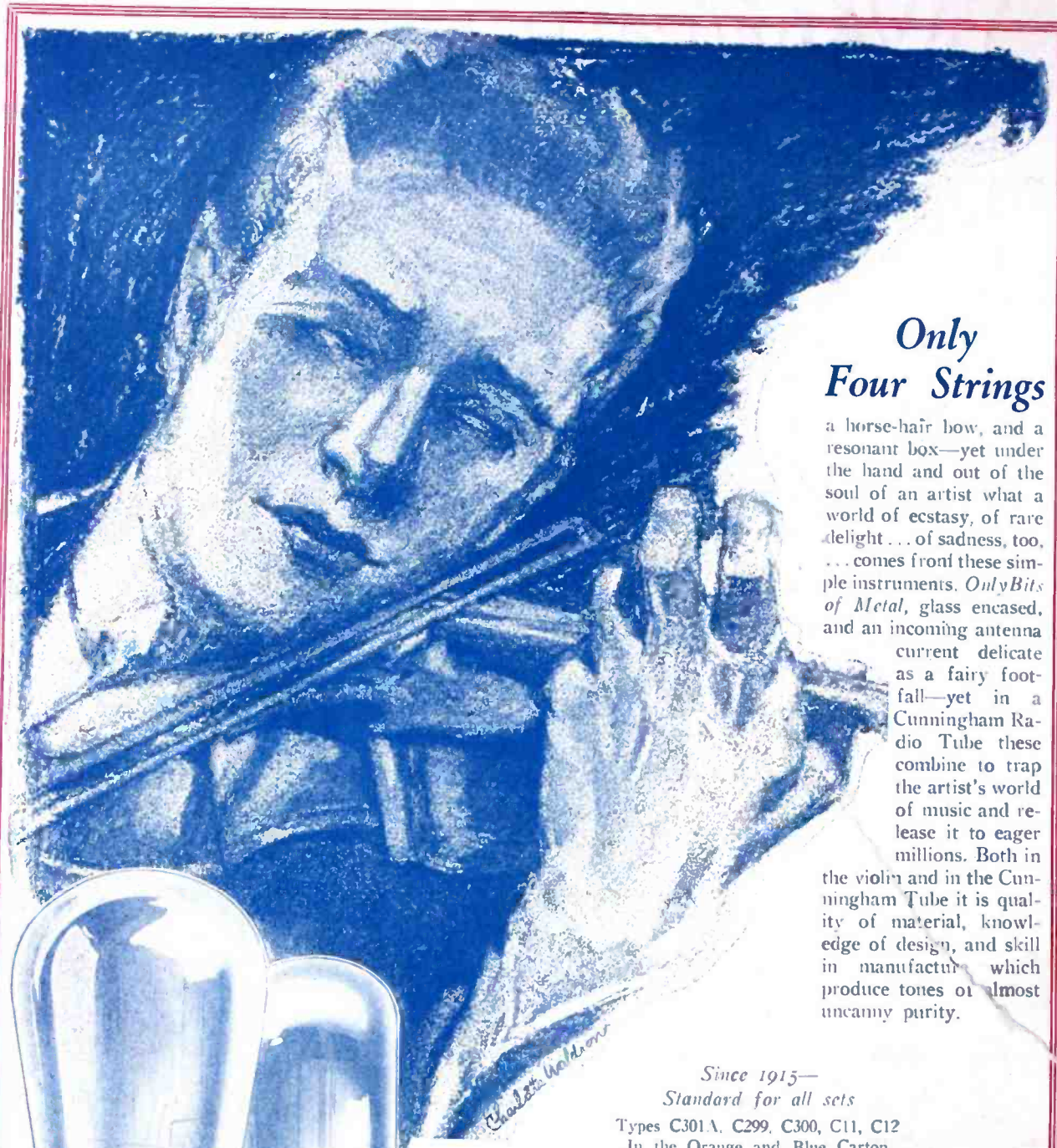
JUNE. 1925 25 CENTS

Wireless Age

The Radio Magazine



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Wireless Age

The Radio Magazine

Vol. XII — No. 9

June, 1925—Contents

Your Authors

A. F. Van Dyck (Review of Radio Telephony) is one of our pioneer Radio Engineers—dating back to 1908 with the old United Wireless Telegraph Co. He graduated from Yale in 1911, holds the degree of E.E., and is a charter member of the I.R.E. At the Fessenden Laboratory, Brant Rock, he did considerable research work in the old days and later conducted experiments in high voltage and high-frequency currents for the Westinghouse Elec. & Mfg. Co. At Carnegie Institute of Technology he filled the position of instructor. During the war he served in the Navy as Expert Radio Aide and subsequently performed engineering work for the Marconi Wireless Tel. Co., and General Elec. Co., and is now with the Radio Corporation of America. His scientific papers pronounce him an engineer of practical experience with a vision of future developments.

DOROTHY Brister Stafford, (The H.I. in Broadcasting) from the Presidential State of Ohio, has done considerable literary work of a serious as well as light character for well known magazines and newspapers. She possesses also the technical knowledge required in the commercial advertising field in which she has engaged to the satisfaction of those who have availed themselves of her services. Having a background of newspaper experience from pub reporter to feature writer, Miss Brister in "The Human Interest in Broadcasting", will prove a highly interesting member of the Wireless Age staff of writers.

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"Quality Goods for Quality Readers"

Editorial Chat

COMES the Spring days and the reanimation of nature from her winter sleep and with it radio is atune so that now we can have a service that spells health and buoyant life. That the "daily dozen" should be directed over the radio accompanied by bