construction is based on. This test measured dielectric absorption losses, which are large at low frequencies, but which decrease directly as the frequency increases. It ignored the

skin effect losses, which are low at low frequencies, but which increase rapidly, and not uniformly, as the frequency increases..

Ignoring skin effect losses, the metal end plate construction shows up superior to the dielectric construction, but, as you say, condensers are used at radio frequencies, not at the low, or 1000-cycle, frequency at which they are tested and perfected, and, as a result, the skin effect losses, which were ignored

in testing, assume considerable importance in actual service, so that where metal end plates were supposed to show higher efficiency, or lower losses, when compared with dielectric end plates, they not only did not prove any better, but in some cases actually proved not as good. The difference, however, was, in effect, splitting hairs, and was as apt to be in favor of one as the other. This has been proven in a number of disinterested laboratories, so it is safe to say that it is true.

If it is true, then our contention is that on the present broadcasting wave lengths there is very

little, if any, difference in efficiency between the two types; one is equally as efficient as the other. A dielectric end plate condenser of good construction is as truly a low-loss unit as the metal end plate type and all the exaggerated claim and propaganda for metal as exclusively "low-loss" are bunk, mainly to influence the radio fan to scrap a dielectric end plate condenser and replace it with a metal end-plate type, under the impression that by so doing he is going to improve his set greatly. After he has done this, no one has to tell him that a lot of "low-loss" propaganda is bunk; he knows it, and it cost him good money to find it out. In a good many cases, he puts the old condenser back in the set and scraps the new one. If the metal end plate condenser manufacturer, in making his wild and wonderful claims, had graduated (Continued on Page 22)

**The Answer to Mr. Rathbun's Letter**

Mr. R. F. Rathbun,  
Rathbun Manufacturing Company, Inc.,  
Jamestown, N. Y. February 10, 1925

My dear Mr. Rathbun:

Your letter about my recent editorial gives me an opportunity to do what I am always more than glad to do—present both sides of any controversy fairly and squarely to my readers and let them decide for themselves. You ask that your letter be given the same prominence as my attack upon you. In order to do that, I am doing something that I have never seen any other editor do and that is step aside from my usual place on the editorial page and print your letter with your signature as the leading editorial of the April issue. I am also printing this letter of mine to you in the subsidiary position usually occupied by the editorial of lesser importance in this magazine.

*In printing your letter I am making no comment upon it further than reproducing this one. I am quite willing to assume that your attitude in the low-loss movement is*

(Continued on Page 21)

# An Humble Thought or Two about "Low Loss"

"LOW LOSS" certainly is a very much discussed subject these days. That Mr. Average Man intends to know all about it is mighty well shown by his persistent questions on the subject. It is not at all hard to find the reason for this when we consider the tremendous desire on the part of all of us to secure better radio reception. Low loss seems to be one point that we can scrutinize with an eye to improved results. My own observations on this subject have extended over a period of about three years and some of the results and actions that I have noted have been very interesting indeed—so much so, in fact, that I feel that my readers will be interested in knowing about them.

First, I wish to emphasize a point or two that oftentimes seems to have been overlooked. It is this: That any change whatever in the frequency (wave length, if you prefer) in a radio circuit means an immediate and prompt change in the action of the material or parts used in the circuit.

As an illustration: it is easy to build a receiver that will not oscillate at 500 meters, but quite a different story to make this same receiver as efficient without oscillations,

By E. T. FLEWELLING

Associate Editor of "Radio in the Home"

entirely a very important item, namely, that the field produced around a condenser or coil may be excellent for one set and impossible for another. This is because of what other coils or condensers may lie in the field of the coil in question.

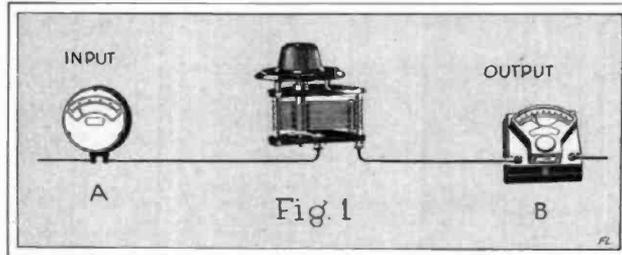
Different condensers mean different fields; different wave lengths, or frequen-

and not change the frequency of the circuit by any reasonable change in the coil or condenser. This circuit had to be such that changing from say 25 degrees to 75 degrees on the condenser, or 50 to 100 turns on the coil, would not materially change the wave length or frequency of the circuit. It was quite a little problem to find such a circuit but, like all other things, was easy after we knew how.

Given such a circuit, what were we to accomplish? We knew the actual resistance of the coils and condensers, what more could we find? The writer is like everyone else in this world: He likes to see with his own eyes! I felt that if I could see what actually happened in a radio circuit I might be able to find a little of value to the art by observation.

I propose, therefore, to give at least one definite answer to such questions as the following:

- (1) Does "Low Loss" pay or is it "Bunk"?
- (2) Which is better, a metal end plate variable condenser or one with bakelite end plates?
- (3) Should a condenser have its



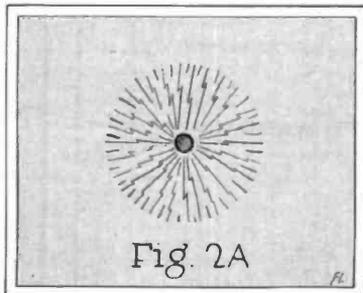
cies, different fields. This carries us also to the statement that a condenser has a different resistance with every setting of the dial and a coil has a different resistance or effect as we use a different number of turns, etc., etc. It is not fair to check one condenser at 75 degrees on the dial against another at 25 degrees on the dial, nor one coil against another of different shape, position, number of turns, etc.

The question now comes to our minds to trouble us, "If any change at all in the circuit means a change in results, how can we ever be sure?"

The answer is not so hard. See that the apparatus is measured at the approximate frequency at which it is to be used. A 1000-cycle test means nothing. Neither is the use of the word "Bunk" a constructive word to help you decide what you should use. The public can help and is helping toward the perfection of radio by the use of that intelligence that the average American is so famous for.

It is comparatively easy to measure the resistance of a coil or condenser at the frequencies at which it is to be used, and no doubt some day we will purchase parts so labeled. To try further to answer this question of "How can I tell?" is the purpose of this article.

Remembering that any change of frequency means a change of results, the writer was anxious to find a circuit in which he could use a condenser or a coil

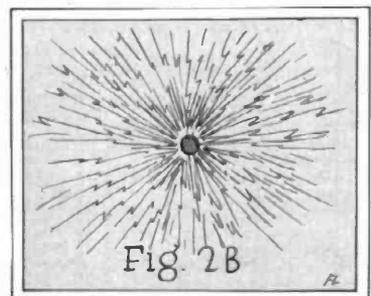


tion at 200 meters, where the frequency is so much higher or faster.

A coil may be excellent for 1000-meter work and no good at the greater frequency at 100 meters.

It is useless to measure a condenser at a frequency of 1000 cycles and expect the results to be the same at 1,000,000 cycles or 300 meters. Yet it has been standard practice until quite recently to measure condensers at a frequency of 1000 cycles.

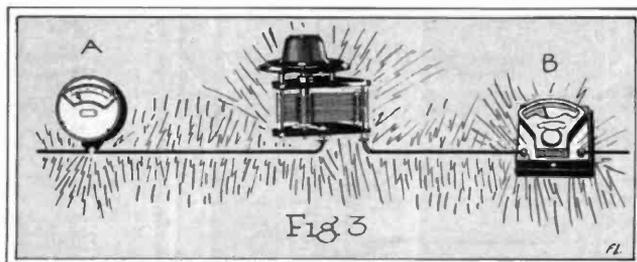
Again, let us consider another favorite method of arriving at some comparison: that of the relative merits of apparatus. We remove a coil from our set, substitute another for it, and immediately notice much better reception, so we decide that the second coil is very much the better coil and neglect



plates spaced closely together or far apart?

- (4) Do bends or right angles in wiring a set make any difference?
- (5) Should a set be wired with bare or insulated wire?
- (6) Does it make any real difference whether the connections are short or long?

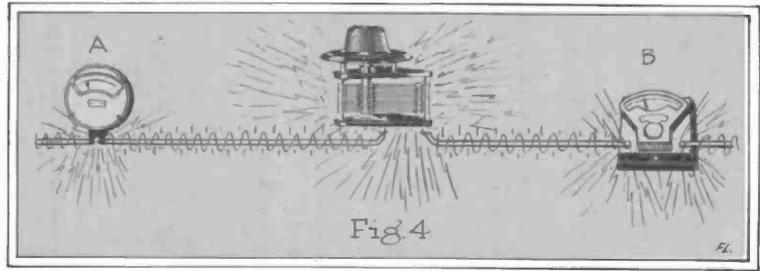
Having formerly confined all of my efforts to receiving apparatus, I have been asked many times why I changed my work to include transmitting apparatus also. There is, you know, more than any one man can ever master in receivers alone and it probably seemed queer that I should also take up transmitting and install Station 9XBG. My answer was, and of course still is,



that it was done simply to study receiving circuits further. A poor condenser might not be so apparent in a receiver, but a powerful transmitter will burn it up, this in itself affording a little chance for actual observation! 9XBG furnishes power enough for this. Here, then, was one step toward the answer to the questions.

Let us suppose that we have a circuit something like that shown in Figure 1, consisting simply of a wire going by us. Let us suppose that we can make this wire carry any radio characteristic that we desire.

For instance, the radio characteristic reads something like this—100 meters, or 3,000,000 cycles, and the meter B which measures the output reads 2, an arbitrary figure, while meter A measures 3, also arbitrary. Let us suppose that we change the condenser shown, which we will say is set at a 25 degree scale, to 75 degree scale, or

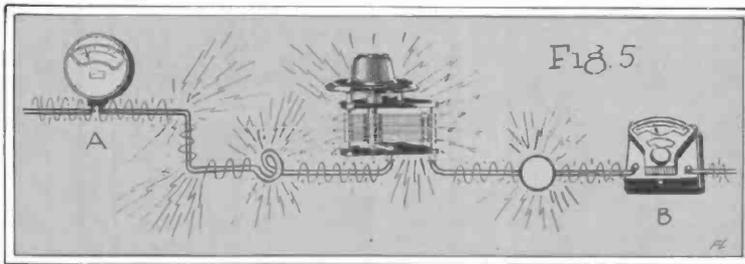


less loss than one not confined. Note Figure 2a. Here we have the field (radio) around a wire, a confined field. Figure 2b shows an overloaded wire with an unconfined field. This second case is the field that causes the well-known hysteresis

move it along the wire, we find that the pencil lights up over the entire length but that it lights more brightly at some points than it does at others. The brighter the light the more current we have, so that we now see with our eyes an actual demonstration of the radio fields about the wire, and instruments and Figure 1 now can be shown something like Figure 3, and here is our first lesson! At the binding posts of each instrument the field is much larger than it is along the wire itself, and look at the stray field about the condenser!

Supposing now that we could make a box that would collapse about the wire, the condenser, etc., and push all this stray current back into the wire where it belonged, certainly it would be better able to do its work at the output point "B." This illustrates the line of thought that I wish to put before my readers, so I can now go on with a few illustrations of what actually happens when various changes are made in the circuit.

If insulated wire is substituted for the bare wire of Figure 3 we find a picture something like that in Figure 4. Here we have so confined the field to the wire that



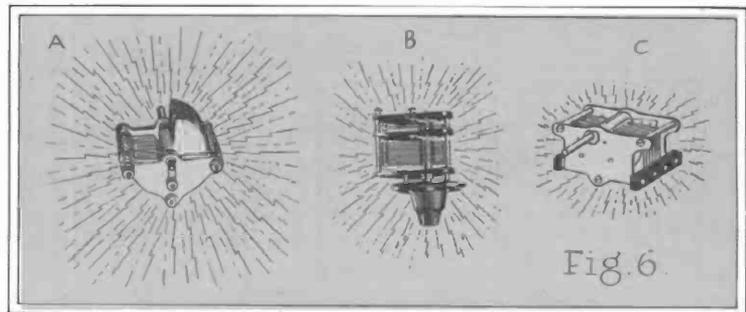
that we substitute for the condenser a coil of 50 turns or a coil to 100 turns.

Now in this circuit, within reasonable limits, none of these changes will affect the fact that the circuit still operates at 100 meters, or 3,000,000 cycles, or that the input or output meters show any appreciable change. Yet if we use a condenser having 20 ohms resistance, we get arbitrarily a reading of 2 in the output meter instead of 3 when we use a condenser having 5 ohms resistance. In other words, change of capacity or inductance does not show appreciably, but a change of resistance can be noted. Such a circuit sounds peculiar, I grant, but is quite common.

We are all familiar with the Neon tube, which is nothing but an automobile spark-testing pencil such as the Westinghouse "Spark C." If this pencil is placed within a high frequency (radio) field it will emit an orange-colored light or glow and thus indicate the presence of such a field. Here, then, we have the two needed things—something to show us visually a radio field and a circuit not affected by capacity or inductance changes. Let us see what we can make of them.

The first thing to point out now is the following statement. A confined field means

absorption, interaction losses. Our object then is to keep our fields all confined as much as is possible. It may even be possible to confine them solely to the purpose for which we create them!

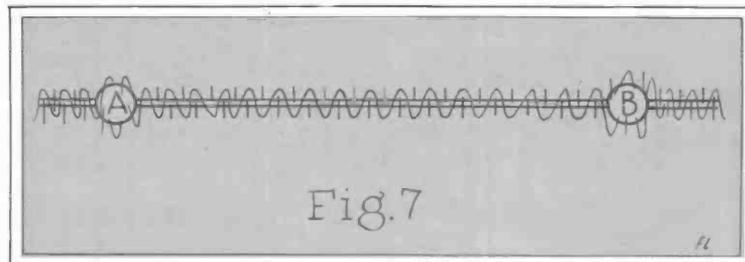


In Figure 1 we have a straight piece of bare copper wire connecting two instruments and a condenser. Consider that there is in the circuit a powerful radio-frequency current. If we take our Neon pencil now and

the Neon pencil is barely able to light at all. But we still observe a large field around the binding posts of the instruments A and B and the condenser. Removal of the binding posts on the instruments and running the insulated wire directly to the meter elements cuts down the waste field at these points.

In the original layout as in Figure 1 our output meter B registered 3, but after reducing the stray field as above we find that with the same input A of two units we are now actually getting more out of the circuit or 3.2. Improving, you see, as we cut down the losses. Our wire has been straight so far and as shown in Figure 4 we have difficulty in lighting the pencil.

Now we run the wire around a corner, tie a knot in it and fasten on an extra binding post as shown in (Continued on Page 34)





# How to Gain Quality



By **BRAINARD FOOTE**

**N**OWADAYS the radio receiver is being classed along with musical instruments, and we find radio outfits and accessories for sale with phonographs, mandolins, saxophones and the like. The mild crimes committed in the name of "music" that are the offerings of not a few of our sets may not be farther from real entertainment than is the blatant squawking of the learner's trombone, but the latter is a necessary accompaniment to the beginner's practice, whereas the former is, almost without exception, preventable.

Opinions as to the possibilities of a radio set for full musical development and expression vary widely. Of course, to a number of listeners, an announcement across the continent is more "music to the ears" than a symphony from the local concert hall, but to those who are really interested in improving the tonal reproduction of their receivers, it may be said that there is a large field for betterment.

It is not alone by altering this little wire, adding a condenser there, or adjusting the loud speaker somewhere else, that faithful reproduction can be secured. It is by a combination of all of the possible improvements that the ideal is attained. In each case the change may be scarcely noted, but the sum total means better music, clearer speech, less distortion and less noise.

If you can plug your headphones into the detector jack and receive clearly and perfectly, as you usually can, your local broadcasting, but fail of good results on the loud speaker, the fault is naturally somewhere in the audio-amplifier. In the amplifier we find tubes, sockets, rheostats, transformers and, perhaps, a condenser or two. Neither sockets nor rheostats can cause distortion of themselves, since neither of them is employed directly for conducting the pulsating electric currents which the voice and music impulses are conveyed. It is possible that through poor contacts some scratching and

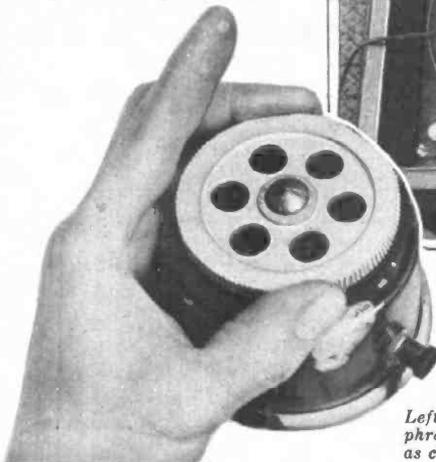
scraping sounds may arise, but these are easily preventable, and since they are so easily removed we shall talk about them at once.

The receiving set must not contribute to the incoming music any sounds of its own, and therefore, when no station is being received, the set should be perfectly quiet. To determine whether or not this is the case, disconnect the aerial and ground and turn on the set as usual. If there are any scratching sounds, there is probably a loose connection in the filament circuit. Perhaps the trouble may be found in loose wires on the filament binding posts, loose wires on the rheostats or in poor contact between the springs of the sockets and the prongs of the tubes. In the last-named case, a bit of sandpaper will fix things and the springs may be

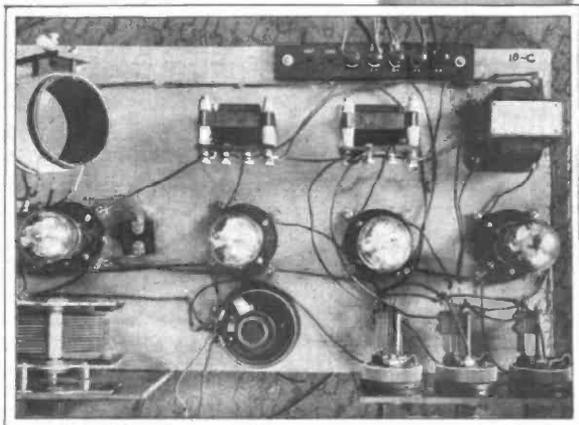
bent upward to make the joint firmer. Sometimes the movable arm of the rheostat does not make continuous contact and there is then a grinding noise as the knob is turned. The contacting parts should be sandpapered then, too. Very frequently the binding posts of the storage battery



*Above—A phonograph makes a good speaker, but be sure there aren't any loose parts, such as tone arm, braces or levers that can get to rattling. If they do vibrate, hold them tight with felt or cloth*



*Left—If your speaker has adjustable diaphragm or magnets, place the diaphragm as close to the magnets as possible without causing rattling on the loud notes*



*Left — Don't blame the loud speaker for blasted music or raucous voices. Maybe the audio-amplifier is at fault. Does it howl or produce scratchy noises? Do you use high-quality transformers and good tubes?*

become corroded, the positive terminal becoming covered with bluish-green copper sulphate. The binding posts should be removed and cleaned with a file and knife blade, and the wire cleaned, also. A little vaseline applied to the posts after reconnecting will prevent such corrosion to a considerable extent.

In case you hear a high-pitched singing sound that is faint with the detector tube turned on but loud when it is turned off, you have audio-frequency oscillation present in the audio-amplifier. This can be stopped by reversing the primary connections to the audio-frequency transformer, either the first or the second. The amplifier should be perfectly quiet whether the detector tube is on or off, if it is functioning properly.

Once in a while one of the leads of the transformer may become "grounded"—that is, accidentally connected to the core

of the transformer. If the singing noise persists as you reverse the primary connections, test the windings with a pair of headphones and a "B" battery, or your loud speaker and a 22½-volt "B" battery in series. Complete the circuit through the primary winding of the transformer, then through the secondary, and finally test between the core and either winding to determine whether there is a "ground." Once in a while audio-oscillation can be stopped by connecting the cores of the transformers to the negative filament circuit, which should be grounded in the set to the ground binding post. However, the good audio-amplifier, if of no more than two stages, should never howl when connected in the customary fashion.

All audio-amplifiers do not use transformers, however, some employing resistances and requiring three tubes in place of two to secure the same amount of increase in volume. The customary trouble with such amplifiers is confined to questions of poor contact, and with all tube prongs making good electrical contact little difficulty is met.

With certain audio-amplifiers, a "microphonic" noise is frequently encountered. This may be likened to the howl produced when the house telephone receiver is held against the transmitter and is due to air vibration alone—this occurring between the diaphragm of the speaker and the walls of the tubes. Particularly is this difficulty found with dry-cell tube amplifiers and it may be most easily overcome by mounting the sockets on spring rubber strips or else by using a socket designed to overcome this drawback, like the Benjamin. If the speaker points toward the set, as when placed in back of it, or if the cover of the set is open, microphonic noises are often noticeable. These interfere with clear amplification considerably and cause a hollow, ringing quality of speech or music.

All of these noise-makers should be completely eliminated while the antenna is off, before further attempts toward improvement in tone may be undertaken with hope of success. Then the aerial and ground are replaced, with the set operating as before.

In case there are then any clicking or scraping noises present, it may be that there is a loose joint in the aerial system. Everything should be firmly soldered from top to bottom, if there are any joints at all, although it is really preferable to use but one piece of wire from the outer end of the aerial right down to the set binding post.

With signals coming in, we are in a position to start in on the quality of the amplification. We immediately run up against the question of tubes and batteries.

Defective tubes cannot properly deliver to the loud speaker the unadulterated current impulses that spell perfection in musical tone. A defective tube is one which does not show a substantial change in plate current as various voltages are

applied to the grid. If you can interchange tubes in the radio frequency amplifier, or in the audio-frequency amplifier, or exchange those of the audio for those in the radio amplifier with considerable differences in results, you may be quite certain that the tubes are not "all there." Of

course, such an interchange is often the only way to get any sort of results with varying amplifier tubes, but, generally speaking, those that fail to perform in the radio-frequency amplifier are not up to the mark for audio, either, even though they seem to operate quite well.

Particularly is this apt to be the case with dry cell tubes. These vary markedly in operation, it often being necessary to choose from twice the number of tubes needed those particular tubes capable of successful operation in a set intended for high sensitivity.

The "A" tubes of the storage-battery type are more uniform although, after a year's use or more, they fall a great deal in amplification and can only be revived into good functioning by permitting them to burn for an hour or so without the "B" battery connection.

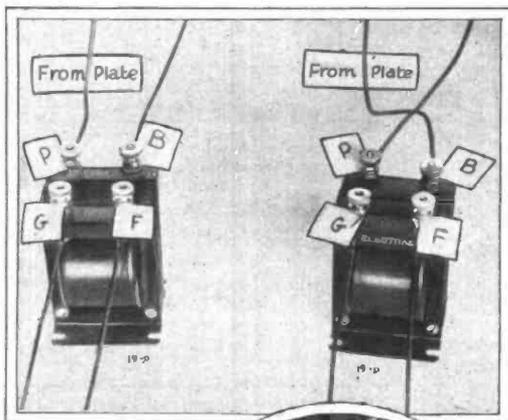
NOTE:—See the article in this month's department, "For the Advanced Student." H. M. N.

Tubes which do not perform as they should may be operated quite successfully by using a higher "B" battery voltage. It is not generally understood, perhaps, that a defective tube distorts music simply because the variations in its plate current do not conform correctly to voltage changes received on its grid. But such a tube can be brought to good operation with higher "B" battery voltage. Of course, in the audio amplifier, there must be a corresponding increase in the voltage of the "C" battery. The full negative 4½ volts that the "C" battery affords will be sufficient for as much as 150 volts on the plate.

There are countless radio receiving sets in operation with tubes that are partially exhausted, perhaps having been used over a thousand hours without a "C" battery and whose owners do not realize how great an improvement in results will follow an increase in "B" battery to 135 volts—three 45-volt units in series. "B" batteries

that are run down may not successfully be used when perfect reproduction is the aim. Where the voltage of a 45-volt unit falls to a pressure below 35 at the very least, it is of little further service and acts more as a resistance than as a "B" battery then.

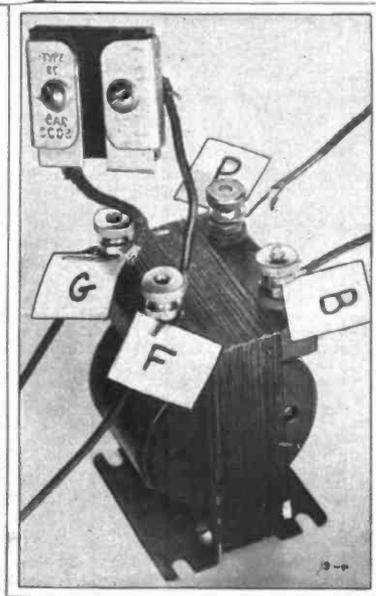
A "C" battery should be used in all cases in an audio-amplifier employing transformers. It is the function of the "C" battery to maintain a negative charge on the grid of the tube. The varying impulses coming from the detector to the first stage of the amplifier fluctuate from positive to negative and thus add and sub-



Top—In case your audio amplifier howls, there's a tube oscillating at audio frequency. Photo at left shows usual connections to primary posts of one of your transformers which may be reversed as shown in the next photo, and thus eliminate the annoyance

Circle—Lots of trouble starts at the storage battery terminals. Frying noises usually mean corroded contacts. Clean 'em up now and then

Right—A fixed condenser placed across the secondary winding of the last audio transformer "melows" the tone. Some like the effect—others don't. Try it



(Continued on Page 32)

# Counterflex Symptoms

FOR the benefit of new readers I must explain that this is the seventh of a series of articles on the "Counterflex" receiving system. The series commenced in the October, 1924, issue of *Radio in the Home* and succeeding articles have contained detailed descriptions of two-tube and three-tube Counterflex receivers.

This month I am going to reproduce some of the letters which I have received from readers who built Counterflex receivers, and answer the questions contained therein. I am sure that the experience of these readers with the Counterflex system will prove interesting to those who have followed this series of articles. Some of these readers have had remarkable success with the circuit. They have every reason to be proud of the excellent results they have obtained with their home-made sets. There are a good many owners of eight-tube super-hets who are not doing much better. Other readers have not been so successful, but I hope that my answers to their questions will enable them, and others with similar troubles, to improve the operation of their sets.

One of the most encouraging letters comes from Mr. Charles Schlapp, of Covington, Ky. Mr. Schlapp built the three-tube Counterflex, using the parts of his old two-tube Harkness reflex set and such new parts as were necessary. He is quite enthusiastic about the operation of his new receiver. He encloses a list of no less than 76 broadcasting stations which he has received. This list includes stations in almost every State from California to Massachusetts, and seven stations in Canada. Mr. Schlapp uses an aerial 130 feet long and found that the use of a counterpoise instead of ground connection greatly increased the selectivity of his receiver. In this connection, he writes:

"My aerial is 130 feet long, including lead-in, and it seemed to be too long, as locals took up quite a bit of the dials and stations within ten or fifteen meters of each other could not be separated. Then I tried a counterpoise, which happens to be another aerial running at an angle of about thirty degrees from the regular aerial and not quite as high. It did the trick. I can separate WTAY (283 meters) from WTAS (286 meters), completely and

By **KENNETH HARKNESS**  
Associate Editor of "Radio in the Home"



**KENNETH HARKNESS**

Associate editor of "Radio in the Home," and originator of the Counterflex circuit

there has been no loss of volume. I use 180-degree dials and, to show how sharp it tunes, I had WSAI (just about three miles from me) on with the dials reading 22—22. I tuned WSAI out entirely and picked up KDKA (Pittsburgh), by moving two points with the first dial and three points with the second dial, so that the dials read 20—19. Then I moved slightly to 19—17 and in came KGO (Oakland, Calif.). One more move of the first dial (18-17) and WPG, Atlantic City, came in clear without a trace of interference. I would advise fans to try a counterpoise. This is a good suggestion. If you are

troubled by broad tuning a counterpoise will usually increase selectivity. Regarding the audibility of his receiver, Mr. Schlapp says:

"It's a bear for outside stuff, but I will say I don't like it for local (WLW, WSAI and WMH). I can't get it cut down enough to make it clear, using either counter-switch or detector rheostat. One night I desired a special program from WLW and took off my regular aerial and used twenty-five feet of old, twisted telephone wire I had; just threw it on the floor, thinking to cut down volume so it would be clear. The joke was on me. Volume was cut very little and I received WGY, WPG, KDKA, WTAM and some others almost as good as ever; in fact, my body makes a very good aerial. I am enclosing a list of seventy-six stations I have received clearly since December 20th, 1924. If they do not come in clearly I do not log them. Most of the stations on this list were received on the loudspeaker. At times two of the Canadian stations come in on the speaker using only two tubes."

Unless the three-tube Counterflex is correctly balanced it is sometimes necessary to provide a means for reducing audibility when receiving local stations so as to avoid distortion and howling. Fig. 1 shows one method of doing this. The double-pole, double-throw switch reverses the connections to the primary of the reflex audio-frequency transformer. When the switch reverses these connections the audibility of the receiver is slightly decreased and, providing the set is not very much out of balance, there will be less tendency toward self-oscillation; the set will not howl when local stations are tuned in and the signals will be free from distortion. When the switch is reversed and the connections returned to their normal positions the set will more easily receive distant stations. Self-oscillation can then be controlled by the counterdon alone.

As a matter of fact, I, myself, do not use any such switch. I find that by turning down the rheostats a little and adjusting the counterdon, I can tune in locals without any howling or distortion. That is because my set is properly balanced. Later I will explain what I mean by "balanced." The switch shown in Fig. 1, however, is a useful adjunct to most sets. If you are able to control ordinary self-oscil-

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H. M. N.



lation with the counterdon but cannot stop howling when receiving locals, by all means insert the switch. Any D. P. D. T. switch will do, the jack type being most convenient.

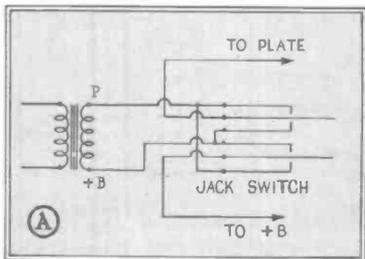
And now, I have a letter from Mr. Raymond Senderling, of Philadelphia, whose Counterflex shows symptoms of being in an unbalanced state, and since I believe this is true of a good many home-made sets I am going to answer his letter in some detail. He writes as follows:

"I built your 3-tube Harkness Counterflex set published in the January issue of *Radio in the Home* and I have been unsuccessful in receiving distant stations and cannot get the howl which you state in testing your receiver. I am using WD12 tubes. I have tried different condensers across my reflex and audio transformers and only get a howl when local stations are on. Local stations come in very loud, but I am unable to receive distant stations. Will you kindly tell me what I can do to make my set perfect?"

In the January issue I explained how to test a Counterflex receiver to determine whether or not it is properly balanced. I first explained that if the counteracting condenser is turned to its minimum position a howl should be heard in the phones when the two tuned circuits are tuned to the same frequency, no matter to what frequency both circuits are tuned. In other words, without the counteraction set up by the counteracting condenser, the circuits are tuned to any frequency within the range of the receiver. Mr. Senderling was unable to get this effect. His reflex tube would not oscillate. If his reflex tube oscillated he could damp out the oscillations by adjusting the counteracting condenser and, to pick up a distant station, maintain the tube at the near-oscillation point at which maximum amplification takes place. Mr. Senderling's receiver, therefore, is not balanced properly. His reflex tube must oscillate at all frequencies. Why does this

grid or plate circuits of the reflex tube. The high resistance may be due to the type of audio-frequency transformers or variable condensers used or other causes. The resistance of one or both of these circuits must be decreased. This can usually be accomplished by increasing the size of the fixed condenser across the secondary of the reflex audio-frequency transformer or the apparatus itself. For instance, the primary of the second audio-frequency transformer. The fixed condenser across the secondary of the reflex audio-frequency transformer, however, should never be larger than .00025 Mfd. If a larger capacity than .00025 Mfd. is needed there must be

.0002 or .00025. Now, in Mr. Senderling's case, the failure of the reflex tube to oscillate at all frequencies may be due to the low internal capacity of the tube itself. Notice that I say "may." I have not used WD12's in this set myself, so I cannot say for certain that the tube will not oscillate. I am rather inclined to believe that it will if the counterformers are correctly wound and the wiring correct. However, if the tube will not oscillate you can remedy this condition by connecting a small variable condenser, as shown in Fig. 2. You can then use this condenser to produce reaction and the counterdon to produce counteraction. By adjusting both condensers



This diagram shows how to use a jack switch in place of a D. P. D. T. switch

tube not oscillate? Well, in this particular case it is probably because a WD12 tube is used. This tube has such a low internal capacity that there is not sufficient reaction or positive feed-back effect present to produce self-oscillation. When a 201A or 301A tube is used, however, there should be sufficient capacity coupling between the plate and grid of the tube to produce self-oscillation when the circuits are tuned to the same frequency. If the tube does not oscillate under these conditions, there is only one other reason, provided the constants of the counterformers are correct: there must be too much resistance in the

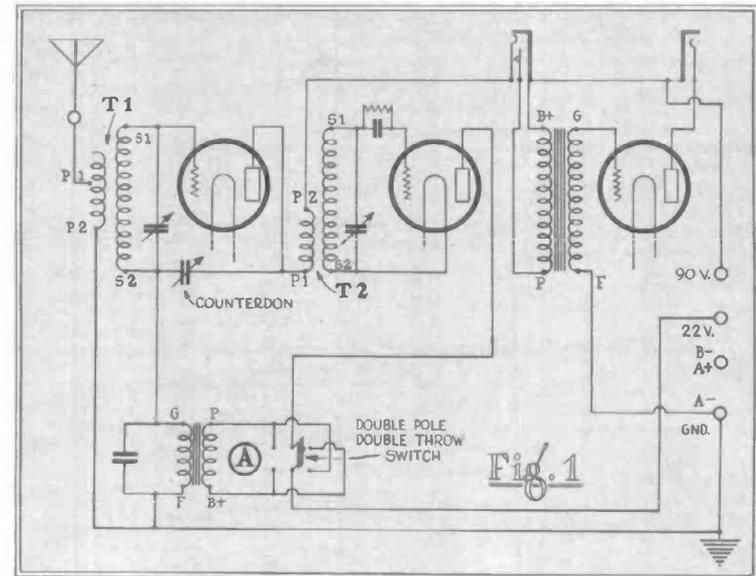


Fig. 1 shows how to use a D. P. D. T. switch to cut down the audibility of the three-tube Counterflex and receive local stations without any howling. The filament circuit is omitted for clarity

something radically wrong either with the windings of the counterformers, the wiring or the apparatus itself. For instance, the connections to the reflex audio-frequency transformer may be reversed. This would increase the resistance of the circuits. Make sure that the connections to this transformer are correct. Don't merely be satisfied with examining the markings on the transformers. I find that a great many audio-frequency transformers are marked incorrectly. If your set shows the symptom described by Mr. Senderling and explained above, first examine your wiring carefully to see that it corresponds with the wiring diagrams; make sure that your counterformers have the correct number of turns, as given in the February issue, on page 51; see that the connections to the counterformer terminals are correct, as explained in the second column on the same page of the February issue; check the wiring to the reflex audio-frequency transformer and try reversing the primary. If the reflex tube still does not oscillate at all frequencies increase the size of the fixed condenser across the secondary of the reflex audio-frequency transformer to

good amplification should be obtainable at all frequencies. Please note that I do not recommend this arrangement for 201A or 301A tubes.

Before going on to the next question, I want to explain further that, even if the reflex tube of a Counterflex oscillates at all frequencies when the counteracting condenser is at its minimum position, the receiver may be out of balance in the opposite sense. That is to say, it may not be possible to stop self-oscillation with the counterdon at some frequencies. The receiver may oscillate too easily. In this case the resistance of the circuits must be too low and must be slightly increased to balance the set.

Again, this can most conveniently be done by reducing the size of the fixed condenser across the secondary of the reflex audio-frequency transformer, or in removing it altogether.

And now you probably understand what I mean by a "balanced" Counterflex. The resistance of the circuits must be neither too high nor too low. If it is too high it will be impossible to get good amplification. If it is too low it will be difficult to

stop self-oscillation. The counterdon and filament rheostats vary the resistance of the circuits, but if the receiver is off balance in the first place the proper value of resistance cannot be obtained by these controls. When a Counterflex is correctly balanced the reflex tube oscillates at all frequencies with the counterdon at its minimum position, but it should require a very slight movement of the counterdon to stop self-oscillation. If it requires a large movement, the resistance of the circuits is a little too low and should be increased.

The next letter is from Mr. John J. Boris, of Bronx, N. Y., who describes a symptom which others may have experienced. He says:

"Over a year ago I built your one-tube Harkness Reflex set. At that time the set really was a wonder for volume. I was prompted to overhaul my outfit, with dire results! When first constructed the set was so good that I still brag about it when others speak of neutrodynes, etc., and in spite of my inability at present to make it work right. My difficulty is as follows: The crystal can be taken out and the set will work. With or without the crystal the movement of the second condenser has no effect on receiving. I have tried numerous crystals without result."

The symptoms described would seem to indicate that there is an open circuit in the detecting circuit. The fact that the set operates without the crystal does not signify anything unusual; without the crystal the tube is acting as a plain rectifier. The thing to do in a case like this is to go over the detecting circuit carefully and test for open connections. The variable condenser may not be making connection to the radio transformer T2. The secondary of the radio transformer T2 may be open. The primary of the reflex audio-transformer may be open. Test the entire circuit for continuity and repair or replace the damaged part.

A similar symptom, but not so marked, is sometimes noticed when the connections to the secondary of T2 are made the wrong way round. If the crystal is good, but does not seem to have much effect, try reversing the connections to T2.

Mr. Sydney P. Cook, of Victoria, Ill., writes as follows:

"I first built the Harkness Reflex and later converted it into the three-tube Counterflex, but since making the change I have not had the results I expected. I am using UV-199 tubes and the same bypass condensers you show in your diagrams. When I plug in with the phones, using only

two tubes, the set is everything I could wish of a two-tube set, with plenty of volume for the phones, and I get Pacific Coast stations quite often, but when I plug in on all three tubes, I can scarcely get anything at all, and nothing with volume enough for the loud-speaker. In fact, the loud-speaker does better on two tubes than on three."

It is evident that the trouble here lies in the apparatus or wiring of the third tube, although this effect may be caused by a run-down filament battery. Your filament battery should be  $4\frac{1}{2}$  volts and in good condition. When you switch on the third tube you must turn up the filament rheostat. If your battery is less than  $4\frac{1}{2}$  volts or run-down, rectify this condition. If you get signals at all using all three tubes, it would seem to show that the transformer and other apparatus are not damaged and the trouble must lie in the wiring. See that

circuit work with low-loss coils as described?"

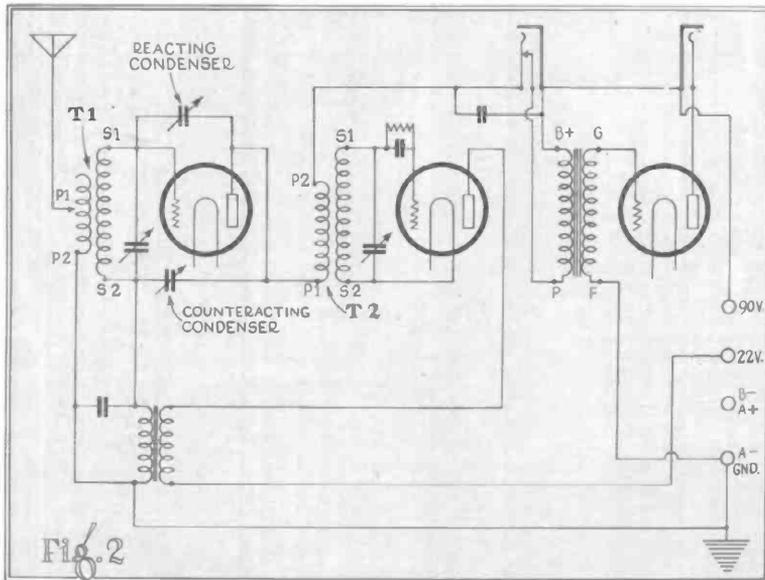
I don't say that it is impossible, but I cannot give you the exact specifications at the present time. The entire operation of the Counterflex, however, depends upon the tight coupling of the radio transformer T2. Your coupling is so comparatively loose that the tuning of the secondary hardly affects the primary. Consequently there is no regeneration in the reflex tube and signals are weak. You might be able to make this arrangement work by increasing the size of the primary of T2 (also use more turns on the secondary than you are at present using) and by connecting different sizes of fixed condensers between the plate terminal of the primary of T2 and the grid terminal of the secondary until you find the value which gives you the correct degree of coupling. If you don't want to do this you can connect a

tickler in the plate circuit of the detector tube. Vary the position of this tickler with respect to the secondary of T2 and you will greatly increase audibility. Then experiment with the primaries of T1 and T2 to determine the values which give best results.

And now I will conclude this article by correcting a couple of mistakes which were made in previous articles, in case they misled any readers. In the February issue Fig. 1 on page 50 showed the antenna binding post connected to what was described as the primary of "Counterformer T2." This should

of course, have read "Counterformer T1." Furthermore, the arrangement shown in that diagram is not a wave trap, as some seem to think. It is a tuning arrangement for tuning the antenna to the frequency of the desired signal. Incidentally, I might suggest that the coil could well be tapped to suit the size of your antenna.

Then in the January issue it seems in the 3XP diagrams we omitted to show one of the connections from the fixed condenser across the secondary of the reflex audio-transformer. If you wired your set up from these diagrams make sure that the fixed condenser No. 11 is connected, on one side, to Terminal No. 2 of counterformer T1 and, on the other side, to Terminal No. 4 of the same counterformer.



(Fig. 2) Shows how to connect a reacting condenser in the Counterflex circuit. This is intended only for use with WD-12 or UV-199 tubes

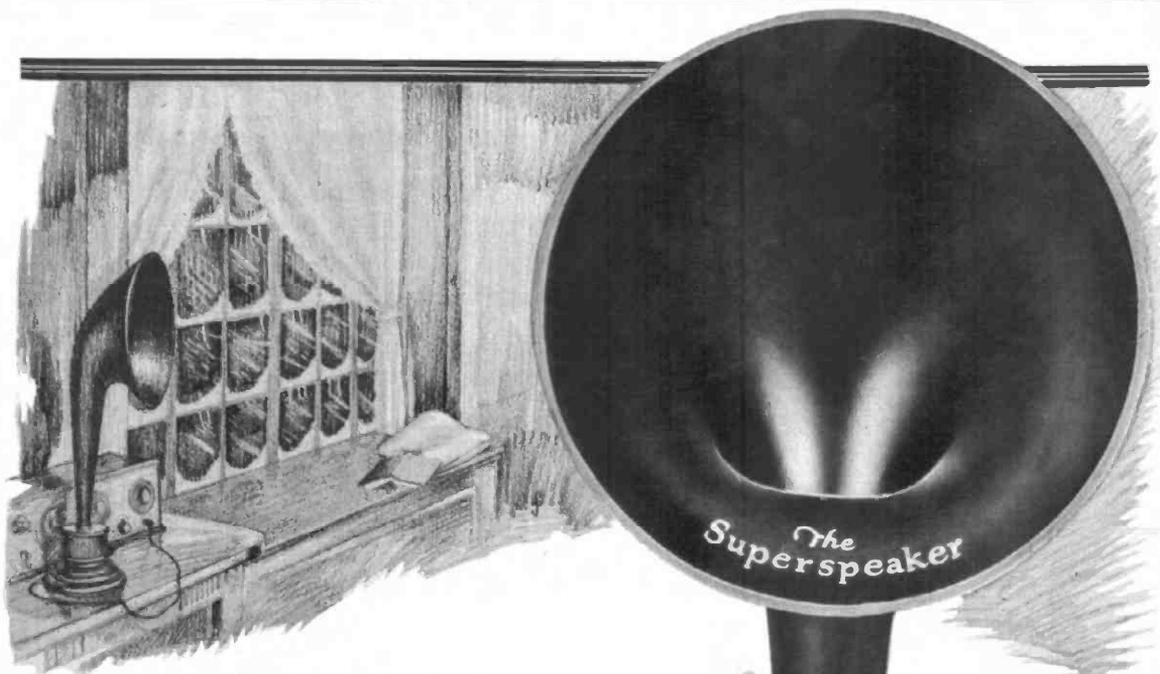
the filament lead of the audio-frequency transformer is connected to the negative side of the filament. Check all other wiring.

Mr. F. Keller, of Minneapolis, Minn., writes:

"After losing a good deal of sleep over your latest circuit, the Counterflex, I finally decided to send out a call for help. Not having a loudspeaker, I decided to use the first two tubes and wire up to the phone jack. I made up four basket-weave coils of No. 20 wire on three-inch diameter and mounted them on the back of .00037 condensers. The primary and secondary coils of each transformer were mounted side by side and the coupling could be varied by sliding them along rubber rods. I find, however, that no matter what capacity of condenser I use across the reflex audio transformer I can't get the howl. Signals are weak. Is it possible to make this cir-

### To Our New Readers

The Harkness Counterflex is one of the most successful circuits of this past season. It is good for both novices and experimenters. We can still supply the issues which Mr. Harkness mentions. See the back page of this number.



## Performance

Through the calm, moon-lit silence of the mid-winter night, your Jewett Superspeaker will increase amazingly your ability to reach out and bring in messages you would hear otherwise only through your headset. But stormy weather is Superspeaker weather too. January blizzards and the hot humidity of July will both find your Superspeaker reproducing faithfully, roundly and without distortion, the sound vibrations brought to it by your Radio Set.

This uniformity of performance is possible only because of the Superspeaker's exclusive, patented air-gap adjustment.

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**JEWETT RADIO & PHONOGRAPH COMPANY**  
5682 TELEGRAPH ROAD PONTIAC, MICHIGAN



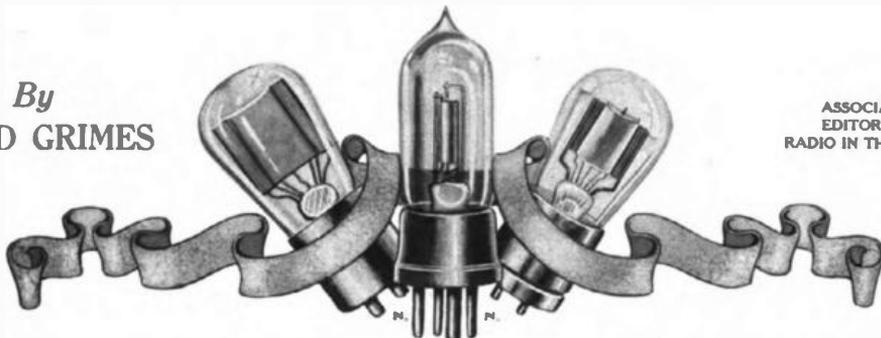
*The*  
**Superspeaker**

Trade-Mark  
Registered

# What Colors Does Your Set Receive?

By  
DAVID GRIMES

ASSOCIATE  
EDITOR OF  
RADIO IN THE HOME



MUCH has been said and many articles have been written concerning the how and why of radio. Most of these compilations, while commendable in themselves, involve theories which are too technical for the average layman to comprehend. Even the theories employed have been questioned by many scientists, and recent discoveries have left many gaping holes in our present explanations.

All would be discouraging confusion if it were not for the pages of history, which, all too often, are left closed and the illuminating evidence found therein forgotten. Suffice it for the present to say that, in this article, we do not care why radio is or how it operates. We will try to paint a visible picture for you that will make the art simpler and more easily understood.

In the first place, radio is literally as old as the hills! If you are laboring under any illusions in this respect, just be prepared for a good stiff jolt.

Radio, in its broadest sense, was used by the earliest savages, and geology tells us, by the animals, before man was. Radio is light and radio waves are nothing more nor less than light beams! So, every time we look about us, our eyes are constantly receiving or recording light beams. The American Indians, with their signal fires, flashing messages from hill to hill, were using, in one form, this mysterious radiant energy—or radio.

Now the ordinary voice vibrations or sounds and words will not travel through the air for more than a few hundred yards. We have great difficulty making ourselves heard to others over greater distances, and even then we are compelled to shout at the top of our voices. This method of communication, then, is greatly limited and has been confined to short distances only.

From almost the beginning of civilization, men have tried to convey their thoughts to others located relatively far away. Light beams—or sight—offered a temporary solution and the wig-wagging and signal lights came into being. Even as late as our Revolutionary War, one Paul Revere made very valuable use of this system.

Without touching on the speculation as to what light is, we know that it has the property of traveling out over great distances, especially at night, with little or no effort. A small pocket flash light can be detected miles away and this same radiating energy can be seen any clear night arriving from stars in the sky so

*R*ADIO rays are merely a form of light rays, vibrating more slowly.

*We see the world today by means of light rays and our impressions of each other and of everything about us are merely the results of the ability of our eyes to respond to these light rays.*

*Suppose our eyes were able to respond to radio rays! What would the world look like then? What would you and I look like? And which is the true world—the one which we see by light rays and our eyes or the one which might be seen by radio rays with the different colors produced by the different wave lengths of radio?*

*Mr. Grimes, in this article, not only shows that radio goes back far beyond Marconi to the earlier experiments of Alexander Graham Bell, but he also gives an astonishing picture based upon our present knowledge that radio rays are merely light rays of a color which is not detectable by the human eye.*

*This is one of the most interesting articles which Mr. Grimes has done for us. Read it yourself, and then, if you have a friend who knows nothing about radio, give it to him.*

H. M. N.

far distant as to be completely beyond imagination. All of the early uses of radio were confined to code signals or telegraphing where certain signs conveyed certain thoughts and the human eye was used as the receiver.

And then came Alexander Graham Bell! He changed everything!

Bell, as you know, was an expert on acoustics. He knew a great deal about sound and sounds. He had made extensive studies into the methods of producing sounds and especially human speech. He determined that it was a purely mechanical operation and that the vocal cord created vibrations in the air and these, in turn, vibrated the tightened skin in the eardrums. Here it was sensed as sound and communicated to the brain. Bell's profession, you know, was instructor of deaf mutes, and his accumulated information on human sounds was compiled in this connection.

Now, Bell knew little or nothing about electricity. If he had, he never would have invented the telephone because the limited electrical profession at that time said it just couldn't be done.

But Bell kept at it. He knew that a thin piece of tightly stretched skin in the ear could reproduce all the sounds in the human voice and besides, all the many tones in an entire orchestra. If a thin diaphragm in the ear could do this, then a thin diaphragm anywhere would do as much. This was a fact that he proved beyond all question and was really his big contribution to society. Shortly thereafter, this fact, having been definitely determined, was used in a number of different ways. Edison's application of it to the phonograph is perhaps the best known.

Bell, by means of thin diaphragms, picked up the vibrations of the voice, changed them into vibrations of electric current in a wire, and then at the distant end, converted the electric vibrations back into sound, using a similar thin disc. He, thus, for the first time in history, sent the voice out over long distances—far beyond the limitations at that time.

This spurred him to greater effort because he realized that this system, as progressive as it was, was still limited by the necessity of stringing wires from the sending station to the receiver.

The beam of light then occurred to Mr. Bell. Here were these beams of light that were capable of traveling out through space

for apparently no ending. Little energy was required and these beams merely had to be pointed in the direction desired without the aid of conducting wires strung on poles.

Bell argued that if speech vibrations could be placed on electric currents in wires, speech vibrations could also be imparted to beams of light and, once so imparted, might be taken off at some distant point and converted back into speech! This would truly be a wireless telephone! A glorious possibility!

This was in 1877, only two years after the invention of his electric telephone and only one year after his public exhibition of it in Philadelphia. Bell was not particularly interested in the commercial aspects of his telephone. In fact, he wasn't sure it had any. He accordingly devoted much time to his wireless telephone—the first in the world!

His first efforts and tests were run in Washington, D. C., between his home and a school nearby. His apparatus was fairly simple and consisted of a thin metallic reflecting disc with an attached mouthpiece. This was all at the transmitting end. At the receiving end he employed what is known as a selenium cell for changing the light variations into electric vibrations—thence through one of his telephones back into sound.

The apparatus worked as follows: The sending apparatus was so arranged that a beam of sunlight shone down onto the thin metallic disc and was reflected out through the window to the receiving set a few hundred feet away. As Bell talked into the mouthpiece in front of the disc, his voice vibrations caused the thin mirror to vibrate and this, in turn, caused changes in the selected beam of light. His conversation proceeded to go out through the air as fluctuations in the reflected light beam.

At the receiving end, the changing light beam caused varying electric currents to flow and these created exact reproductions of Bell's voice. The telephone receivers thus faithfully gave forth Bell's speech, connected with the sending station by merely a measly light beam! And this was in 1877! Think of it!

You naturally have been wondering just what all this has to do with radio. The interesting part of the development was just starting.

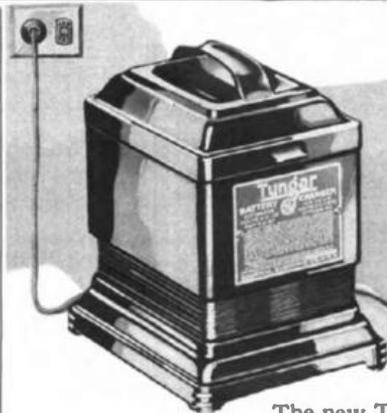
Bell next substituted an arc light for his reflected sunlight and this permitted him to send on cloudy days and at night when the sun was not available. His researches carried him into employing different colored lights and noting their relative efficiencies.

Violet light, for instance, was not nearly so effective in penetrating foggy atmosphere as deep red light. If his wireless telephone were to be practical, he would need to use red and not violet light. Otherwise, the slightest haze in the atmosphere would cause his outfit to become inoperative. Of course, trees, buildings and other solid objects were still obstacles to him—forcing him to have a clear line of vision between sender and receiver.

Several more years of study and investigation followed and scientists throughout the world became deeply interested in Bell's work on this subject. His efforts were described in the technical press of most European countries. It was also becoming generally realized that there were more colors in existence than could be seen with the human eye. The eye was known to be capable of responding to colors from red, through the rainbow to violet. Up to this time, these were assumed to be all the colors in existence.

Now, by various means, they were discovering others beyond the range or limits of the eye!

There were other colors, then, only



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—any size  
—all makes*

The new Tungar will keep all your storage batteries up—fully charged all the time. It charges radio "A" batteries of 2, 4, or 6 volts. Radio "B" batteries of 24 to 96 volts. And auto batteries, too.

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The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

The New Model Tungar charges Radio A and B batteries, and auto batteries. Two ampere size (East of the Rockies) \$18.00

The Tungar is also available in five ampere size (East of the Rockies) \$28.00

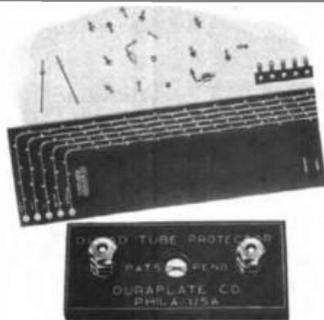
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*(The price of the Durad tube protector with two renewals (free))*

The Durad tube protector is put in the B-base lead. In case of crossed wires or B voltage being applied to filament, a fine which is easily removable covers the connections before any harm can be done to the tubes. Two renewals come with each Durad protector—at your dealers or sent direct first-class mail upon receipt of fifty—50 cents. Please mention your dealer's name.

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*saves time, eliminates losses and makes a neater work*

THIS is the base about which the article appeared in the March issue of "Radio in the Home."

In addition to saving time and eliminating losses, you also save space, for transformers and sockets can be put right over the embedded buss wires which are slightly below the level of the base surface.

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Technical engineers know that for 36 years the Bristol Company has made for the great plants of America highly accurate and sensitive Recording Instruments, and that they are fully qualified to make loud speakers of great excellence. They know that Bristol experience, scientific knowledge and honest purpose must be this loud speaker's full inheritance.



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Real mahogany. Size 17 x 10 x 10 1/4.

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## BRISTOL AUDIOPHONE LOUD SPEAKER

The Bristol Company Waterbury, Connecticut



the eye would not record them, any more than the ordinary camera will record colors at all! Light beams were found to exist both above or beyond the violet and also below or beyond the red. What could be better, then, for our growing young infant, the wireless telephone? If red lights were more suitable than violet and would pass through hazy atmosphere, while violet was obstructed, then perhaps some color below the red, still further removed from violet, would be even more suitable. The mere fact that it would not be visible to the eye would not affect the results one way or the other. The main thing was to find a special light beam that would penetrate fog and smoke so that conversation over it would be somewhat more reliable. If the beam passed from the sending station to the receiving station at all, even though invisible, devices could be rigged up at the receiving end that would detect and record the light beam and the conversation on it.

Bell tackled this problem in earnest. His next tests were with invisible light beams in the lower red regions. The light beams down at the point were called *infra-red* light. Noticeable improvement was obtained here and finally he employed *heat* waves, which were found to be light waves of color

openly argued that if red passed through haze and violet did not, and if the colors in the *infra-red* and heat regions passed through fog and smoke, and red did not, then if still lower colors could be found, more and more so-called "opaque" substances would tend to become transparent to such a beam. If the proper colored beam of radiant energy could be produced, it might even pass through woods, trees, brick buildings, etc. No wonder every one was agog. It was a wonderful vision. A new era was dawning.

A brilliant young mathematician named Maxwell had already proved that ordinary visible light was an electromagnetic vibration as was also *infra-red* and heat. Their wave lengths were determined and the new much desired radio colors were predicted.

No one knew, however, how to create this new desired spectrum. It was one of those exasperating situations where one knows all about a thing with the exception of how to create it. These predicaments occur quite regularly in scientific research, especially in chemistry.

Hendrick Hertz, a young German physicist came to the rescue, but quite by accident. He literally fell upon the new beams when carrying



One of the most wide-awake youngsters to be heard from Station WJJD, Moomshoort, Ill., is 7-year-old Elmer Pell. He is shown above with Jack Nelson, director of the station, who says he never knows what Elmer is going to do or say next, although he never fails in his performances before the microphones

still further removed from violet—down below the *infra-red* group.

The use of heat waves or beams completely overcame his difficulty regarding fog and smoke. A conversation imparted to such a wave passed right through from sender to receiver, without worrying about smoke and fog. The whole instrument was becoming more and more practical.

We do not need to discuss the details of this device, here, other than to say that he used a piece of burnt cork mounted in the end of a pipe for his receiver of these invisible beams. This instrument worked well enough to warrant its exhibition at the Chicago World's Fair in 1892. It was listed as a "thermo-phone" because it employed a heat beam for operation. However, it was often referred to, even by Bell himself, as a "radio phone," because heat suggested the idea of radiation. A "radio-phone" as early as 1892, actually working as such. It may interest you to know that Marconi did not start his work until some four years later—in 1896!

Meanwhile, the scientists of the world were in a furor. It was becoming increasingly obvious that the "lower" the color of light used, or the further removed from violet and the so-called upper color, the better the penetration of the beam. It was

on experiments on electric discharges between spark gaps in 1887, and just as predicted, they passed through wood and stone walls as easily as visible light passes through a glass window pane.

Hertz added greatly to the store of information on these beams because he proceeded to study them after the discovery. He proved experimentally what Maxwell had proved mathematically. He showed that these new beams were one and the same as ordinary light beams except for color or wave length. They were, of course, invisible, but that was no fault of theirs. That fact was a limitation of the human eye and should not be blamed on the poor radio beam.

Hertz rigged up the necessary apparatus to focus, reflect, refract and polarize these invisible rays. The same had been done many times before with visible light. He was able to do it with the new light, thus proving the absolute similarity of the two. His work was so valuable that the new colors were named after him and for many years were known as Hertzian waves.

Bell's experiments together with Hertz's discovery led many people to believe that the practical wireless telephone was about to be. Sir William Crookes, an English scientist, gave the subject some deliberate

thought and accordingly wrote an article appearing in the *Fortnightly Review* about 1893. Sir William Crookes said in this article that the practical possibility of communication between two remote points without any intervening medium such as wires and pole lines was certainly at hand. He said, however, that there were three distinct drawbacks as he viewed it, in the then present development:

1. More powerful senders were needed.
2. More sensitive receivers were required.
3. Some means of selection or tuning between stations was necessary.

Crookes had nothing in particular to suggest in the first two cases, but proceeded to enter into a discussion of tuning that shows today his clear vision in this regard. He definitely outlines the basic theory of modern tuning, giving ideas for the construction of both the sending and receiving stations for mutual resonance. *This was in 1893—three years before Marconi started his work.*

The waves or beams of Hertz were noisy in their characteristics, this being caused by rather irregular jumping of electric sparks between conductors. This fact alone made them hopeless for use with Bell's telephone idea. Many attempts were made, but the waves themselves were not steady and quiet enough to permit the speech vibrations to pass over them. Bell's development accordingly met with a temporary stone wall. The proper colored light had been discovered for him, but means for producing a steady source of it were still lacking.

The Hertzian waves could, however, in their present state be used for telegraphic purposes so accordingly most of the scientific minds turned in this direction and the art of wireless telegraphy started. Marconi came along in 1896 with the missing link in the second limitation outlined by Crookes. He supplied the more sensitive receiver or detector and the first real telegraph messages were sent over real distances via the new invisible light beams—the wireless—the radio. Marconi, about four years later, carried his work to such a stage of perfection that he was able to transmit and receive radio-telegraph messages across the Atlantic. He immediately rose to well-earned fame, but unfortunately, became known to the general public as the inventor of wireless. He merely invented a good sensitive receiver of wireless telegraph signals. It was Bell who started the pot boiling some twenty years earlier.

But people still wanted to be able to talk and hear the actual voice over this beam of invisible light. Here and there some experimenter still struggled with Bell's idea. Ernst Ruhmer was perhaps the best-known and really carried Bell's work forward to a well-earned commercial application. Ruhmer was carrying on his researches in Germany, co-operating to a large extent with the German Navy. His tests consisted of rigging up large electric searchlights and so controlling the visible light beam by means of a telephone transmitter as to impart to the outgoing light a fluctuation corresponding to the vibrations of his voice. By means of selenium cells and reflectors, he was able to pick up these beams many miles away and understand talking perfectly.

Of course he confined his efforts entirely to visible light, so he was greatly limited in his field of application. He installed these light-beam transmitters and receivers on several German Navy ships and to say they were successful would be putting it mildly. They worked better than could have been expected, permitting telephone conversation between two moving ships at a separation of several miles.

It remained for Dr. Lee DeForest

finally to discover in 1907, and develop the source of steady, quiet, invisible beams, satisfactory for carrying the voice. In his invention of the three-element vacuum tube, he had the necessary device for generating a steady beam of radio. To place the voice on this was an easy matter and radio-telephony became a very practical art during the World War. Here it was used to communicate between airplanes and between the ground and airplanes. In 1916, officials of the American Telephone and Telegraph Company talked from Washington, D. C., to Honolulu and Paris. Behind it all was the same simple basic theory of Bell's—only applied to a better color than the visible beams afforded.

As to why certain colors of light perform penetrating stunts while others do not please don't ask us. An answer to that would involve a theory, and the theories just now are undergoing slight renovation. We only know that they do.

Try to compare radio to X-rays and you may perhaps be able to visualize them. X-rays, we know, are a form of light. They cannot be seen by the human eye. They are very powerful and will pass through ordinary substances quite well. They will

act upon a photographic plate, and it is by pictures taken with them that we know of them at all.

As to why certain colors of light are visible to the eye while others are not, please don't ask us that, either. That answer involves theories and we don't know much about them. We can only surmise what the world would look like if we could see it through other colors than those utilized at present. If our eyes could be changed "in the twinkling of an eye" by some magic Aladdin's lamp so as to permit us to see the radio beams in place of the present colors, we might be very much astonished and confused. All of the broadcasting stations would appear as large, bright lighthouses sending forth beams of colored light in all directions. Each station would have its own particular color, depending on its wave-length only. Right now, we couldn't tell you what colors they would be, because we have never seen them.

And, as we strolled up the main streets of any one of our cities, we would look to right and left of us in vain for a sight of the buildings. They would be transparent, only the steelwork standing out as visible. The present radio beams do not pene-

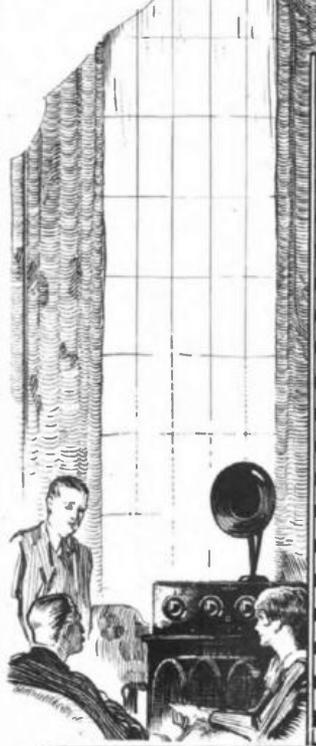
trate metal work, although new ones discovered in the future may overcome this slight drawback.

We might see the steel skeleton of an elevator rising up from floor to floor, an automobile running along the street, several inches off a rather translucent pavement. Even the trees would be invisible.

And last, but not least, we certainly would be puzzled to see many watches and metal pencils hurrying hither and thither through the air, all bound on some apparent journey. We would turn to ask each other what it all meant, only to find neither of us there. We could talk back and forth and we might recognize our watch in your pocket, but alas! even we would be transparent.

Now please don't ask us if we would be as we are now if we couldn't see ourselves as we are now. That would be too much!

So, when you are cursing your radio set for not behaving, or when you lose patience with that distant station when it fades out, try to call to mind the above picture we have painted for you and realize that the wonder of radio is not the reception of a distant station but the reception of a station at all!



**Compare the Value!**

COMPARE the MARV-O-DYNE point for point with any other receiving set. Consider the performance and the appearance and the units—consider those things and you'll wonder how such a set can be sold for only \$98.

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And speaking of the Fil-a-meter—that in itself is an exclusive MARV-O-DYNE feature. The Fil-a-meter alone should make you choose the MARV-O-DYNE. What this device saves in tube and battery costs by keeping the tubes at the proper operating point is obvious.

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# HARKNESS Counterflex Kit



Canadian List Price, \$48.00

WITH this complete kit of parts you can build the 3-tube Harkness Counterflex receiver described by Mr. Harkness in the March issue of Radio in the Home.

This is the set which "makes distant stations sound like locals." You can build it for less than forty dollars. To get the same volume, selectivity and receiving range with any other circuit you would have to spend two or three times as much.

The parts in the Harkness Counterflex kit were designed by Mr. Harkness to make it easy for you to build the set. The 7" x 18" Celeron front panel and the triple socket sub-panel are completely drilled and engraved, ready for you to assemble the parts.

An instruction booklet, written by Mr. Harkness, is supplied with each kit. This booklet clearly illustrates and carefully explains each progressive step in the assembly and wiring so that you cannot possibly make a mistake.

Ask your dealer for the genuine Harkness Counterflex kit. Avoid cheap imitations. If your dealer does not stock genuine Harkness products, send your order directly to us, giving your dealer's name and address.

**WARNING:** Deliberate imitations of the Harkness Counterflex kit, unlawfully using the signature and photograph of Mr. Kenneth Harkness, have recently appeared on the market. Local action is being taken to stop the further sale of these kits. To protect yourself, examine the label of the kit you buy and make sure that the words "Kenneth Harkness Radio Corp., Newark, N. J.," appear on the label.

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Newark, N. J.

Please send me a copy of your Illustrated booklet, written by Mr. Harkness, describing the commercial model of the new, simplified 3-tube Harkness Counterflex receiver with detailed building instructions and step-by-step wiring diagrams. I enclose 25 cents to cover cost of handling and mailing.

Name .....

Address .....

### The Broadcasting Hotel Is Overcrowded

(Continued From Page 8)

tutions seldom are warranted in such undertakings—it is more logically the function of institutions interested commercially or otherwise in the welfare of every community throughout the land. For example, a department

probably see this principle more generally recognized and, if so, unwise investment in broadcasting apparatus will be saved and the problem of allocation of wave lengths will be simplified.

"The Department of Commerce is now embarrassed by the number of broadcasting stations desired in comparison to the number of wave channels available. A reallocation of wave

#### Broadcasting Station Activity During Each Month

(Figures are as of end of month)

1921	New Stations	Deletions	Increase	Decrease	Total
September	8	..	3	..	3
October	1	..	1	..	4
November	1	..	1	..	5
December	23	..	23	..	28
1922					
January	8	..	8	..	36
February	24	..	24	..	60
March	77	..	77	..	137
April	76	..	76	..	213
May	97	..	97	..	310
June	72	..	72	..	382
July	50	..	76	..	458
August	39	..	50	..	508
September	39	23	16	..	524
October	46	22	24	..	548
November	46	29	17	..	565
December	31	20	11	..	576
1923					
January	28	34	..	6	570
February	24	13	11	..	581
March	30	29	1	..	582
April	31	14	7	..	589
May	27	25	2	..	591
June	23	50	..	18	573
July	19	25	..	6	567
August	7	11	..	4	563
September	15	16	..	1	562
October	22	14	8	..	570
November	12	33	..	21	549
December	12	34	..	22	527
1924					
January	27	20	7	..	534
February	31	7	14	..	548
March	32	11	21	..	569
April	37	19	8	..	577
May	23	11	12	..	589
June	37	81	..	54	535
July	22	13	9	..	544
August	7	18	..	11	533
September	16	30	..	14	519
October	28	12	16	..	535
November	19	16	3	..	528
December	24	24	..	..	538
1925					
January	35	26	9	..	547
February 12	10	5	5	..	552

store or a local newspaper in Natchez, Mississippi, can have very little interest in broadcasting to Portland, Oregon. Thus three years of broadcast casting have resulted in a rough classification of stations, local and general, the former being of interest in a limited range and the latter having national or at times international interest. The future will

lengths is now in progress in the hope of improving conditions for the radio listener. It would be highly desirable to provide an exclusive wave length for each station operating with sufficient power to reach across the continent and having programs of national interest. Such a plan would increase materially the reliability of

(Continued on Page 18)

#### Division of Broadcasting Stations Into Classes

(Figures are as of End of Month)

Year	Class A	Class B	Class C	Class D	Total
1923					
April	none	30	552	none	582
May	146	39	405	1	591
June	203	42	327	1	673
July	232	46	288	1	567
August	249	44	268	2	563
September	260	45	255	2	562
October	285	47	236	2	570
November	281	47	219	2	549
December	283	45	197	2	527
1924					
January	299	48	185	2	534
February	315	49	181	3	548
March	351	49	166	3	569
April	371	52	152	2	577
May	392	54	141	2	589
June	378	54	101	2	535
July	354	56	92	2	544
August	326	56	89	2	533
September	322	57	78	2	519
October	399	60	74	2	535
November	416	61	59	2	538
December	423	68	45	2	538
1925					
January	450	78	17	2	547
February 12	454	80	16	2	552

**Editorially Speaking**

(Cont'd From Page 4)

well up into six figures every year in order to induce the fan to listen to what they are putting on the air.

If the attention of the radio fan is as valuable as this, he is most certainly giving the broadcasting stations something and he himself is not, in the final analysis, getting something for nothing as so many people are so fond of saying.

The attention of the public is a marketable commodity of tremendous value. For this reason, link-toll broadcasting is entirely changing the former aspect of radio and this lesson is being brought home forcibly to the minds of every one concerned. As a matter of fact, the radio fan has always given this marketable commodity—his attention—and therefore he has never, as so many people have said, got something for nothing. If his attention were not so valuable no one would have ever established a broadcasting station, because no one has as yet arisen who is so charitably inclined as to pay the expenses of one of these stations for the purpose of furnishing free entertainment to the public at large. It is a business proposition pure and simple; *it has always been a business proposition* and it always will be a business proposition. When it ceases to be so, radio will fail—but it will not fail.

Now let us keep in mind very clearly the distinction between toll broadcasting as it is being done by this link of stations and the direct advertising which is so frequently and unfortunately done by a great many of the lesser stations throughout the country.

We will start with the frank admission that all such direct advertising and sales talks should be suppressed. Let us then turn our attention to link-toll broadcasting.

Why is it that there seem to be so many periodicals editorially opposed to the spread of this chain of stations?

I think the answer is very easily found. At the third Hoover conference, I attended the committee meeting which had this matter under consideration and there heard a man who represented a very large association of publishers make the statement that he was convinced that the great majority of the members of his association were opposed to toll broadcasting. I venture one opinion in that connection; I am almost willing to bet that 90 per cent of the members of his association really do not know what toll broadcasting is. They have simply been told that it is using the radio for advertising purposes and they had therefore announced themselves as opposed to it because they themselves make their living from advertising, and they are afraid that this radio advertising will cut into their profits.

That is just the point which seems to be misunderstood in all of these articles which appear so frequently.

I know of one case in which the owner of a Texas newspaper refused even to discuss the matter with a broadcasting official. "This toll broadcasting is going to take advertising away from the newspapers," he declared, "and I don't want anything to do with it. They will spend all of their money for radio advertising and none for printed matter."

"I'll just ask you to do one thing," said the broadcasting official. "Look up your records for the past year for, let us say, the National Carbon Company, and see whether they have reduced the amount of space they have bought in your paper since they began broadcasting."

The next day the two men met again. "You win," said the publisher. "National Carbon Company bought nearly 50 per cent more space with

us during the past six months than they did in the same six months a year ago. Sit down and tell me your proposition."

I think that if the average advertising agency would look over the records of the various people who are doing toll broadcasting, they would find much the same condition. Radio can never sell directly when it is done in this way. All it can do is to make friends of the public and so increase the efficiency of the printed advertising. Only in the printed page is direct selling possible, and all that toll broadcasting does for the manufacturer is to win the good-will of the listener so that, when Mr. and Mrs. Radio Fan see his advertising the next time in a magazine or newspaper, that advertisement is read word for word because Mr. and Mrs. Fan have met the manufacturer in a friendly way over the air, and feel a more intimate contact with him. This result has been mentioned in so many thousands of letters received by the different manufacturers who are doing toll broadcasting that there can no longer be any doubt of the truth of this statement. Toll broadcasting builds good-will for the house; it does nothing more, and the wise house uses just so much more printed matter to take advantage of the good-will built up by radio.

In spite of the campaign of opposition to toll broadcasting, I have received, in all of my mail, just two letters which express opposition to it. One of these letters was very mild in its opposition, and really did not concern toll broadcasting as done by the A. T. and T. chain, but more specifically mentioned some exceedingly raw instances which the writer had heard from his local station. Therefore that letter was really not against toll broadcasting in the definition I am giving it here.

The other letter came from a man who is evidently interested in advertising, because he sent me a copy of a recent issue of *Printers' Ink* which contained about the most unfair and deliberately biased article that I have ever read in that publication. Having been a newspaper man for twenty-seven years, I have always had the highest respect for *Printers' Ink*. That article, however, was so obviously prejudiced and this prejudice was so apparent in every line that I made a special trip to New York to find out what was behind it all.

It was exactly as I had expected to find it. The article in *Printers' Ink* was written under orders, and these orders were so deliberately dishonest that they resulted in what amounted almost to misquotation of some of the men whose names were attached to expressions of opposition. There was one case in which a prominent manufacturer wrote a letter which said that he was inclined to favor toll broadcasting. Then, in two sentences, he merely indicated objections which might possibly be raised to it. These two sentences were quoted with his name to them; the good things he said about toll broadcasting were not mentioned.

During all the period of preparation of this article, the writer, under orders from his superiors on *Printers' Ink staff*, refused to visit WEA F to learn their side of the story.

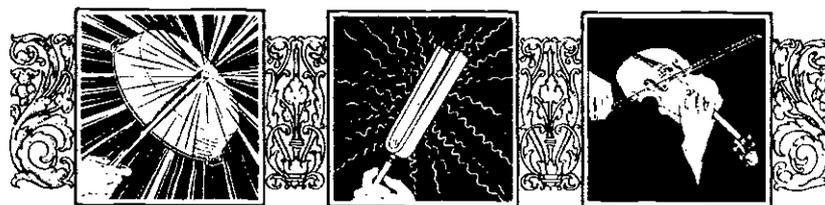
This kind of deliberate propaganda is foredoomed to be a boomerang. No legitimate advertiser and no legitimate advertising agency will have any respect for an opinion which is foisted upon the public by any such unfair means.

Toll broadcasting, as it is done today, is not yet perfect. It is, however, a million per cent better than toll broadcasting as it was done in the beginning.

Mistakes were naturally made at

**Does Your Radio Set Reproduce—**

*this— or this— or this*



**NOISE**  
(Unpleasant sounds)

**TONE**  
(Sounds which have mere musical pitch)

**TONE plus OVERTONES**  
(Tone color—REAL music)

**In Radio, people want Distance—but they want TONE even MORE**

**Without Overtones You Get no Rich, Resonant Voice nor Tonal Beauty**

**How the Pfanstiehl Reproduces the Most Delicate Overtones**

ANY good radio set can get distance, simply by amplification. There is no distinction about that. To get tone quality is quite another matter. And tone quality is the real measure of radio reception. Radios differ in this respect just as pianos differ. You judge a piano by its ability to produce a beautiful tone. You judge a radio by its ability to reproduce a beautiful tone, from a distance.

In a piano, tone depends upon the manner in which the overtones are produced and controlled. Without them you could have no richness or beauty of tone. You would have a thin, hard, metallic sound—mere pitch. You can get beautiful piano music only from a fine piano in the hands of a good performer. Paderewski himself could not get tonal beauty out of a poor piano.

**Overtones Perfectly Reproduced**

In radio you have a similar situation. It cannot receive a lovely voice or beautiful music unless it reproduces the overtones which make it beautiful, exactly as they are sent out in delicate vibrations from the transmitting station.

That has been an extremely difficult thing to do in radio reception, simply because radio engineers have not known how to control the forward stream of radio energy as it passes from circuit to circuit in the set. Some of the energy strays off and feeds back. That is what causes the uncanny noises you hear, noises which have to be choked down or neutralized by a lot of complicated devices, and these distort and spoil the delicate super-vibrations which make overtones in your reception. Your tonal beauty is gone, in exactly the degree that your overtones are suppressed.

The matchless beauty of Pfanstiehl tone lies in the utter absence of feedback to disturb the delicate super-vibrations which make the overtones. These come through INTACT. There is no distortion whatever. The tone is full, rich and clear. You can enjoy exactly as transmitted the vocal charm of a beautiful singer or the tone color of a great violinist.

What an immeasurable advantage that is!

Distance, selectivity, volume, portability, are all values in radio which people want and can have to the extent that the maker chooses to afford them. There is no special problem about that. Radio science knows *how*.

**The Big Problem in Radio Is Tone Beauty**

The big problem in radio is tone beauty, a full and true reproduction of voice or music EXACTLY AS TRANSMITTED. This problem has been fundamentally solved in the Pfanstiehl. It gets the same distance, selectivity and volume as other high-grade 5-tube receivers; but in tone it is matchless, for the reasons above given.

Hear the new Pfanstiehl Overtone Receiver at your radio or music dealer's. If he does not have one we can quickly get it to him.

**PFANSTIEHL RADIO COMPANY**

Sales Offices: Dept. E, 11 South La Salle St., Chicago, Ill.

Factories: Waukegan, Illinois



**OVERTONE RECEIVER**

*A 5-tube Receiver using the new Pfanstiehl system of tuned radio frequency*

## Here's a peculiar fact about radio insulation



Surface leakage very low with Radion Panels

**T**HE high-polished, satin-like finish of Radion Panels prevents moisture from gathering to form leakage paths and cause leakage noise. Surface leakage and dielectric absorption are exceptionally low.

Radion Panels resist warping. They are easy to cut, drill and saw. They do not chip. No special tools needed. Eighteen stock sizes, two kinds. Black and Mahogany.



Radion Dials match Radion Panels perfectly, and make the ideal mounting for your set. Radion Sockets help to eliminate capacity effects.

## RADION The Supreme Insulation PANELS

Made to order for radio purposes exclusively

**M**ATERIAL that is satisfactory for general electrical use often gives poor results in radio-frequency service. Experience has shown that best results come with the use of material and apparatus designed especially for radio's peculiar demands. This is particularly true of insulating material.

Radion is a special material, developed to order by our engineers to meet the needs of radio. For radio-frequency insulation its characteristics are highest, as shown by authoritative laboratory tests.

The use of the most efficient insulation material is important not only for panels, but also for dials, sockets, knobs, binding-post panels, rotors, stators, spaghetti tubes, etc. In all these there is a Radion product of the right type and size for your set. Radion is also used by leading set manufacturers who appreciate the superiority of "the supreme insulation."

AMERICAN HARD RUBBER COMPANY  
Dept. N 4, 11 Mercer St., New York City  
Chicago Office: Conway Building

Pacific Coast Agents:  
Goodyear Rubber Co.,  
San Francisco—Portland

Mail coupon for  
booklet, "Building  
Your Own Set"



AMERICAN HARD RUBBER COMPANY  
Dept. N 4, 11 Mercer St., New York City

Please send me your new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, showing a new set with standard panel, sets with the new Radion built-in horn, lists of parts and directions for building the most popular circuits. I enclose 10 cents.

Name .....  
Address .....

the start. These mistakes had their quick reaction from the public and this reaction invariably met with an immediate change of policy. Through many such experiences as this, the men who are doing this broadcasting—and I mean not only the officials of WEAF but the big advertisers who are paying for the time—are learning just exactly what the public wants and what it does not want. They are learning just how much credit they can give themselves and still build good-will and just how much ill-will is built when they try to overstep this line.

Personally I see nothing objectionable in the way it is being done now. The mention of the name of the manufacturer or merchandiser is, as was pointed out in an article in this magazine some time ago, little more than the "credit line" that is given a photographer under a photograph in a magazine or newspaper. It is not nearly so blatant as the name of the automobile or the automobile dealer which appears on the casing of the spare tire behind so many motor cars. It is not nearly so obvious as the trade name on almost every

but I like to hear it at the beginning of the period and at the ending of it.

I have been much interested in watching my own mental reaction to this to find out whether it is really true. A short time ago, the newspaper which I have read for many years gave the names of these various entertainers in the radio program for the evening. Lately, however, apparently in the fear that they were giving some free advertising to somebody, they have cut out these names, and now I constantly see that we will have, from 9 to 10 P. M. "Radio artists." This doesn't mean a thing to me. What I want to know is, what artists are they that we are going to hear? Are we going to hear the Atwater-Kent orchestra or the Goodrich Silvertown orchestra or the Eveready Hour?

It is important for me to know which of these various attractions is going to be on then because, like everybody else, I have my own favorites, and if it is to be one of these, I am going to stay home and tune them in and listen to them. If not, there are plenty of other things to do in the world.



A view of the reception room at Station WHAR, Seaside Hotel, Atlantic City, N. J.

device which we buy in our ordinary affairs of life.

When you have listened to the Gold Dust Twins, have you ever heard the name of the firm which makes Gold Dust? I never have. When you listen to an Eveready Hour, you hear the name of the National Carbon Company only twice—once at the beginning and once at the end. The Happiness Boys are broadcast in much the same way.

One or two of the features in this toll broadcasting are still open to considerable pruning of credit lines but this is a process which is going on constantly and I believe that by the end of this season we will see the entire situation so cleared up as to be perfectly satisfactory to the average listener-in.

So far as I am myself concerned, I want to know the name of the man who is giving me such excellent entertainment as is being provided by these advertisers. I do not want this name constantly dinned into my ears

I have found, since this change of editorial policy in the newspaper which I mentioned, that I am building up almost unconsciously a very strong feeling of resentment against that newspaper and have lately been buying an opposition sheet. This would seem to indicate that the credit line may have a definite and real value to the listener-in aside from its value to the man who is paying for the broadcasting. I have discussed this subject with a great many people whom I know, and I find that they feel much the same way about it. The credit line is not an undesirable feature when it is well done. It is, on the contrary an important and desirable part of the entire period of entertainment.

I should be very much interested to receive the opinions of readers in this matter. It is extremely important that those of us who are associated with radio should know the public reaction to changing phases like this and so, if you will sit down

9  
Points of  
Superiority

- 1-Soldered brass plates.
- 2-Steator plates shaped for easy tuning on low waves.
- 3-Adjustable ball-bearing rotor shaft. Metal end-plates.
- 4-Soldered clock-work pig-tail.
- 5-Loses too small to measure.
- 6-Rugged construction.
- 7-Minor-screw Vernier moves all plates in no back-lash.
- 8-Takes any size dial.
- 9-The product of 14 years experience, making precision instruments.

New Model "C"

U.S. and Foreign Patents.

For BETTER  
Radio

HAMMARLUND CONDENSERS, from the first, have been designed for better radio.

The New Model "C" more nearly approaches perfection than any similar instrument the engineering world has produced.

Look for Hammarlund Condensers in the receiver you buy. Use only Hammarlund Condensers in the receiver you build.

All capacities; plain and vernier. Sold by the better radio dealers.

Write for Descriptive Folder

HAMMARLUND MFG. CO.  
424-438 West 33rd Street, New York

For Better Radio  
**Hammarlund**  
PRECISION  
CONDENSER

and drop me a line, I will more than appreciate it.

I would like to ask also, that, if you know any man who is in the advertising business or interested in advertising in any way, you send him this editorial, marking for him what I have to say about the article which appeared in *Printers' Ink*.

**A. R. A. DEPLORES  
CONFLICT OF PROGRAMS;  
WE'LL ALL AGREE**

A GREAT many complaints about good programs being broadcast from different stations at the same time have recently been expressed by listeners-in, according to a statement issued by Alfred M. Caddell, Secretary of the American Radio Association, the national organization representing the listeners-in. The general feeling is that this situation has been made particularly acute, due to the shift of time of the Brunswick Hour to the same as that of the Eveready Hour, which has become more or less of an institution in countless homes throughout the country.

"While apparently a matter of concern only to the broadcasting stations and the companies furnishing the entertainment, it is also the concern of the radio listener-in who has spent his money for the privilege of listening to the radio programs," said Mr. Caddell. "Without the listener-in as the consumer, no company could sell a dollar's worth of merchandise, and if the wishes of the listeners are to be overlooked in the desire of the companies to get their programs on the air, somebody is going to lose out by it.

"In the instance cited, the programs offered have commanded a very large following, and the conflict of time is bound to react adversely on the great numbers of people who desire to listen to both programs but who, on account of the Brunswick people camping on the Eveready hour, are not now able to do so. If we are to have good programs it is essential that studio directors maintain a proper regard for the offerings of other stations and bear in mind that listeners-in desire to receive the best that is broadcast but that they can listen to only one program at a time.

"In view of the fact that there is a scarcity of really worth-while program material from which the listener may choose, the offering of two of the very good numbers at the same time can only result in considerable displeasure. Such conflict is not conducive to the best interests of radio and seems quite unnecessary."

**The Answer to Mr.  
Rathbun's Letter**

(Continued from Page 15)

perfectly sincere. I am also quite willing to admit that you make a mighty good condenser. In fact, if you will look over the files of this magazine, you will find that I have specified Rathbun condensers in my own articles.

It seems to me that the truth of this whole matter, so far as concerns its purely theoretical or technical side, is still so much a matter of experiment and controversy that nobody really knows the answer as yet. Therefore, I am assuming that I have a certain amount of justification for my attitude, and you have an equal amount of justification for yours. With that, I think we may dismiss the purely technical aspect of the case.

Therefore, if your letter to me and this letter to you do nothing further than stir some of our readers into

original investigation in the technical aspect of low-loss, it seems to me the argument will have been very valuable and well worth while.

This, however, does not alter my position with regard to the tone of your advertising. I object to the low-loss movement being denoted as a "craze." It seems to me that this whole movement has resulted in a much closer study of radio losses than anything else that has happened in the science. This movement is producing constantly improved apparatus, better design, more scientific planning of circuits and is in every other way leading to better radio.

It is for this reason that I consider it most unfortunate to see any one in so high a standing as yourself carrying on a campaign which must inevitably plant in the minds of thousands of radio fans a serious doubt as to the real value of the low-loss movement. To me, there seems to be no doubt whatever of its value.

That is the opinion which prompted me to write the editorial which you complain of. You will note that Mr. Sylvan Harris is beginning this month a valuable series of articles for me under the general title of "For the Advanced Student." In his article next month he gives a hint that he agrees with your position in the technical aspect of the case. If he comes out in future articles and proves it, I shall print his articles exactly as he writes them. In other words, this magazine is not being run to prove that my opinions are correct, but to give the truth to its readers with absolutely no regard to the personalities involved.

Very truly yours,  
Henry M. Neely.

February 16, 1925.

Dear Mr. Neely:

Wish to acknowledge with thanks your letter of February 10. We certainly could not ask for a squarer deal; it has increased our respect for *Radio in the Home* 100 per cent. From the comments that have already come to us on your editorial, we know that if you publish our letter as you say you will in the April issue, it will go a long way toward increasing the popularity of *Radio in the Home*, and will prove profitable financially.

We stand for low-loss or increased efficiency, absolutely. We have no fight with metal-end plate condensers honestly advertised. Our fight is against the *bunk* on low-loss and the exclusive featuring of metal-end plate construction with low-loss. The phrase low-loss does not mean anything as applied at the present time; it has no value, because no standard of efficiency has yet been established. In describing our condenser, the statement that low-loss screws are used exclusively in construction means just as much as the phrase applied to twenty-five different makes of condensers, the dielectric characteristics of which are certainly not identical.

Very truly yours,  
Rathbun Manufacturing Company,  
Inc.  
(Signed) F. F. Rathbun, President.

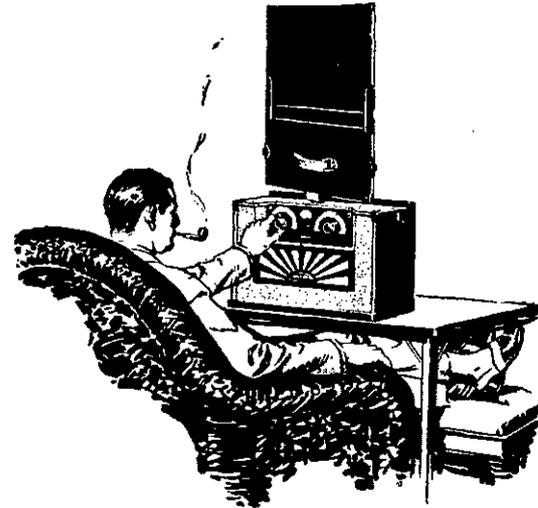
February 21, 1925.

My dear Mr. Rathbun:

I am sorry that I will not be able to carry out my plan exactly as I contemplated in the April issue. That is, I shall have to use my regular editorial space for commenting upon a matter which has recently turned up and that is of rather vital interest to the general radio listener, whether he be interested in condensers or not. I shall, however, give you two letters and mine as prominent a display as is possible and I shall be just as interested as you are in the outcome.

Very truly yours,  
Henry M. Neely.

**The Old Fashioned Radio  
Set Has Given Way to the  
Self Contained Receiver**



**Now you can enjoy  
Radio all summer!**

**Indoors - Outdoors - Anywhere**

The radio set with outside aerial and separate loud-speaker is disappearing—following the way of the early phonograph with its awkward "horn." In its place has come the complete unit, requiring no outside wires or connections, containing everything necessary to efficient radio reception.

Such a set is the 1925 Operadio, a powerful receiver that has taken the country by storm. It has six tubes, a remarkable loud-speaker, big battery supply and all parts enclosed in a compact carrying case. The aerial is in the cover.

Think of it! Nothing but a smart-looking case carried easily anywhere, opened and tuned in less than a minute!

The 1925 Operadio is not to be confused with the or-

dinary so-called "portable" set. It has far longer battery life, it is more efficient, because three years of concentrated effort by nationally known engineers are back of it.

Its performance is comparable in range, selectivity, ease of tuning and tonal qualities with that of any set on the market. It is ideal for home use and the only truly satisfactory set for summer use—giving splendid performance and enabling you to enjoy radio indoors-outdoors—anywhere.

Mail the coupon below for a booklet telling about this marvel of radio, which is amazing and delighting thousands of people everywhere.

Price Complete  
With Tubes  
and Batteries **\$189.00**  
East of Rockies



Close it Up  
Take it With You

**OPERADIO**

**THE ORIGINAL SELF-CONTAINED RECEIVER**

Mail this Coupon

THE OPERADIO CORP.,  
8 S. Dearborn St., Chicago, Ill.  
Please send me complete particulars about the 1925 Operadio.

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

# Transformer Results

Correct loud speaker performance depends almost entirely upon transformer design. Jefferson Transformers provide full, rich, smooth amplification. They furnish the loud speaker with the proper energy and assure the greatest possible volume consistent with purity of tone.

Even amplification over the entire musical range; perfect reproduction of the voice and instrument—these are some of the reasons why radio authorities and music lovers the world over recognize Jefferson superiority,

Designed by a concern which has specialized for more than 20 years in the manufacture of high-grade transformers of every description. Jefferson Transformers meet the most exacting demands of every circuit. Give your circuit a treat—install Jeffersons.

Ask for latest Jefferson Circuit diagrams.

**JEFFERSON ELECTRIC MFG. CO.**  
503 S. Green St., Chicago, Ill.



#### Manufacturers of:

Hell Rinsing Transformers  
Sign Lightix Transformers  
Toy Transformers  
Heavy Duty Signal Transformers  
Auto Transformers  
High Voltage Transformers  
Welding Transformers  
Automobile Ignition Coils  
Jump Spark and Make and Break Coils  
Testing Instruments  
Gas Furnace and Oil Burner Transformers and Ignition Equipment

## PORTABLE SETS

for your summer vacation will take city entertainment into the country with you. Factory-made or "roll-your-own"—the portable set this year will make you forget the old summer static when the new high-power stations are broadcasting.

Next month's issue will be the **PORTABLE SET NUMBER**. Don't miss it.

**RADIO IN THE HOME**

## How to Gain Quality

(Continued From Page 19)

tract from the charge already on the grid.

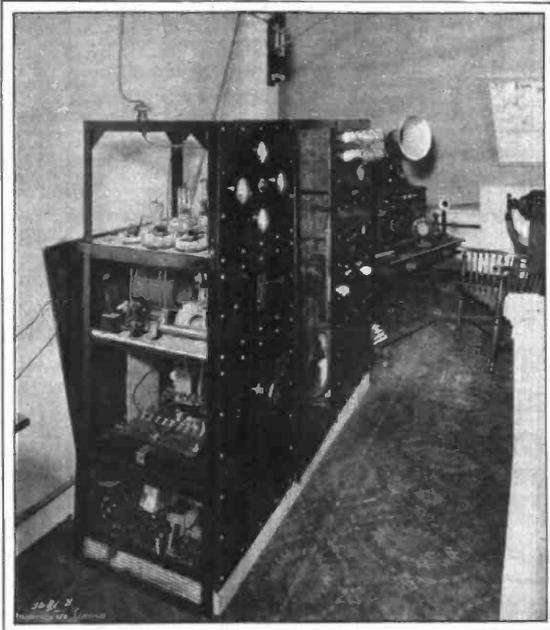
In the old days, the grid "return" lead or F minus of the transformer was connected to the negative side of the filament wiring. This was considered to place a negative charge of sufficient magnitude on the grid. Usually it does, but the grid is too close to the neutral point (neither plus nor minus) to operate at the "best point on the curve."

At the proper part of the "curve," any alteration in grid voltage produces a proportional alteration in plate current and thus the amplification is clear. However, toward the neutral and positive side of the grid charge, this relation doesn't hold, and the nearer the grid gets to positive, the poorer is the amplification in point of clarity. Hence, the "C" bat-

higher pitched note and is superior for speaking, whereas the larger diaphragm lowers the pitch. The larger diaphragm seems to make for a more natural tone even though the articulation is not quite as good as with the small diaphragm.

The mellow effect is easily gained by shunting a small fixed condenser across the secondary winding of the last audio transformer. A capacity of .00025, .0005 or .001 mfd. will answer, the exact size depending upon the transformer itself to some extent and also to the extent of "mellowness" that is wanted. The device does, it is true, distort voices slightly, but it has the effect of cutting out the harsh noise that is so often heard along with broadcasting as brought out by the speaker.

Frequently it is noticed that on very loud notes a tendency to rattle is present. Several reasons may account for this. Usually it is due to contact between the diaphragm and



A view of the operating room at Station WHAR, Seaside Hotel, Atlantic City, N. J.

ttery is employed to provide a fixed negative charge of a few volts on the grid, above and below which the incoming signal will swing. At the same time, this negative charge reduces the flow of electrons from grid to plate and thereby cuts down the drain on the "B" battery very considerably. In this way the "C" battery not only economizes on the "B" battery, but lengthens the life of the tube as well, since fewer electrons are drawn out of the filament in a given time.

Now as to the question of quality of tone. Some listeners like the sharp, distinct and slightly metallic tone that is so good for voice and that brings out each detail of modulation with accuracy. A metal horn produces this effect to some extent. On the other hand, there are possibly more who prefer a more mellow sound, and the wooden horn loud speaker gives this.

Of course, the loud speaker unit itself has a great deal to do with the tone. The small diaphragm gives a

the magnets in the speaker. In cases where there is an adjustment knob or wheel, whereby the magnet may be moved away a bit, such rattling is easily overcome. In non-adjustable speakers, rattling is a sign that they are being operated at too great volume. The remedy there is obvious.

The best quality is secured when the diaphragm is very close to the magnets, as it is in this way only that the faint overtones are registered and that the weaker sounds are reproduced in almost as great degree as the stronger ones. The diaphragm should be close, but not close enough to touch on strong notes.

Other vibrations arise from loose parts in the unit, the horn or the base on which it rests. To locate these it is necessary to use as much volume as possible and then touch the horn at various points, lift it off the base, etc., to determine just what is vibrating.

Some horns are built in two sections that are riveted together. Often

the rivets work loose, or the parts that overlap do not lie firmly together. A bit of cardboard as a wedge corrects this difficulty. Once in a while a pin or bit of metal or wood will fall into the horn accidentally and joggle about, causing rattling noises. And in summer time tiny insects may get inside and die and bounce about as the diaphragm vibrates.

The speaker should be kept from hard contact with the radio cabinet or table by means of a felt pad or rubber feet. Vibration of the support or base is thus avoided and alteration in tone through such vibration overcomes. A phonograph used with a good speaker unit makes a very fine loud speaker.

Frequently there are metal parts which work loose and start to vibrate with certain voice or music frequencies. Sometimes it is the starting lever, or the brace which holds the cover up, or perhaps a few phonograph needles have dropped inside and are resting upon the horn.

It is important to connect the speaker unit so that the plate current of the audio tube will traverse its magnets in a direction which will not demagnetize the permanent magnets within it. The proper direction may be quite readily told by trying the reversal and connecting the cords for the loudest signals.

The day of the headphones, when employed for family radio entertainment, has practically passed, but the loud speaker and audio amplifier still have plenty of room for improvement before the music will equal in faithful reproduction that available on the 'phones alone. But the many and obvious advantages of the loud speaker are bringing it into widespread use. It may be made more universally pleasing to the ear by a little painstaking investigation of the sources of distortion, and by correcting both those disturbances arising from within the amplifier itself and the faulty operation of the signals, the loud speaker's work will be clearer, smoother and more nearly perfect.

### The Question of "Low Loss" and "Bunk"

(Continued From Page 16)

to refund, in case his condenser did not make good, it never would have been necessary for us or any one else to start a fight for safe, sane and clean advertising and merchandising of radio apparatus.

On the other hand, if the claims made for the metal end plate construction had been proven, or could have been proven, we would have been among the first to adopt it, for we have not been asleep for the last three years, as you seem to think. We can probably show you a complete condenser data, tests, models, etc., as any concern in this line.

To prove our convictions and still not attempt to force our product, we say to the purchasers of our condensers that if they can get longer distance, more volume, sharper tuning or clearer reception with any other condenser on the market regardless of price, they may return ours and full refund will be promptly made. Results are what they are interested in regardless of what the squared paper of the physicist may say.

We want to ask you candidly, who do you think is taking all the risk in a guarantee of this kind? How can we retard the march of radio by telling the radio fan to take our condenser, test it out against the field and bring it back if it isn't satisfactory in every way?

You can name a dozen large and

prominent manufacturers of receiving sets who use condensers with dielectric ends. They sell these sets on the results they produce. If they could improve these results by using condensers with metal ends, wouldn't it seem logical for them to change, or do you think they are also asleep to the march of radio?

The points you bring out about dielectric material causing self-oscillations may be new; you state it as an absolute fact, and as such infer that there is but one perfect set. If this is true, and your readers have absolute confidence in your statements, then it would seem wasted effort for manufacturers of other sets to advertise and attempt to sell their products through your magazine.

The perfect set is the ultimate goal of all. When it arrives, all others will have to go, but the more we consider this, the more we are inclined to think that all the bunk is not in our advertising.

Another point comes to mind in this connection. Are you sure that in the set you mention use is not made of the losses induced in the metal ends of the condensers for stabilizing the radio-frequency tubes, rather than to do this through the use of potentiometer, reverse feedback or resistance of some kind, and that this is the reason the condensers having dielectric ends would not function? We have not seen this particular set or circuit, and would greatly appreciate your securing for us a circuit diagram, if possible.

Before closing there is another question. *What does low-loss mean?* Is there any standard yet established by which condensers can be rated? Do you contend that any and all of the metal end plate condensers with which the market has been flooded recently are low-loss, and that all those using dielectric for ends are not?

If you can clearly and positively define just what low-loss means, and furnish proof that is convincing through actual results, you will have done a wonderful service to the radio fan as well as to all condenser manufacturers, for it is safe to say that all conscientious manufacturers are endeavoring to build into their apparatus the highest efficiency possible, and always welcome constructive criticism that will better their products.

In the recent trans-Atlantic broadcasting tests, our condensers were used in a number of sets that were successful in bringing in the foreign stations on their loud-speakers and we have in our files unsolicited letters from these listeners who have had their reception verified.

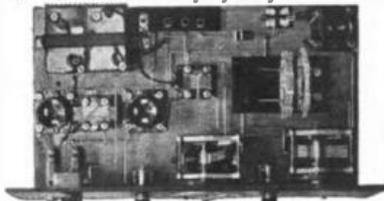
We have also, today, been advised that broadcast reception, on a loud-speaker has been received from Sydney, Australia, at Atlanta, Ga., on a Super-Hilton-Dykes set using our condensers, verification of which is expected from Sydney very shortly. Are you prepared to say that metal end plate condensers would have given louder reception or longer distance? If not, why then are not our condensers as low-loss and as efficient as the metal end type? And how are we fooled, or fooling the public, or stopping the march of radio in any way?

Yours truly,  
(Signed) F. F. RATHBUN,  
Pres. P. Rathbun Manufacturing Company, Inc.

P. S.—If you care to publish both sides of this controversy, which you started, so that those who have read your editorial can get our side of it, we are willing to abide by the results. If not, then we shall feel at liberty to furnish copies of your editorial, together with this letter, and your reply to same, to certain manufacturers who are interested.

## B-T Condensers Go With Fleet

F. H. Schnell to Accompany Navy in Maneuvers



Schnell's Short-Wave Tuner Set With B-T Condensers

F. H. Schnell, Traffic Mgr. of the American Radio Relay League, is to accompany the Pacific Fleet in its forthcoming battle practice in Hawaiian waters. With him goes his short-wave Tuner set for Navy-Amateur experimental tests. In his receiver he uses B-T Type L Condensers.

The enormous frequencies at low wave lengths—25,000,000 per second at 12 meters, for example—compared with 134,000 at 560, demands the utmost of condensers. Mr. Schnell chose B-T's.

### Choice of Experts

The B-T Tuner will be found in such stations as those of Kruse, Technical Editor of Q & N; Clayton, Information Service Mgr., and Budging, Current Service Editor of the League.

### A Leading Technical Editor Says:

This is what another leading Technical Editor says:

"I have been testing various tuners—everything we could get on the market, and I want to go on record that the B-T Type 'B' run circles around the whole bunch. Tunes were all made in one evening, and the only changes made were one tune for another."

"Best reception was KGO on an indoor care antenna with the B-T, and best with any other was WGN, Chicago, with an outside antenna, 300 ft. For a motto for B-T, I suggest, 'Ask the man who owns one.'"

### The B-T Nameless

The 5-tube "Nameless" will be found in America's finest homes. It can be built and tested step-by-step. Write for information on this greatest of B-T achievements. It is described in "Better Tuning."

Have You Read "BETTER TUNING"—Seventh Edition  
Ask Your Dealer or Send 10c for Copy

"Better Tuning," a 48-page booklet of diagrams, hook-ups and advice will help any one get better results on all circuits. The 7th edition is ready. If your dealer doesn't carry a stock, send 10c for postpaid copy. "Better Tuning" is packed with each B-T Tuner.

## BREMER-TULLY MFG. CO.

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Patent Jacks  
Come in  
10 types  
50c to 90c

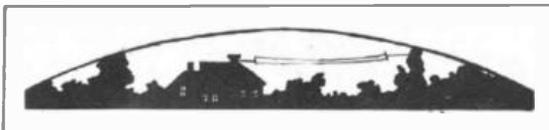
## The spring's the thing!

Don't underestimate the importance of good jacks. Don't buy jacks because they're cheap. Over 60 leading set manufacturers use only Patent Jacks. They have that most important quality—fine springs that keep the tension constant and the contact perfect.

Write for catalog of complete Patent line.  
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DON'T IMPROVISE — PACENTIZE



# CIR-KIT

## More Power per Tube brings Greater Radio Most Economically

Triple power is the basis of Erla Supereflex records. Tubes, as used in Supereflex, simultaneously amplify received radio frequency currents, reflexed radio and reflexed audio frequency currents. So 1-tube Supereflex rivals the power of conventional 3-tube circuits. And 3-tube Supereflex readily outclasses the ordinary five!

Only such power can give you the thrill of Supereflex distance and volume; always with Erla crystal-pure tone—and with uncanny selectivity that gets what you want when you want it.

This finer radio is brought within the reach of all by Erla Supereflex CIR-KIT, the factory-sealed carton of genuine Erla apparatus for building Supereflex yourself. Anyone can follow the CIR-KIT assembly plan perfectly, using only screwdriver and pliers, without the risk of drilling or soldering.

### SEE ERLA RECEIVERS

Inherent Erla advantages in power, tone and selectivity are now available in beautiful complete Erla receivers. Retail prices range from \$67.50 to \$127.50. Both performance and price place Erla receivers among the sensations of radio history.

Pride of workmanship, extreme economy, priceless radio performance, are yours in Erla Supereflex CIR-KIT. Select your model at the Erla store. 1 to 5 tubes, antenna and loop types.

Electrical Research Laboratories  
Dept. Q, 2500 Cottage Grove Ave., CHICAGO

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HIGH QUALITY — LOW PRICE

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TUBE BY MAIL

For Brilliance of Tone, Sharp Volume, More Pep—Use Claritrons The Highest Quality at the Lowest Obtainable Price. Low prices because we cut out the jobber-wholesaler's profit.

All types, including our 501A, for 6-volt storage batteries; our 499, for 4½-volt dry cell batteries; and our 112, for 1½-volt dry cell batteries.

ALL MADE WITH BASES OF PURE BAKELITE—for superior efficiency. We Guarantee Complete Satisfaction. From dealers, or direct by Mail C. O. P., or airmail on receipt of Express or Postal Money Order. WE PAY POSTAGE. \$2.30, all types. Dealers Write!

**SUPERIOR RADIO COMPANY, Dept. 204**  
176 Shepard Ave. Newark, N. J.

TYPE 499  
Detector & Amplifier, 4-6 volts.  
For dry cell Batteries. 0.08 Amc.

TYPE 501A  
Detector & Amplifier, 6-6 volts.  
For Storage Batteries. 0.25 Amc.

## Super Kits Save Half

Buy a RUBICON KIT containing only the parts needed to round out your present outfit. Coils, intermediate transformers and fixed condensers tested to match are important. RUBICON KITS supply these. Use your own parts for the rest—and save half.

**RUBICON COMPANY**

29 N. Sixth St. Philadelphia, Pa.



Kits to build 4 or 5 tube sets, \$23.50 to \$38.50

## Radio Preacher Is Paid "Country Style"

(Continued From Page 14)

tion broadcast by Pastor Brown. Again and again he has sounded his slogan: "No contributions solicited." But the radio fans won't have it that way.

After spending more than two years in Pastor Brown's invisible congregation, they can't be satisfied not to make some returns. Hence the new auto, the radio, the fresh country eggs, the home-made candy and

is with the crowds who hear him at his Omaha Gospel Tabernacle.

"I see 'em all in the steel-framed glass circles of my microphone," he declared. "There's the hard-boiled husband who won't go to church with his wife. There's the gang at Billy's billiard hall at Denver. There's the little consumptive girl who is taking the fresh-air cure. There's an old couple out on a farm who wrote to



The Holnes five-tube receiver shown above is just another of the hundreds of presents which Pastor Brown has received from members of his World Radio Congregation. Pastor Brown is holding "the radio baby," his daughter, Marylyn Jean. His two other children, Robert, 12, and Helen, 6, have also become ardent radio enthusiasts since the set was presented to the Browns.

angel-food cakes, and almost everything else that will travel by mail or express.

Nearly two years have rolled around since the radio fans named Marylyn Jean the "Radio Baby," Pastor Brown's youngest child, born shortly after he became a radio preacher. And in those two years Pastor Brown has become as well acquainted with his assorted congregation who wear the headphones and gather around the loud-speaker as he

me: "You brought Sunday back to us." "There's the little lad at the School for the Blind who says I'm making a good boy of him. There's the chap out in the car inspector's shanty who hasn't gone to church for years because he has to work on Sundays. And there's a group of worshippers in a country schoolhouse in Colorado. "I take off my coat and preach to them for hours till the perspiration pours down my face.

"The preacher who has his audience where they can't get away can use subtle methods and build up an climax. But the Radio Preacher must say something in every sentence."

The letter-carrier brings Pastor Brown his measure of success. By plowing through a stack of letters, numbering between 15,000 and 20,000, he has learned that his congregation now extends into every State in the Union and elsewhere.

"Tis a strange admixture of city and country, of old and young, of rich and poor, of ancient and modern—the World Radio Congregation.

And it pays its preacher in the good old-fashioned way, with heartfelt "thank yous" and free-will offerings.



Marylyn Jean, just 21 months old, is Pastor Brown's youngest. A few hours after her birth she was christened "the radio baby." Even the very photograph from which the above picture was taken was paid for by one of Pastor Brown's listener-admirers.

## An Humble Thought or Two About Low Loss

(Continued From Page 17)

Figure 5. Our pencil bursts into brilliancy at the corners, at the knot and at the extra binding post, and we note a drop on meter B. Not an improvement certainly, so we go back to the straight wire. This



## More Money For You in RADIO

THE amazing expansion of Radio has opened up hundreds of wonderful new positions on land and sea. Big salaries, fascinating, easy work, short hours, and a wonderful future are offered to ambitious men who get into Radio now.

Take advantage of these wonderful opportunities to step into a big paying position in this great new field. You can stay at home and work up to a position paying up to \$10,000 a year; or Radio offers you an opportunity to travel and see the world, with all expenses paid, and a fine salary besides. One of our recent graduates, Emmett Welch, of Peculiar, Mo., secured a position one week after graduating, paying a salary of \$300 per month. Hundreds of other report equal success.

## Easy to Learn Radio at Home

Thousands of Certified Radio-technicians are wanted to design Radio sets; to make new Radio improvements; to manufacture Radio equipment and to install it; to maintain and operate great broadcasting stations and home Radio sets; to repair and sell Radio apparatus; to go into business for themselves; to operate aboard ship and at land stations.

You can easily and quickly qualify in your spare time at home through the help of the National Radio Institute, first school to teach Radio successfully by mail, established 1914. No previous experience or training needed. Prominent Radio experts will help you in every problem, giving you personal attention.

You learn by actually doing, as we furnish free with the course, circuits and parts for building latest receiving sets, making the work thorough and practical. You learn quickly and easily—right at home.

This is an absolutely complete course which qualifies you for the real "big pay jobs" in Radio and our big employment department helps you get one.

### Send for FREE BOOK

No other field today offers such great opportunities as Radio. Take your choice of the many wonderful openings everywhere. Prepare now to step into the most interesting and best paid profession today. Read about the opportunities open now—the different kinds of work—the salaries paid. Write today for the 32-page book that tells how America's biggest Radio correspondence school (government recognized) can teach you to become a Certified Radio-technician in your spare time and also Special Offer to those who act at once! Mail coupon or write at home now. National Radio Institute, Dept. 34FB, Washington, D. C.

National Radio Institute, Dept. 34FB, Washington, D. C.

Without obligation, send me your book, "Rich Rewards in Radio," which tells all about the opportunities in Radio, how spare time study at home will qualify me quickly as a Certified Radio-technician so I can get one of these splendid positions, and how your Employment Service helps me to secure a big pay job. (Please Write Plainly).

Name..... Age.....  
Street.....  
City..... State.....

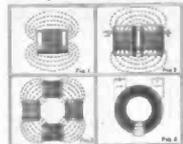
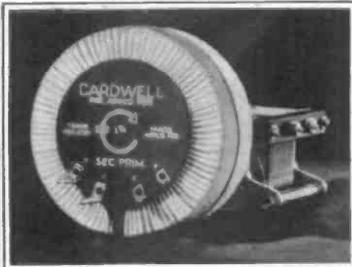
wire has up to now been about 50 feet long, but we can shorten it and find that when we do output meter B again goes up a peg.

I have saved the condenser and coils for the last because these seem to be the most important radio items. This series of experiments is not as yet entirely completed and I am therefore unable at this time to show a graphic story of coils. The difference in variable condensers was, however, very "illuminating." Metal and plate condensers are said to be the "bunk." They were primarily designed to avoid absorption or poor dielectric losses prevalent in composition or bakelite end plate condensers. Certain designers, in fact all of them so far as I can see, entirely overlook the fact that hysteresis losses in metal may be very much greater than absorption losses in bakelite, etc. This was very beautifully shown in our tests as in Figure 6a. Here we have any metal and plate condensers of the type now on the market. The field around these condensers reached out to six and seven inches beyond the condensers, representing a very appreciable loss. Figure 6b shows a typical bakelite condenser. The field is much smaller and the losses evidently less.

Bakelite, then, you say, is the answer to low-loss condensers. I am afraid not, because further comparisons showed that while the field was less for bakelite than for metal ends, we found that spacing the plates closer together made the losses less, and substituting metal rods for the bakelite improved matters still more. Bakelite was mechanically unable to stand removal as was the metal. We then built a condenser of extremely small metal end plates, bakelite only as insulation, spaced the plates very closely and secured a condenser that looked like Figure 6c. This seemed to be the best condenser that we could conveniently handle. But we took the two ends of the insulated wire and wrapped them around each other, the more turns the more capacity, and securing the various capacities in this manner found that the stray field was never any greater than that of the wire itself. This seemed to be the most efficient condenser, for our output meter was at top notch. Figure 7 shows now a continuous line from "a" to "h," with much less energy wasted than when we first started.

These observations, I feel, cannot help but point in some degree to the following answers to our questions.

- (1) Yes, "low-loss" certainly does pay and is not "bunk."
- (2) Metal end plates are better than bakelite for variable condensers because it is the amount of material used that should be considered. Metal being mechanically superior to bakelite, it is possible to use much less of it.
- (3) A variable condenser for receiving circuits should preferably have its plates spaced closely together.
- (4) A bend in a wire will cause an extra and unnecessary field. Bends are therefore not to be desired.
- (5) A set should preferably be "built" and not "wired" any more than can be helped. If you must use wire use insulated wire.
- (6) If a set is "built" and not "wired," one part fitting to another, the shortest possible connection will result. Every inch of wire used means just so much more resistance in the set. Of course, we must use some wire, but if we really try to build our auto instead of tying a "Packard" together with hay wire, it is surprising how we can cut down our stray fields and losses.



General Theory of the Toro-Tran  
Figure 1 shows how the field of the ordinary coil extends into space and increases linearly due to stray field. Figure 2 shows a tube containing the field around a wire. In Figure 3 the Toro-Tran field is indicated. The field lines are concentrated around the wire and do not extend into space. The field is introduced from the aerial of the tube to be followed out at "V," by the reversed polarity of the winding. This rejects stray field lines on the ground shield. Hence maximum efficiency and selectivity.

## —and now the TORO-TRAN!

CARDWELL, whose pioneer "low-loss" condenser established new standards of radio efficiency, is now introducing the Toro-Tran\*—the ideal balanced coupling inductance for all radio frequency work.

A TRADE MARK

The Toro-Tran eliminates signal energy picked up by ordinary coils from nearby stations. It eliminates magnetic feedback in multi-stage radio frequency circuits, thus removing the most active factor in causing howling and distortion and thereby increasing selectivity and distance. It rejects almost entirely the interference effects caused by electrical

power machinery, elevators, door bells, arc stations, etc.

The Toro-Tran winding confines the field to the inside of the coil, a small area, and thus avoids one of the greatest causes of loss known to radio receivers— that of stray magnetic fields which result in the absorption of signal energy and reduce the efficiency of the receiver tremendously.

### Note these unusual advantages in assembly and operation

1. Compactness. The coils do not require spacing or angular mounting. They occupy less space than your condensers.
2. Permit exact nullification for tube and stray capacity without guess work or tedious testing.
3. Closed magnetic field eliminates magnetic feedback in tuned radio frequency amplifiers.
4. Low distributed capacity due to air spacing of each winding and to low voltage-drop per turn of small diameter wire.
5. Maximum coupling and high ratio of voltage increase due to concentrated field with zero leakage.
6. Absence of all supporting insulation in the field of the coil. This is one of the great-

est factors in the ordinary circuit and is not remedied by "skeleton" or so-called "low-loss" windings.

7. Ease of neutralizing oscillation due to tube capacity by means of rotating control which anyone can "balance."
8. Low capacity between primary and secondary, affording maximum transfer of energy to succeeding grid-circuit.

The Toro-Tran has a lower "circuit resistance" (i. e. effective resistance as assembled in a set and not as isolated in the laboratory for theoretical measurements) than any inter-stage tuned transformer made and has a correspondingly higher amplification factor, its ratio exceeding ten.

To appreciate the many remarkable advantages of the Toro-Tran write for our two free booklets: "The Torodyne Circuit" and "The Most Interesting Radio Frequency Transformer Ever Invented."

Toro-Trans are ready to mount in any tuned radio frequency circuit. Replace your ordinary coils with Toro-

Tran. You will be astonished with the results. Most .00035 mfd. variable condensers will tune them, but by using Cardwell Condensers, you get maximum efficiency.

- Order from your dealer or direct
- |  |       |
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| CARDWELL TORO-TRAN WITH BALANCING POTENTIOMETER  | 4.00  |
| Cardwell .00035 Condenser for tuning             | 4.75  |
| Cardwell .00035 Vernier Condenser                | 6.25  |
| Cardwell .00035 Dual Condenser (two-in-one)      | 8.00  |
| Cardwell .00035 Triple Condenser (three-in-one)  | 12.00 |
| Cardwell Audio-Tran (compound audio transformer) | 10.00 |

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Everwhere! **110**

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**AMPERITE**  
"means right amperes"

The self-adjusting rheostat that automatically controls tube current, eliminates hand rheostats, filament meters, condenser and tube wipers. Simplifies wiring. Increases component life. Doubles tube life. Makes every operator an expert. Tested and approved by all leading laboratories. Used by more than 50 foremost set manufacturers. Be sure the set you build or buy has AMPERITE.

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ALL-GLASS SOCKET  
Means Better Reception!

Made of Vira-lon, a special glass, processed for 100% efficiency. Sturdy, absolutely heat and moisture proof, and unaffected by those influences that commonly make rubber, rubber derivatives, porcelain or vitreous products so inefficient.

Other exclusive features are Rayclean Contacts (ip to o f exact correlation) — One Piece Contact Strip — Handy Soldering Terminals, etc. Price, \$1.25 standard size.

Write for interesting pamphlet! If your dealer cannot supply you, send us \$1.25 and parcel post to cover each socket.

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"The Authorized Shopping Service of Radio in the Home"



"I will buy for You"

Free Shopping Service in the great Radio Markets of New York and Philadelphia for readers of this Magazine.

**I Make No Charge for This Service!**

Avail yourself of the service of an expert BUYER in these markets. I will buy any apparatus mentioned in this magazine, and send it, carefully packed, direct to your door, at its regular price, plus only parcel post and insurance. It is conducted in close co-operation with Mr. H. M. Neely, and in for the convenience of his readers.

**TO MY CUSTOMERS—PRESENT AND FUTURE**

Readers of Radio in the Home have been buying from me for more than a year now, at Mr. Neely's suggestion, and EVERY ONE has had a SQUARE DEAL. In witness whereof, my repeat business is steadily increasing.

**DO NOT BE MISLED BY "CUT PRICE" ADVERTISING.** I do not cut prices or "gyp" in any way. I shop for STANDARD apparatus only. I personally test and inspect everything before it is shipped, and I STAND SQUARELY BEHIND the merchandise I ship you. If it is not just as represented, send it back and it will be replaced without a question.

**CUT PRICE HOUSES CAN'T DO THIS**

**HERE IS A SCOOP!**

I doubt whether you can buy the NEW

**SCHICKERLING S-1600 TUBE**

from any one but myself. I can supply you with them, despite the fact they are not as yet on the general market. **\$4.00**  
A wonderful tube, and the price.....

Again I Beat Them to It!

**THE XL VARIODENSER MODEL "N"**

This is the high grade neutralizing condenser used by 3XP in their latest circuit. Brand new and the finest thing I've seen. I don't know who else can supply them yet, but I have them. Each..... **\$1.00**

**Now for the Big Surprise of the Month  
THE 3XP BROWNING-DRAKE**

After reading its description in this issue, you will surely want to build it. I have prepared one of my Kits of parts, made up in exact accordance with the specifications, including the Variodensers, General Radio Transformer Type 285; Genuine National Regenerformer, Amperites, **\$43.00** and complete parts for.....  
Post Paid to Your Door

**This Has Been Aptly Called the  
3XP—\$100.00 OUTFIT**

The above kit and following accessories:  
3 S-1600 Schicklerling tubes  
A good cabinet  
Antenna Equipment, including Lightning Arrestor  
A Batteries—B Batteries  
2 Weston Phone Plugs  
1 Brandes Headset  
Any \$15.00 Speaker or Unit — BRISTOL regularly furnished  
**\$100.00**  
Post Paid to Your Door

**INVERSE DUPLX**  
John DeQ. Briggs has written a booklet on this subject, and it will be to the advantage of every builder of the set to read it. 50c post copy.

**E. M. CLARKE CO.**

Office 202, 1523 Chestnut St., PHILA., U. S. A.  
Depend on Me for Reliable Radio Apparatus

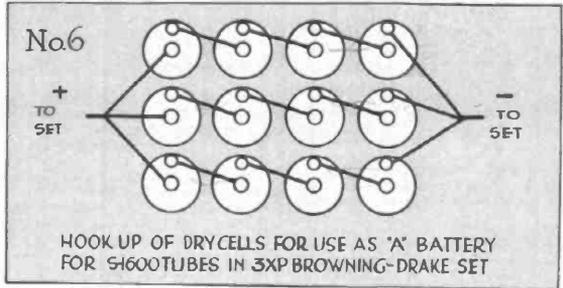
**The 3XP Browning-Drake**

(Continued From Page 13)

10. You will need a six-volt "A" battery, either storage or dry cell. If you wish to use dry cells see diagram No. 6 for the way to hook them up. You will also want a 4½-volt "C" battery and two 45-volt "B" batteries. One of these 45-volt batteries should be tapped so that you may vary the voltage you use for the detector until

find it at the same place on the dials each time.

Those who have operated regenerative sets before will find this set very simple to handle. To the rest of you, I can only say do not be disappointed if you live on the eastern seaboard and do not get Kansas City during the first twenty minutes you are run-

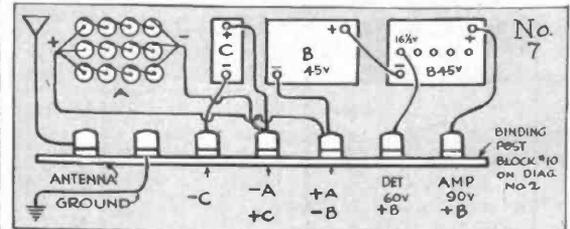


you get the best results with the tube you are using. At 3XP we used 60 volts on the detector and 90 volts on the plates of the other two tubes. In case you are in doubt as to just how to do this see diagram No. 7.

Now with the batteries all connected, set rheostat No. 4 at full resistance; insert the tubes, turn No. 4 until filaments light. Tune in a local station at its loudest. Turn off the filament rheostat No. 14, and you probably will still hear the station. Now turn the neutralizing condenser

ning the set. I couldn't either, but that was my own fault, as I had forgotten to solder a connection and could not even get Philadelphia, thirteen miles away.

Browning and Drake with their sets in Cambridge, Mass., have no trouble in getting KGO with only 20 feet of wire for an antenna. I do not promise you that, but I will say that we had 6KW at Tunleu, Cuba, on the loud-speaker at the laboratory in Delanco. It might also interest you to know that at 4:45 P. M. (Eastern



No. 3 until the station disappears. The set is then neutralized and will not radiate. Turn on rheostat No. 14 again and go to it!

A different way of neutralizing is to rotate the tickler No. 20 until a click is heard, when the moistened tip of the finger is touched to the connection marked G on the coil No. 18. Turn the tickler until the clicking stops. Then, if by turning the dial of condenser No. 6 the clicking appears, the set is not neutralized. Adjust the condenser No. 3 until no position of condenser No. 6 gives you this clicking.

Now, in regard to the jack switch No. 7, in the section on connections for the antenna and grid circuits to be used with diagram No. 4 you had one wire which ran to A1 from this switch and another which ran to A2. If you are in a congested radio section and are after selectivity turn switch No. 7 so that you are making contact with the side that goes to A2. If selectivity makes no difference to you, use it in the other position. Of course you understand that switching from A1 to A2, or vice versa, is going to make a difference in dial readings on Condenser No. 6. But after you have once logged a station you will

Standard Time), this set picked up Montreal, Canada. Not so bad for daylight reception.

**The Broadcasting Hotel  
Is Overcrowded**

(Continued From Page 28)

long-distance broadcast reception and the increased range would stimulate the large stations to strive for the best in programs.

"Progress along these lines would not restrict the development of the strictly local stations designed to reflect the community life of their own districts. Such stations, operating on another band of wave lengths, have their own function and they may, on occasion be tied into the general or national group by means of wire lines or radio rebroadcasting."

SUCH an idea is in keeping with the opinion expressed in this magazine by G. C. Furness, who is very largely responsible for the link broadcasting of the famous Ever-

**Extra! Special!**  
**Complete Parts**  
**Browning-Drake**  
**3-Tube Set**  
*As described in this*  
*issue Radio-in-the-Home*  
 Including **\$34.75**  
 Panel

Regular Price \$46.40

A SET that combines the best in Radio—radio-frequency with regeneration (a combination much sought, but until now impractical) and perfect dry-cell tube operation. Needs no storage battery. A set that will bring in DX on loud speaker, with no sacrifice of tonal qualities on local stations. Tinsic, Cubs, on loud speaker, and Oakland, California, frequently heard on 20-foot aerial. Simplicity itself. Dials always legible. All parts thoroughly tested, neatly packed and ready to be hooked up anywhere.

Recommended by Henry M. Neely in his feature article in this issue

**The M. & H. Radio Engineering Service**  
 —Recommended by **HENRY M. NEELY**  
 for All Sets  
 Described in  
**Radio-in-the-Home—**

**Will Supply Parts or the Complete Set**  
 of Any Hook-up Ever Published in Any Issue of This Magazine at No Extra Charge

**Complete Parts**  
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**3-Tube \$22.95**  
 Set

Including Drilled Panel  
 Regular Value \$32

As described in March Radio-in-the-Home.

**Another M. & H. Special Complete Parts**  
 Including Drilled Panel  
**3-Tube Harkness**  
**Counterflex \$17.50**  
 Circuit . . .

Described in October Radio in the Home and as Improved in January Issue

The equal of any 5-Tube Set in audibility and selectivity. So simple, child can operate it. Dials always leg. Radio in the Home for February, page 19, says: "The Harkness 3-tube Counterflex Set successfully picked up European Stations during international tests."

Set on Demonstration

**Only One Kind of Quality here—**the best. Radio Sets that give satisfaction demand quality parts. Every set thoroughly tested by our Radio experts. Our reputation built up by 19 years' faithful service, is back of each sale.



ready Hour. In our December issue Mr. Furness said:

"For those who wish to broadcast but who do not own a station, or who are interested in the progress and betterment of radio as a whole, the remedy for poor programs seems as clear as the cause. It is to spend money on the programs themselves, utilizing the facilities of existing stations, not building and operating more stations."

This matter of the growing additions to the number of radio stations is the most important that is confronting the listener-in today. The plan of the Department of Commerce to put all of these new stations below 280 meters is going to cause tremendous confusion on those low wave lengths, but there is absolutely nothing else that the Department can do. The low wave lengths must simply be regarded as a waiting list of stations which are functioning and will continue to function, meanwhile proving their efficiency or their inefficiency, until a wave-length channel is vacant for them above 280 meters.

The Department is now utterly helpless in the matter. The solution remains entirely with the public. There must be, in some way, a public showing of undoubted opposition to the establishment of any more broadcast stations until the present chaos is in some way cleared up.

I would personally advocate action by Congress which would enable the Secretary of Commerce, with a proper court of appeal from his decisions, to refuse to grant licenses in his discretion. This would mean that he could hold up license applications that are on their way now and would not have to grant them until a definite vacancy occurred in the already existing wave bands. It would mean that he himself could hold everything up until a number of present stations went out of business to enable him to separate all stations by a margin of at least 15 kilocycles. I do not believe that a 10-kilocycle separation is efficient. I am quite sure that the average reader will agree with me. Inefficiency is proved by the fact that there is scarcely a single setting of our dials today which will not bring in the whistle which means that two stations are too close together.

Theoretically, 10 kilocycles separation is all right. Even a moderately good receiver will tune out a station which is 10 kilocycles away from the desired one.

The difficulty is, that 10 kilocycles does not allow the slightest margin for variation.

The moment one of these stations is just a few cycles off of its exact wave length the heterodyne begins and continues until the stations get back to where they belong.

Now, with so little margin for variation—virtually none, as a matter of fact—it is physically impossible to keep the ordinary broadcasting station on its exact wave length to a decimal point of a meter. Changes in the internal electric wiring system of a building will throw the wave length off that much in many cases. The sagging of the aerial a few feet under stress of weather conditions will do the same thing. Most important of all, however, is the fact that the operator of a station must adjust his wave length according to the wave meter which he has in that station and it is utterly impossible at the present time to make a portable type wave meter that will be always accurate over a period of time to within two-tenths of a meter. This accuracy is essential in 10 kilocycle separation.

You will never know the thrills of radio until you own a

# FRESHMAN MASTERPIECE

The Greatest Value ever Offered in a Radio Receiving Set

## 5 tube tuned radio frequency

embodying the 5 big features demanded in a perfect receiver.

- ☑ Built of only the finest low loss material in a beautiful mahogany cabinet (or soft-toned leatherette);
- ☑ It brings in far distant stations;
- ☑ Night after night at the same points on the dials;
- ☑ With real loudspeaker volume,
- ☑ And full throated, true to life tone.

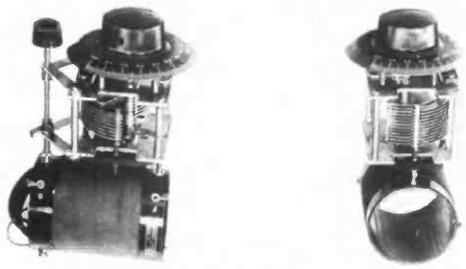
Be sure the serial number is riveted on the sub-panel. It is your protection and guarantee.

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 for the  
**BROWNING-DRAKE CIRCUIT**

The novelty and design of this receiver lies in the radio-frequency transformer and that the design is excellent is amply demonstrated by the results obtained. Remarkable amplification is obtained in the radio stage, giving the receiver extreme sensitivity and distance-getting ability.—Boston Post.

Place an order now with your dealer. If he is not yet stocked, send us his name and we will see that you are supplied. Write for Bulletin 104-RH.

**NATIONAL COMPANY, Inc.** Engineers and Manufacturers  
 110 Brookline St., Cambridge, Mass.

It is impossible from the viewpoint of the portable wave meter manufacturers. The only wave-meter which will do this is one which is permanently installed in some place with permanent surrounding conditions and is constantly checked up by means of the standard frequency signals from station WWV. I doubt if there are many broadcasting stations in the United States equipped to do this.

It is largely for this reason that we are getting so many heterodyne whistles and are having so many of our broadcast concerts utterly ruined.

Let us then demand a 15-kilocycle separation and demand from Congress authority in the Department of Commerce to adjust broadcasting stations and withhold or postpone the issuance of new licenses until we are able to have this 15-kilocycle channel. In no other way, so far as I have been able to gather suggestions from a number of people, is it possible to clear up the present terrible conditions in radio.

Unquestionably a great many of the present stations will go out of existence in time. I wish they would

stop tomorrow—if that is too soon I am willing to wait until a week from next Monday—but a great number of them should unquestionably quit not only to clear the air of its heterodynes, but also in the interests of good programs and good taste. The inefficient broadcaster has no right whatever to smear up the ether with a lot of junk merely for his own amusement and with no regard whatever for—in fact with a deliberate disregard of—the public service aspect of radio.

In Judge Davis' office in Washington, there is a large map of the United States with pins of various colors denoting certain things about different broadcasting stations. Red pins mean the Class B broadcasting stations; black pins mean stations which have given up the ghost and quit.

The most interesting part of this map is the way the black pins are clustered closely around the red pins.

This means that in the early days there were a great many small and inefficient broadcasting stations in that locality. When a Class B broad-

casting station was erected, started operation and proved to be so much better than the smaller stations, the smaller stations were forced to discontinue operation.

I think there is not a single red pin in the whole map that is not surrounded by the tomb stones of defunct and unnumbered stations. But now the red pins are so thickly scattered over the map that it is time that some other condition should arise and get many of them out of business and so clear the air further.

There is a chance that this may be done by the new high-power stations. Don't let us call them super-power as is so often done. Super-power should not refer to anything less than 50,000 watts. And our high-power stations are working on only 1500 or 2000 watts. They are high power but not super-power.

It is to be very much hoped that these high-power stations, representing a very much greater investment in money, and therefore requiring a correspondingly greater investment in time and capital to keep their programs better, will have the same effect upon the poorer type of Class B station that the Class B station had on the old station.

If this does happen, it will be the best thing in the world for you and me—providing by that time that the Department of Commerce has the authority to delay the issuance of any more licenses. This proviso is important. Without it, this clearing up of stations will do no good because, as soon as one gives up, there will be two more to take its place and the confusion will still be there.

Nobody can bring about this much desired result except the radio fans themselves. They must let their Congressmen know that they are demanding this relief from the present condition of the ether. Radio is no longer to be regarded by Congress as a hobby. It is a great public utility—rapidly becoming probably the most important form of welding the sentiment of the country together that has ever been developed. It should be regarded now principally from this viewpoint of public utility and the millions and millions of dollars invested in it must be a secondary consideration.

We do not permit great railroad companies to exercise their right of eminent domain whenever and wherever they please without regard to the convenience of the public. We do not permit street railway companies to run their tracks on every alley and side street they please. We do not permit telephone and telegraph companies to string their wires all over our properties without regard to our rights. These are public utilities and are managed for the greatest good of the greatest number.

Radio must now be looked upon in the same way. We must consider the greatest good to the vast and rapidly growing radio audience. This greatest good requires the immediate and efficient clearing of the ether. It cannot be done without giving to some one or to some department the power to withhold licenses until there is shown a definite need for the station proposed by the licensee, and also, and probably more important, until there is available or can be made available a broadcasting channel for his operation which will not conflict with other channels.

With the waning of the present season, no more important message can be left with the readers of this magazine than this one of stirring up themselves and their friends to write to their Congressmen demanding some such relief as this.



## For Clearest Reception

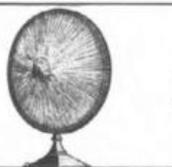
your socket  
must have  
these 3 features

- 1 **Low loss.** Laboratory tests proved that of thirteen best-known makes, Na-Ald Sockets were the *only* ones having losses lower than a good low loss condenser.
- 2 **Low capacity.** The same test showed that Na-Ald has lowest capacity of any socket. This is very important for short wave length reception.
- 3 **Positive side-scraping contact** (not just side pressure) that cleans corrosion from tube terminals. Only Na-Ald Sockets have this essential feature.

Use Na-Ald Sockets in the set you build or buy, if not already installed by the manufacturer. De Luxe, 75c; others, 35c and 50c.

Write for free booklet of tested circuits and facts about laboratory test.

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Also makers of the famous  
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Show the Formica heat  
resistant panels and  
insulating parts  
which give you the  
best.

## They have re-designed but they still use Formica!

There has been a great deal of activity in the engineering departments of the set makers since the first of the year—new models, new prices, newly simplified sets. Every conceivable substitute for Formica panels, tubes and insulating parts has been examined, tried and thoroughly tested.

But Formica is as prominent as ever in the sets that have been O.K.'d for production. For there is no substitute—nothing that combines the beauty and permanence of Formica, its strength, freedom from warping and distortion.

The makers know that Formica in their sets *never gives trouble!* And trouble is the most expensive thing the set maker can have. No small saving in material cost can make it worth while.

Last year 128 leading makers used Formica—this year the percentage will be just as high.

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Write for booklet, "What Formica Is."

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- 1 Formica is used by 128 leading makers—and has for years been used by more makers than all other materials.
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- 7 Formica panels are sold in neat craft paper envelopes which assure you that you are getting the genuine.
- 8 Formica is one of the most widely approved materials in radio.

**FORMICA**  
Made from Anhydrous Bakelite Resins  
SHEETS TUBES RODS





**D**ID you ever look the tube question square in the face? Ever stop to realize that the vacuum tube will make or break your receiving set as far as good results are concerned?

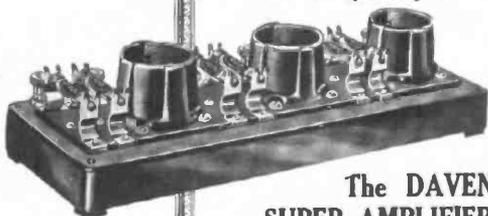
Give your set a fair chance to bring in the distant programs. Resolve now that a good set deserves good tubes and decide on MAGNATRONs. The results will pleasantly surprise you.

MAGNATRONs know no superiors. And yet the MAGNATRON DC-201A, the MAGNATRON DC-199, and the MAGNATRON DC-199 with the large base cell for only \$3 each, at your dealer's.

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# MAGNATRONs

Now that you get "distance," how about "quality"?



## The DAVEN SUPER AMPLIFIER

Obtain from your Dealer, the "RESISTOR MANUAL," our complete handbook on Resistance Coupled Amplification. Price 25c, Post-paid 35c

To the Home Set Builder the DAVEN Resistance Coupled Super Amplifier will be found the most ideal. It simplifies the construction of his receiver, which, when completed, will reproduce the broadcast concerts with a faithfulness not obtainable with any other method of amplification. Let your next amplifier be Resistance Coupled, for this is the only method of audio amplification whereby high and low tones are amplified alike, therefore distortionless.

Your Dealer can supply you with the DAVEN SUPER AMPLIFIER — Sold Everywhere.

**DAVEN RADIO CORP.**  
"Resistor Specialists"

Newark New Jersey



THE ARISTOCRAT OF AMPLIFIERS

appeal to the dealer. With a 110-volt, 60-cycle power supply, two UV201-A or eight UV199 radiotrons may be reactivated at one time. Where the frequency, however, is 25 cycles, only one UV201-A or eight UV199 radiotrons may be reactivated.

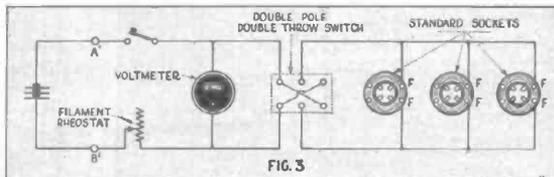
On the low side of the transformer in series with the filaments to be operated, a rheostat should be included, this rheostat to have such a resistance that with one radiotron (or with the minimum number to be reactivated at once), the applied potential may be reduced to 3.6 or 5.5 volts in the case of the UV199 or UV201-A radiotrons respectively. The desired

Model FD ..... DC  
The wire connections for direct current reactivations are shown in Fig. 2.

In the operation of reactivation equipment the following precautions should be observed:

A rheostat having sufficient resistance to adjust, to the correct reactivating voltage, the filament potential applied to one radiotron (or the minimum number to be reactivated at one time) should be set so that its maximum resistance is in the circuit.

The radiotrons to be reactivated should then be placed in their sockets.



Hook-up to change polarity when using storage battery or dry cells. This is a modification of the circuit shown in Fig. 2

number of UV199 or UV201-A sockets (only one type to be used at a time), should be connected in parallel as shown.

An Alternating Current voltmeter of good quality should be used, such as:

Model Number	Scale
G. E. Model P-8	0—7.5 Volts AC or DC
Westinghouse, Type PY-4, Style 439,135..	0—10 Volts AC or DC
Weston, Model 429	0—10 Volts AC
Roller-Smith, Type FA	0—10 Volts AC

The meter used should preferably have a full scale reading between six and ten volts. The lower the full scale value down to six volts the more preferable the instrument, because readings can be closer.

As A. C. voltmeters require considerable current, they should be left permanently in circuit in parallel with the tubes. This is necessary because if the voltmeter is only occasionally connected in circuit to take a reading the voltage is usually greatly increased when it is disconnected from the circuit.

No plate voltage should be used in connection with this reactivation process.

### Direct Current Reactivation

When no alternating current supply is available, storage batteries or dry batteries must be used, the former being preferable. For the UV201-A type three lead cells fully charged are required, while for the UV199 type two lead cells are sufficient.

Dry cells are not recommended for this purpose, but if the other sources of supply are not available, they can be employed, although they greatly increase the cost of reactivation. Use one group of four in series for each UV201-A tube to be reactivated. For UV199 tubes use three in series. One group of three dry cells is sufficient for one to three UV199 tubes. In the use of dry cells for reactivation purposes, the voltage must be watched closely as in use there is considerable voltage drop with time in this type of cell.

For Direct Current voltmeters, the following are suggested:

Model Number	Scale
G. E. Model DO	0—10 Volts DC
G. E. Model P-8	0—7.5 Volts AC or DC
Westinghouse, Type PY-4, Style 439,135..	0—10 Volts AC or DC
Weston, Models 267 or 301	0—10 Volts DC
Roller-Smith,	0—10 Volts

This will cause a voltage drop which should be carefully adjusted to the correct reactivating voltage, viz:

UV199	..... 3.6 volts
UV201-A	..... 5.5 volts

The correct reactivating voltage should be maintained as closely as possible throughout reactivation. An under-voltage will retard the speed of reactivation and an over-voltage will prevent reactivation and possibly permanently injure the radiotrons.

The voltmeter should be left continuously in circuit, as its removal causes an increase in voltage.

The tubes should be left operating at the stated voltages for a period of

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(A Transformer for Tuned Radio Frequency Amplifiers)

Placed ahead of your circuit it gives:

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Thousands of Radio Fans are already using the Toroformer. It vastly improves any Reflex or Radio Frequency set, such as Acme, Murad, De Forest, Reflex, Four, Erie Loop, Aerial Sets and sets built for a loop aerial in which a Toroformer may be used in a single stage of tuned radio frequency.

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It cuts through powerful local broadcasting and brings in distance. Yet even a child can tune this highly selective receiver, stations are always found at the same dial settings.

Descriptive circular sent on request

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### INSTRUMENT TESTED

Read the guarantee furnished with every Atlas Tube:

"This Atlas Tube has been individually instrument tested and is guaranteed to give entire satisfaction. If unsatisfactory for any reason whatever, it may be returned within a period of thirty days to the manufacturer or to the dealer from whom it was bought, provided the filament has not been burned out.

"Dealers are authorized by the manufacturer to make replacement or refund (in such cases) whichever may be desired by the customer.

Atlas Instrument-Tested Tubes are guaranteed to function efficiently in Reflex, Neutrodyne, Superheterodyne, Radio Frequency or any of the circuits which require highest efficiency in tubes.

At best dealers or direct from us. Mail orders promptly filled. **\$3.00**

**SPECIAL OFFER**—At no extra charge, we will furnish tested, instrument-tested, matched tubes in sets as follows:  
Reflex Set—3 Tubes ..... \$9.00  
Neutrodyne Set—5 Tubes ..... \$15.00  
Superheterodyne Set—3 Tubes, \$4.00  
They will get the most out of your Radio Set.

**DEALERS and JOBBERS**—There is satisfaction as well as profit in handling ATLAS TUBES, the first tubes to be sold on merchandise principles affording full protection and satisfaction to your customers.

Write or wire for proposition.



500 Carsten Building, Cleveland, Ohio  
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about two hours. They should then be removed and tested in the radio equipment. If found to give satisfactory operation at normal rated voltage (three volts for the UV199 and five volts for the UV201-A), they may be considered reactivated. If they do not show very satisfactory operation at rated voltage, they should be run for about five hours more and again retested. If, again, they are not satisfactory, the run may be carried on up to about fifteen hours. If by the end of this time, satisfactory operation has not been restored, the filaments cannot be reactivated so as to give satisfactory operation and further operation at the reactivation voltages is of no benefit because the useful life of the radiotron has been expended, either due to the fact that it has completed its normal operating life or that it has been excessively abused.

The filaments of reactivated tubes should, of course, be operated at normal-rated voltage when used for radio purposes after reactivation.

Tests on a considerable number of tubes returned from users, showing loss of emission, have demonstrated that about one-third of them could be fully reactivated by the above procedure.

### Bird's-Eye View of the "Low-Loss" Idea

By SYLVAN HARRIS

IF ONE were to tell you, my reader, that a man went out and paid fifty dollars for a pair of shoes, what would you think? There might be three answers to this question: either the man was crazy, or he was very extravagant, or the narrator of the story was a fabricator. Assuming that the narrator was telling the truth and that the man was perfectly

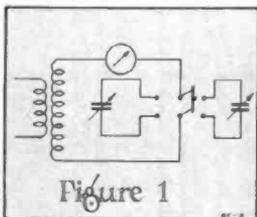


Fig. 1—Showing variation of resistance with setting of condenser plates

further, can you, dear reader, imagine a multi-millionaire joining a Christmas Saving Fund? Or, would he sane, the only answer would be that the man is very extravagant.

But, upon learning that the purchaser of the shoes was a multi-millionaire, the idea of extravagance dwindles, for a mere fifty dollars means nothing to him.

To carry the illustration a little further, to invest a small amount of money in something that would bring him an income of five dollars a week, the five dollars a week would be a negligible quantity to the rich man, whereas it may amount to considerable to the ordinary workman.

Then, again, consider the man in moderate circumstances who will walk a mile to buy a pack of cigarettes because he can get them a cent or two less, while at the same time he squanders his money on questionable stocks or other risky speculations.

But what has this to do with the idea of "low-loss" in radio? Just this, that things look entirely different when viewed from different points of view, and with regard to this "low-loss" idea the radio fan has not, yet learned the proper point of view, nor has he learned how much impor-

The **Low Loss** Supercoils Fully Adjustable for all Circuits

Three-circuit tuner is shown above. The last word in Low-Loss Coil constructed for Superdyne, Neutrodyne, Harkness, Roberts' Reflex, and for all other circuits. Write for details.

Basket weave windings—large wire—duplex insulated. Minimum of dielectric—each coil fully adjustable—180° tickler. Extreme volume—distance—selectivity. The Three-Circuit Tuner is endorsed by H. M. Neely—The Non-radiating Coil—The "Beginner's Best Set."

Send \$1.00 for full-sized blue prints, for 18" panel and baseboard, lay-out and complete instructions for building the ideal three-tube set.

Jobbers and Dealers Write for Open Territories

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**\$7.** At Your Dealer, or Direct plus p. p. C. O. D

## Unlike Any Other Tuner You Ever Saw!

It clears up muffled, fuzzy signals and separates conflicting stations in a way you will never fully realize till you prove it in your own set. It permits complete control of the antenna circuit over the entire B. C. range, cutting down antenna losses, strengthening reception and doing away with all tapped coils and high-loss aerial tuners.

**L+K Variable Clarifying Selector**  
(Pat. Appl. For)

**Improves All Standard Circuits**

No matter what your set is, it can be improved with this Variable Clarifying Selector. And it is especially recommended for use with the L+K VT25 Variotransformer. The Selector is \$7.00; the VT25 is \$8.50, at your dealer's.

**Send for FREE DIAGRAM Spread**

It shows the complete L+K line of technically accurate tuning devices, layout of the Super-Selector (the Improved Greene Concert Selector) and other standard hook-ups.

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Dept. R, 511 Chapel Street, New Haven, Conn.

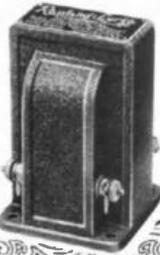
**LANGBEIN+KAUFMAN** L+K  
High Grade "Low Loss" Tuning Devices  
A Guide to TECHNICAL ACCURACY

## Rauland-Lyric

AN ALL-AMERICAN TRANSFORMER

*"Bringing the artist to your home" is a reality when Rauland-Lyrics are used in the audio amplifying stages of your radio receiver. No other device makes possible such faithful reproduction*

Rauland-Lyric is a laboratory grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. Rauland Mfg. Co., 3635 Coyne St., Chicago



*The Choice of Noted Music Critics*

tance should be assigned to some things and how much should be assigned to others. In other words, he has not acquired a "sense of proportion" in connection with the "low-loss" idea.

A difference of a tenth of an ohm more or less in the resistance of a tuned circuit, consisting of a coil and a condenser, which has a total resistance of, say, 30 ohms, means no more with regard to the low-loss idea than the fifty dollars did to the multi-millionaire. Why? Because a tenth of an ohm out of 30 ohms represents only one-third of one per cent of the total circuit resistance.

But when this same tenth of an ohm, more or less, is considered in a "low-loss" circuit which has a total resistance of, say, 5 ohms, it now represents 2 per cent of the total circuit resistance. In the first case the one-tenth of an ohm change in the circuit resistance was hardly appreciable, but in the latter case it was not so.

The moral to be learned from this lesson is that we should not be "penny wise and dollar foolish" about this "low-loss" idea. Nothing is gained by trying to reduce the losses in a condenser when the resistance of the condenser in the first place was small compared with the resistance of the coil used with it.

Thus, suppose a condenser having a resistance of 0.5 ohm is used with a coil having a resistance of 30 ohms. It is true that if the resistance of the condenser is lowered 0.1 ohm, it will represent a reduction of 20 per cent of the resistance of the condenser. But it will only represent

$$\frac{0.1}{30.1} \times 100 = \frac{1}{3}\%$$

of the resistance of the coil and condenser connected together.

The resistances of nearly all the different makes of variable and fixed condensers on the market were lately measured, and were found to vary from 0.5 ohm to 1.5 ohm. Having an

## New CARTER LOOP AERIAL



**CARTER LOOP AERIAL \$15**

Greater Volume, Distance and much greater Selectivity, Carter Compound Pentagon Winding.

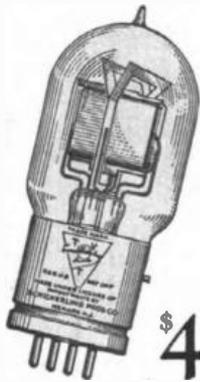
Here is a loop 18 inches in diameter that gives better results than any on the market. The elimination of the frame, the compound Pentagon winding gives efficiency never before. Try it yourself.

Write for folder. Order from your jobber.

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1817 REPUBLIC BUILDING  
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## The Newest Schicklerling Tube!



A standard base  
5 volt tube consuming but  
16/100 amperes!

THINK of it! A big huaky tube with the equal volume and sensitivity of the quarter ampere tube, yet consuming only 16/100 ampere filament current!

This combined Detector, Oscillator, Amplifier tube is the true economy tube for multi-tube sets. Imagine—a 5 tube set equipped with these new Schicklerling tubes will consume only 8/10 of an ampere as against 1 1/4 amps using the usual 1/2 ampere tubes.

Can be used in all sets now using 1/2 amp. tubes, with absolutely no changes necessary. Call at any authorized Schicklerling dealer—at our factory—or at any of our branches and listen to an actual demonstration. It's the most convincing test.

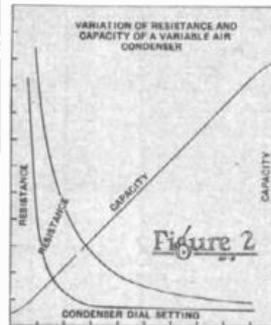
Sold with a written 10 day guarantee  
**SCHICKLERLING PRODUCTS CORP.**

Executive Offices and Factory  
41-407 Mulberry St., Newark, N. J.  
New York Sales Office  
Knickerbocker Bldg., Broadway at 42nd Street  
Jewellers Bldg., 56 West 47th Street  
Havenmeyer Bldg., Cortlandt at Church Street  
Philadelphia Sales Office  
Jefferson Bldg., 1015 Chestnut St.  
Chicago Sales Office  
230 South State Street

Address all correspondence and mail orders to executive office and factory at Newark or to our nearest branch office.

**SCHICKLERLING RADIO TUBES**  
1000 1/2 Schicklerling Triangle Plant

Sold only by authorized Schicklerling dealers



average resistance of slightly less than an ohm. These condensers included all types, with metal end-plates, end-plates of insulating material, inclosed and open. Used with a high resistance coil, it is very doubtful if any radio fan can detect any difference in the operation of his receiver, when changing from a half ohm condenser to a one ohm condenser, without exercising his imagination considerably.

Many may think that they have detected the difference in their own sets, and many assert that the difference is like day unto night. But it will generally be found that other things in the circuit were changed at the same time the condensers were changed.

For instance, it is not fair to make any comparison between two condensers unless they are set at the same dial setting. This is because the resistance of a condenser changes with the setting of the plates. Suppose a 0.001 microfarad condenser

(Continued on Page 46)

## Apex Super 5

This highly efficient tuned radio frequency converter is the most advanced in design and construction. It is an instrument that meets every critical requirement of the connoisseur radio enthusiast.

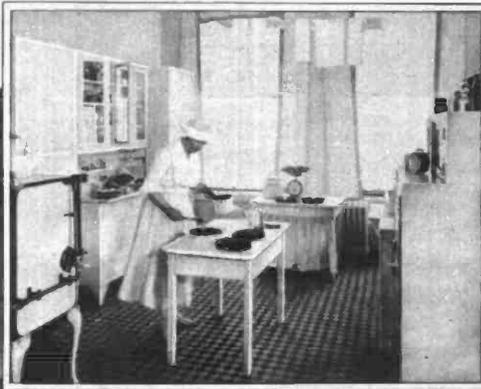
Buy the Apex Super 5. You will have a radio receiver that brings in distant stations clear and distinct. Select the station you desire in your logarithmic dial to that condenser. Vary the tuning capacitor until there you see—perfect reception. No greater selectivity can be had than is easily obtained with the Apex Super Five.

Housed in a highly finished walnut cabinet, complete with Car Jones Multi-tube Battery and all settings highly gold plated. Sells for \$95 complete—excepting accessories.

At All Good Dealers  
Apex Elec. Mfg. Co.  
1410 W. 90th St.  
Dook, Ill.  
Chicago

on the dot





Miss Olive Stiles Allen in her "skyscraper kitchen" making some of the chocolate layer cake like "mother used to make"

# From Dollars to Doughnuts

By GOLDA M. GOLDMAN

ARE you one of those who compose what Mr. Horace K. Hutchens, of the American Bond and Surety Company, calls "the substantial and reliable element" of the radio audience, or are you one of those who always claims the T. B. M.'s right to be constantly amused in the evenings?

If you are one of the latter, and always tune out immediately upon hearing a human voice speaking instead of singing, usually without even waiting to find out what all the talking is about, you have never had the pleasure of meeting Mr. Hutchens or of getting any of the excellent advice which he puts on the air. You have also missed a number of other regular features which might easily solve some of those problems which keep you awake at night and dull during the day. The features come from the National Surety Company, the Bank of America, the Metropolitan life, and a dozen other established corporations—and if you are the guiding spirit of a home, we must remind you of the cooking talks broadcast by Miss Olive Allen for Procter & Gamble, the makers of Crisco, Ivory Soap, etc.

For the privilege of giving you these talks, the above-mentioned firms engage the facilities of WEA F and its affiliated stations at stated intervals. They pay the expenses and they divide the resultant benefits with you fifty-fifty; they get the incidental advertising and what business that may bring and you get the full advantage of the talk.

A survey of these results indicates the fact that this "substantial and reliable element" who recognizes the knock of opportunity when it sounds in the earphones is far larger than might be expected, and it shows also that the talks must be extremely valuable to cause such an enormous response from these listeners-in. Let me tell you, therefore, about two

widely different instances of what you are missing if you are confining your attention to jazz orchestras and motion-picture symphonies. It is a far cry from first mortgages to Christmas fruit cake, but if you haven't something similar to the former you are apt to have to do without the latter—you will find on the air a man to tell you how to obtain the "filthy lucre" and a woman to tell you how to make the cake.

Mr. Hutchens does not look much like a wizard as he sits at a very prosaic office desk on the second floor of the American Bond and Mortgage Company, yet once a month for ten minutes he tells you how you may lift yourself out of the class of those who must worry perpetually because of the difficulty of making both ends meet into the enviable society of those for whom the future holds no terrors, but rather the assurance of comfortable age and untroubled home life. This is very modern magic. It lacks, perhaps, the ancient color and mystery of alchemy and transformations; it smacks, undoubtedly, very much of the things of this world—of dollars and cents, of budgets and

bank balances—but it does not disappear when the fumes evaporate or the alarm clock goes off.

A thoroughly alert man, this Horace Hutchens, with the sincerity of the business man well sold on his own commodity, which in this instance happens to be safe investments. He thinks it is a good thing that you can't see him when he talks over the radio, because he is not old, or dignified, but youngish and full of fun. Since "money to be invested is a serious thing," as he says, he never tells you any of his humorous stories over the radio, for fear you will think him a charlatan. Instead, he sticks very close to his subject, whether it be "Fortune Building," "Will Your Ship Come In?" "What Makes a Good Investment," "Estate Building," "How to Have Five Thousand Dollars" or "Building Good Citizens."

About two years ago Mrs. Clara I. Judson came on from the Middle West and talked from WEA F on budgets. Mr. Hutchens accompanied her to the studio and was impressed by the wonderful force which could be put to work. As he was consid-



Horace K. Hutchens, of the American Bond and Surety Company

## 100% Tone



### Magic Radio Clearness

with this new-principle  
horn—this Kellogg  
Symphony Reproducer.

This offers a new conception of radio clearness—a recent scientific advance in radio reproduction. It "brings in" the marvels of the air exactly as they were broadcast. With an absolute fidelity of tone that will delight you.

This new way is the Kellogg Symphony Reproducer — now made in quantity production to sell at prices within the reach of every radio owner. It is made by the 28-year-old Kellogg Switchboard & Supply Co., leading specialists in the reproduction of sound. The acoustical engineers of this company worked for years on the problem of clarifying radio reproduction before they finally perfected the Symphony.

The shape and contour—the composition of the horn itself, is one of the principal features. But the theory and design of this "unit" is the secret of its wonderful success.

This "unit" is unlike anything ever offered before for radio. The magnetic feature gives it watchlike precision. The improved results are noticeable instantly to any who hear it.

**Hear It Today**

Today, hear the Kellogg Symphony. Do not buy any lesser horn until you have heard it. It will increase the value of your set 100% in musical quality—in pleasure to your family and yourself. Any dealer will gladly demonstrate the Symphony for you. Hear it—today!

**KELLOGG SWITCHBOARD  
& SUPPLY CO.**

Chicago, Ill.

**KELLOGG**  
Symphony  
Reproducer



**This Is Not a Kit**

All American Semi-Finished Receivers are not to be confused with kits, knocked-down sets, etc. While the All-American sets come to you without cabinet or wiring, they are *completely* mounted at the factory, and there is no labor of selecting the right set, getting it in just the right place, etc. You do not need to understand circuits or blueprints. You



need not know or try to learn the names of the parts. Just one delightful evening of wiring your set like the photographs, and you have a set which could not be approached at the price if sold in a cabinet.

**All-Amaz Junior**  
A one-tube set that brings in the locals to the loud speaker. With wonderfully clear tone quality, or tunes them out and gets real distance. Non-radiating. Price \$28.50

**Now You Can Afford — a modern precision-made set which "cuts through"**

(Tuned radio frequency for distance and selectivity, reflex for economy, the unequalled loudspeaker tone quality and volume which comes with ALL-AMERICAN precision manufacture — all are present in this non-radiating three-tube receiver. (And, owing to the economy of "wiring it yourself," ALL-AMAZ SENIOR costs less than a finished one-tube set of equally high quality. Price \$42.

The RADIO KEY BOOK is a radio education in itself. Send ten cents, coin or stamps, for your copy!

**ALL-AMERICAN RADIO CORP.**  
PIONEERS IN THE INDUSTRY  
2666 Coyne Street Chicago

**ALL-AMERICAN**

Charges both A and B Batteries



Price \$18.50  
complete with cord, battery leads and clips

**The Charger with Ten Points of Superiority**

When you buy a battery charger, ask for the Valley and you will be sure of these ten points of superiority:

1. No bulbs.
2. No liquids.
3. Quiet in operation.
4. Cannot harm your battery.
5. Efficient. Takes about a dime's worth of current for a full charge.
6. Correct 6-ampere charging rate enables you to recharge your battery overnight.
7. Ammeter mounted flush with panel shows if battery is receiving charge and if charging rate is correct.
8. Listed as standard by Underwriters' Laboratories.
9. Has only two wearing parts, the contacts, which can be replaced easily and cheaply. Average life of these contacts is about two years.
10. Built in handsome black case with grained and engraved Bakelite panel and clear glass top which shows simple, patented working parts. Harmonizes with the finest receiving set.

The Valley is the only charger needed for all radio batteries: 6-volt A batteries; one, two, three or four 24-volt B batteries; and 2-volt batteries. Also 6- and 12-volt automobile batteries.

Mfd. by VALLEY ELECTRIC COMPANY, St. Louis, Mo.

**Valley Battery Chargers**

ering its possibilities, Mr. Smith, one of the account executives of WEAF, came to talk to him, with the result that for two years now this monthly talk has been a regular feature. Usually Mr. Hutchens himself makes it; sometimes one of the district managers talks by means of a tie-up from a station in the city where his office is located.

"The basis of selling bonds," says Mr. Hutchens, "is confidence, and this confidence cannot be obtained without personality. Radio provides the contact by which that personality can be felt as no other advertising medium does. Selling must be done on an emotional basis.

Mr. Hutchens thinks that his subject is, among the most romantic in the world, for, he says, "One of the greatest romances in the world is the accumulation of money." Here he called to his secretary to bring him a clipping from a recent newspaper reporting that a piece of land purchase for \$87 in Manhattan Island in 1658 had just been sold for more than two million dollars. While I was still gasping he hurled at me the fact that that same \$87 invested in 6 per cent bonds in the same length of time would have been ninety-seven millions!

Mr. Hutchens has found that the indirectness of radio publicity does not make it a poor medium, but heightens its value. "The less I try to sell first mortgage real estate bonds, and just talk sense, the more I sell," he insists.

If you are interested in the talk of the evening, you may, of course, write to the speaker, asking any questions you wish, and you will be answered either directly or by means of a related pamphlet. All letters, either of inquiry or of appreciation for advice or inspiration, are acknowledged, and are followed up by salesmen, for a very live list is obtained in this way. A man or a woman who is interested in a talk on how to live within your income, or what it costs to send a child to college, is a person who will be interested in sound investments sooner or later, so here is where the American Bond and Mortgage Company gets its direct returns. This list, of course, runs into the thousands, and about 60 per cent of these people eventually invest.

Mr. Hutchens has the good fortune to have done a number of different things in his life-time, so that he knows the needs and problems of various communities and types of persons. He comes from a small country town, Pulaski, in New York. He went to Union College in Schenectady, and then came to New York City to be a writer. He even went off into the North Woods to give the chusks a chance, and wrote some fiction there, but gave it up to go into the navy during the war. Both before and after that he had advertising experience with a variety of firms, such as Hampton's Magazine, and the McCall Company. He was assistant to the manager of the Photographic History of the Civil War, published by the Review of Reviews Company, and editor of the Dry Goods Guide. It is interesting to note that in doing advertising work he constantly sold himself, being offered one position after another by the firms with which he came in contact. For instance, in selling an advertising account, he was offered a position as advertising manager, and was taken away from that place in the same way, only to have the experience repeated with his present firm.

So there you have him—alert, widely experienced, thoroughly sincere, entirely dependable—and to let him finish his own story, "I live in New Rochelle and like to raise roses and shoot a lot of bull!" And play, incidentally, with the most beautiful

four-year-old daughter in Westchester County.

And now let me introduce to you another person—you've had the dollars, now for the doughnuts.

Miss Olive Allen looks like a witch as little as Mr. Hutchens looks like a wizard, yet her magic is quite as potent as his. Just as he takes the kinks out of your pocketbook, so does she spread cheer through your home—and so, instead of a witch, she should properly be called the best kind of a household fairy, as indeed she is, with her sweet face, soft voice, and gift of turning out goodies that would cause the best-intentioned person in the world to desert a diet.

You will find her in a sunny white kitchen, perched, of all places, on the fifteenth floor of a New York skyscraper—the Wurlitzer Building, in Forty-second Street. This is the test kitchen in which the Blackman Company, an advertising agency, test out the household products of the companies whose advertising they handle.

Miss Allen is a busy person. On my first visit to her kitchen, she was ironing a buffet scarf which she had just washed with one of the soap products advertised by the Blackman Company. The second time she was taking a cake out of the oven. She investigates dyes, cans by the oven method—but if I'm going to tell you about her I had better begin at the beginning.

The best cooks in the United States come from Dixie and New England—at least, with all the boasting that New York and Chicago and Los Angeles do. I never heard them talk very loudly about their fried chicken or brown bread or oysters. Miss



**For Greater Distance, Volume and Clarity Use X-L VARIO DENUSERS**

Endorsed and Used by the Foremost Radio Engineers of the Country  
Model "N", capacity range 1.8 to 20 3200 is used in the Browning vacuum circuit in this issue. For Roberts two tube, Neutrodyne, tuned radio frequency circuits, etc. Price \$1.00  
Model "G", capacity range 00016 to .00050 MUF. For Superheterodyne filter and intermediate frequency balance and positive grid bias in all sets. Complete with grid lock wire and clips. Price \$1.50.

**X-L RADIO LABORATORIES**  
2484-26 Lincoln Ave. Chicago  
If your dealer cannot supply you write direct



**NO MORE "B" BATTERIES!**

**Make Your Own B Current Supply Unit**

from parts which I furnish and use your electric light current at a cost of less than \$2.00 per year. Unit is easy to assemble, requires no skill or special tools. Full instructions are furnished with kit of parts.

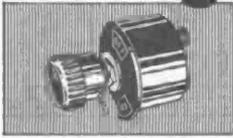
Price for all essential parts, \$18.50.

Send for free hook-up.

**C. E. JACOBS, Mfr.**  
2806 N. Kedzie Ave., Chicago

Dealers' Inquiries Solicited

When the phone rings



**Snap — AND ALL IS SILENT Snap again — AND THE PROGRAM CONTINUES — without retuning**

No modern set lacks the convenience of a MAR-CO filament battery throw switch. Its definite on and off positions make it far superior to any pull switch. Saves tubes and batteries—you don't forget to turn them off! Saves annoying interruptions when you only want to stop reception for a minute!

Make your set convenient with a **MAR-CO**

ON AND OFF BATTERY SWITCH **\$1.00**

**BRACH AERIAL ANTENNA** brings the world to your home

A fitting companion to every good radio set is the Brach Complete Aerial Outfit.

All essential parts, including the famous Brach Vacuum Arrestor, in one package. Each part of highest grade, selected by experienced radio engineers, and meeting the requirements of the National Board of Fire Underwriters.

Full instructions for easy installation with each outfit.

FEATURING LEADING RADIO DEALERS

**L.S. BRACH MFG. CO., NEWARK, N.J.**

**THE Antennaphone** INCREASES SELECTIVITY IMPROVES RECEPTION

REPLACES THE AERIAL NO LOOP NO AERIAL

Complete with wires Easy to install

The Antennaphone is not attached to but merely placed under the telephone. Sold with a money-back guarantee.

At your dealer or sent by mail upon receipt of

**ANTENNAPHONE COMPANY** 90 West St., New York City, N.Y.

Allen comes from Connecticut, which automatically puts her in the right class, and she has spent most of her life in Massachusetts. She began her career by doing catering for schools and colleges; then she went into the same work with hotels, but during the war, canteen work attracted her and she was put in charge of the headquarters of the National League for Women's Service. Many are the stories told of the boys who were taken out on parties from the hospitals, and who, when asked where they would like to eat, said they would just as soon return to the hospital if they couldn't have one of Miss Allen's dinners.

The war over, she looked for work that would put her in touch with real business people. She found an ad in the paper which she thought required some kind of welfare work, so she answered it. In reality it was a carrying-on of the Blackman Company's unique test-kitchen policy in regard to their food accounts.

She was made mistress of one of the cheeriest spots in the building—the southwest corner of the fifteenth floor, and was given carte blanche to order what she thought she needed.

That was three years ago. Today, in a modern kitchen, Miss Allen tests Crisco and its competitive products, makes new recipes, plans menus, instructs you in methods of cooking and of making the home attractive, and gives the instruction both by means of the printed page and via the radio through station WEA.F.

All education must have a definite aim. Miss Allen is, of course, interested in proving the value of one definite food product, but she has a far bigger goal than that. She wants to prove that housework is not mere drudgery.

"People 'eat with their eyes' in cafeterias and restaurants," she said as we chatted over a cup of tea, supplemented by one of her delicious cakes. "If the food does not look good to you, you will not eat it. The same fact is true in a home. Appetite is stimulated by attractive appearance. If the housewife has grown so tired of her task that she just throws things together any old way, and fails to make them look well on the table, her husband and children are not appealed to, and so do not eat well."

"Cooking is an art, and America is the last country to make it so. Italy was the first country to appreciate that fact. Then Catherine de Medici took her cooks into France, and soon the French cooks surpassed the Italian. In those days even kings did their own cooking, partly through fear of being poisoned and partly through pride in the accomplishment. The women of America look upon cooking only as drudgery, yet in the American courts it has been proved that cooking is an art."

It is all of these points that Miss Allen has in mind when she makes her radio talks from WEA.F. They are carefully written, each one being devoted to a single phase of cookery, so as to focus attention. For instance, there is her "Bread Talk," her "Apple Talk and Apple Recipes," her "Christmas Dainties," her "Thanksgiving Specialties," and a dozen more. Each talk consists of an informal little chat on the art of cooking, with possibly an historical background for the subject under discussion. Then comes a slowly given recipe of such delectable titles as "Christmas Snow Balls," "America's Favorite Cake," "Dutch Bread" or "Jolly Boys." If you like these you may write to Miss Allen and request a copy of her talk, and you will receive a most attractive folder containing not only the radio material but a great number of additional recipes for the same type of cookery.

Miss Allen's work does not stop

## Greater distance for any set — with a Brandes!

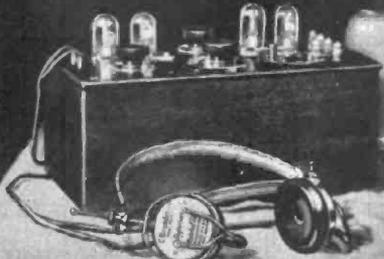
A headset adds just about thirty per cent to the distance that any receiving set can get

It means not only greater distance—but keener clarity of tone

It means listening in without disturbing others—and without being disturbed

It means getting the best out of your set—whether it be large or small

Buy the receiver that's equipped with a Brandes



# Brandes

The name to know in Radio

For Testing "B" Batteries



It Tells The Truth

**NOT** Too Little Resistance to Overdrain the Batteries. **NOT** Too Much Resistance to Give a Meaningless High Reading.

The No. 34 Sterling Pocket Voltmeter tells you whether your new dry "B" Battery is full of energy or shellworn; whether your dry or storage "B" Batteries have the voltage required for your set. Thus you often locate your trouble instantly and save exasperating searches for the trouble where it is not. It tells you when to recharge Wet "B" Batteries and when to discard the Dry. Tells at times that the "static" is right in your set. It has just the "right resistance."

It does not overdrain the battery because of having too little resistance nor yet give a meaningless high reading due to too much resistance. It tells the actual ability of the battery to function under working conditions.

Price (0-50 scale, 1 volt division), \$2.50.

Also, No. 35 voltmeter for measuring voltage of five 22½ or two 45 volt battery units. Price 0-120 volt scale, 5 volt divisions. Price \$3.50.

Ammeters, voltmeters and potentiometers of all types.

**THE STERLING MFG. CO.**  
2831-53 Prospect Ave., Cleveland, Ohio. Dept. K.

# Sterling

POCKET VOLTMETER

### DURHAM Grid Leaks

Used by Eagle, Howard, Thompson, Zenith and others. Fit all sets. Sold on guarantee.

**50¢** Metalized Flood Leads  
18 sizes under 1/4 meg., 75¢ over 1/4 meg., 50¢.

**75¢** Glass Sealed Variable Leaks  
3 sizes fit all sets; 75¢ each for 1/10, and 10 meg.

At dealers or postpaid

**DURHAM & COMPANY, Inc.**  
1936 Market Street - Philadelphia, Pa.

## KARNOON

TRADE MARK

### READY-WIRED UNITS

for all of the favorite circuits.  
Detector unit. Detector and one step.  
Detector and two steps.  
Two-step amplifier.

Five tubes for any hook-up.

**KARNOON PRODUCTS CO.**  
451 Greenwich St., New York City  
Philadelphia Office, 606 Chestnut St.

## E B Y

### BINDING POSTS

Twenty-five They Don't  
Different Look  
Engraved Tops Their Heads

At dealers everywhere  
**H. H. EBY MFG. CO.**  
Philadelphia

### Make 100 Weekly-sell RADIO

Demonstrate Cases - Remake Menus Serve Sals

Costs least, lowest prices, attractive four-tube instrument \$39.50, the commission to you. Exclusive territory in your neighborhood. Free literature, color leaflets, radio books for agents. Immediate bank No. 108. Don't fail to name your county.

**OZARKA, Inc.**  
600 West 10th Street, St. Louis, Mo.

### 60 FT. Aerial Mast \$45

50 Ft. Mast, \$10  
60 Ft. Mast, \$25

We Pay Freight

All masts complete with guy wires and mast base. Can be put up by concrete base in the foundation. Write at once for literature and large FREE technical blueprint.

**S. W. HULL & CO. Dept. J-3**  
3046 E. 79th Street, Cleveland, Ohio

## ZENITH RADIO

Tunes straight through the locals, gets distances. Brings in more stations—clearly and with volume—in a given length of time than any other set. Direct comparisons invited. Zenith receiving sets cost more, but they do more. —The exclusive choice of MacMillan for his North Polar Expedition.

**Zenith Radio Corporation**  
333 S. Michigan Avenue, Chicago

with this. She also writes all the Cricco advertising matter now appearing in the leading periodicals. When she started in the "Skyscraper Kitchen" three years ago she knew nothing of advertising, had never done any writing, and did not know that she could explain to others—that is, that she could teach. Yet if you will look up one of her pages in the Ladies' Home Journal or Pictorial Review, you will find not only the recipes which she has perfected, menus which she has prepared, and attractive reading material, but you will find some one process explained, step by step and detail by detail, with the assistance of colored sketches carried out by Blackman's Art Department. Incidentally the goodies depicted there will make your mouth water, whether your pet weakness happens to be chicken patties, candied sweets or chocolate cake.

I think that Mr. Livingston, of the marketing department of the same company, very aptly summed up Miss Allen's work when he said of it:

"This work is just as much an education as going to the public schools. Miss Allen is giving something really constructive. Radio has many possibilities, and every one is not attracted by the same thing. There is, however, some interest for every person, and she has found the right interest for a great mass of women. Radio reaches another cross-section of the great American public. The fact that these talks are so interestingly introduced takes away the encyclopedia feeling from the instruction which she is giving, and so the talks are eagerly assimilated and real work is accomplished."

As many as eleven hundred letters have been received in answer to one of these talks. Sometimes the requests for folders come weeks after the talk has been given, which is the result of "back-fence advertising"; that is, one woman sends for the recipes, tries them out, likes them, and tells her neighbors about them. And again we answer the question: "Is advertising of this sort worth while?"

Miss Allen also believes in keeping one's self human by having a hobby. Mr. Hutchens raises roses; she plays the harp, and she has, by the way, one of the most beautiful instruments in the country. Her early ambition was to be a musician, but probably it is her artistic sense carried over that has enabled her to see the beauty of tasks which seem sordid to so many million other women.

So here you have a little introduction to some of the modern magicians of the microphone. Let Mr. Hutchens pad your bankroll and Miss Allen glorify your housework, and don't tune out next time you hear the sound of some one talking.

### Bird's-Eye View of the "Low-Loss" Idea

(Continued From Page 43)

is being compared with a 0.0005 condenser. This is generally done by connecting the two condensers to a double-pole, double-throw switch, listening to a certain signal, or setting an oscillator going at a given wave length, and comparing the volume of sound in the earphone or the deflections of the current measuring device. This is illustrated in Fig. 1.

If both of the condensers are resonated to the same wave length it is evident that the 0.001 condenser must have its plates considerably out of mesh, while the 0.0005 condenser will have them considerably in mesh. As a result the 0.001 condenser may show up the poorer even though it may be the better condenser. This is because the resistance rises rapidly

at the low dial settings, as shown in Fig. 2.

Fig. 2 also brings out a very important idea which has heretofore been entirely neglected, and which may cause considerable surprise to many. This is, that a condenser, to be used efficiently, should not be used at the very low dial settings. Fig. 2 shows the resistance of one condenser to begin to increase very rapidly at about 25 on the dial. This curve is characteristic of all variable condensers, though the position of the bend of the curve may vary somewhat. At any rate, since the condenser should not be used at the low dial settings, why worry about what the minimum capacity might be?

There has been a great deal of fuss over this idea of low-minimum capacity of condensers, and it seems that nearly all the manufacturers have been trying to outdo one another in obtaining the lowest minimum. In fact, the whole thing has been almost ridiculous. For instance, one advertiser has it that the minimum capacity of his condenser is 2.16 microfarads. Any one who has ever attempted to measure the capacity of a condenser at radio frequencies will at once recognize that the 2.16 microfarad does not mean anything. In fact, to make such a statement implies that the person who made the measurement can determine the capacity of the condenser as close as one-thirtieth (0.01) of a microfarad.

As a matter of fact, it is extremely difficult to approach such precision, even at low frequencies with the most precise instruments. The average radio engineer does not make such measurements at low frequencies, but makes them at radio frequencies, under which conditions a precision of about 1 microfarad is generally all that can be attained.

It is not necessary to go further into this, however. It has been shown that, since the resistance of a condenser may be very high at the low dial settings, and consequently, that the condenser cannot be used efficiently at these settings, we may just as well forget about the minimum capacity, assuming, of course, that it is not abnormally high.

Some one may raise the question, "How will it be possible to tune to the low wave lengths if the minimum capacity of the condenser is not low?" It is a sad fact, but a true one, that many have forgotten that the inductance of the coil in the tuning circuit determines the wave length of the circuit as well as the condenser. The wave length is determined by the product of the inductance and capacity. So, if the condenser will not tune low enough, the inductance can be cut down by making the coil of fewer turns.

To avoid using the condenser at the low dial settings, then, it is required that the proportion of capacity to inductance in the tuned circuit be such that the whole wave length range can be covered between 100 on the condenser dial and, say, 20. The reduction in the size of the coil at the same time reduces the resistance of the circuit considerably. Also, since a larger condenser must be used, and these have generally slightly lower resistance than smaller ones, a small gain is also obtained in this respect.

Such a combination can be secured by using a 0.001 microfarad condenser. At 20 on the dial this condenser will have a capacity of, roughly, 0.0001 microfarad. If a 100 microhenry coil be used with this condenser, the wave length range of the combination will be, roughly, 600 to 190 meters between 100 and 20 on the condenser dial. The whole range is, therefore, covered without going to the very low dial settings. A coil like this can be made of about 25 turns of ordinary bell wire, closely wound, on a 3/4-inch tube. If this coil is used

as a secondary, and has a primary coil coupled to it, more turns, of course, will be required. A regenerative receiver employing these principles of design was described in the last issue of *Radio in the Home*. The advantages of such design are explained in that article.

As to the proper proportion of coil and condenser to use in a tuning circuit, more will be said later. For the present it is advised that the radio fan experiment along these lines himself. He will find much to surprise him. The thing that will surprise him mostly is, perhaps, the fact that condensers with end-plates of "molded mud" will give as satisfactory results as those with end-plates of metal, and also that coils built like this will be truly "low-loss" coils in spite of the heavy insulation and the bakelite or cardboard tubing.

The secret of the low coil resistance lies in the fact that the thick insulation furnishes considerable spacing between the turns, thereby reducing the skin-effect in the coil. This will be explained in detail in a subsequent article. The reduction of the skin-effect far overbalances the added losses due to the insulating material and the coil capacity. The idea is that in this design the more serious causes of losses are tackled first. In a single-layer coil the effect of coil capacity is negligible compared with the skin-effect and the losses in the insulation are likewise small.

(To be continued)

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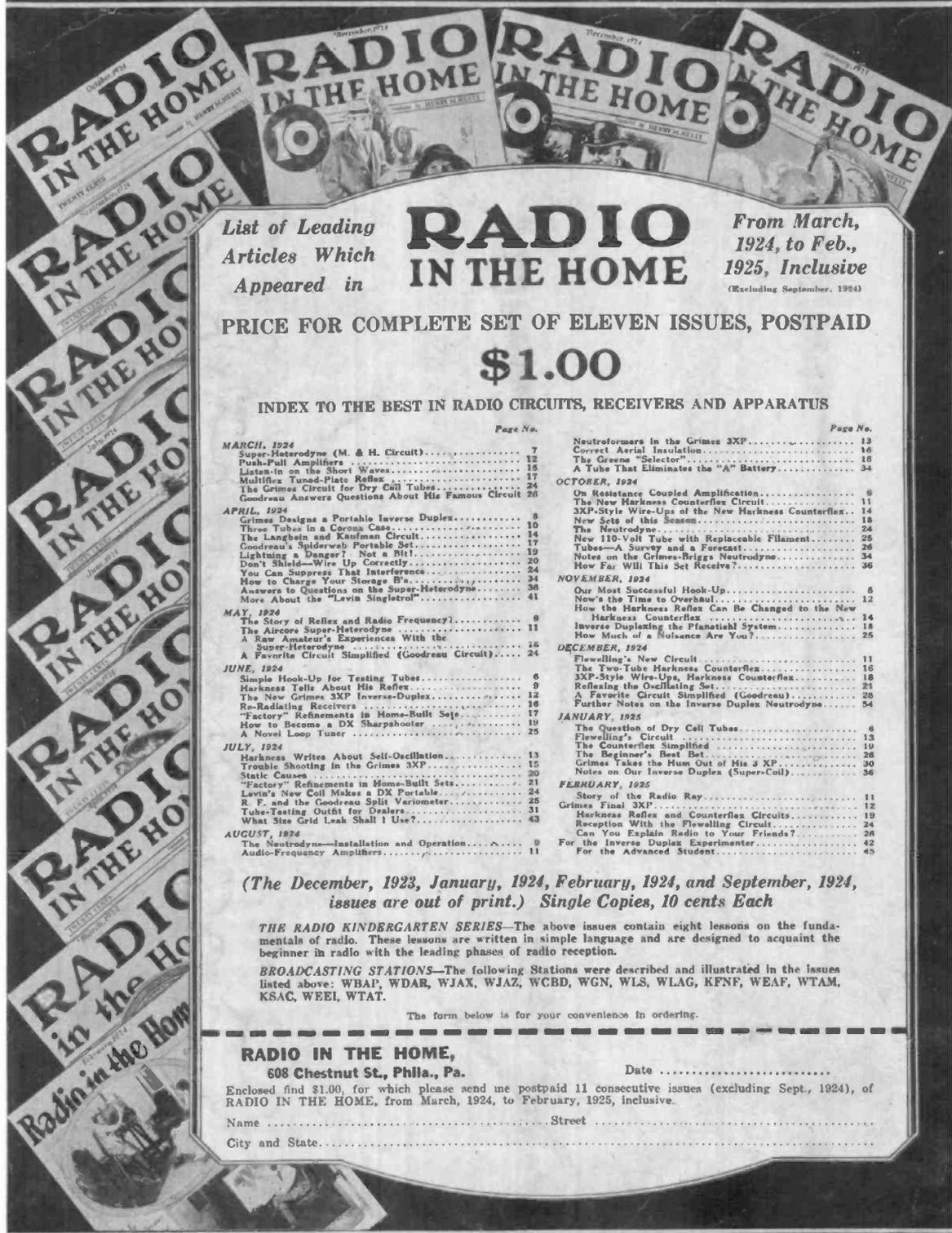
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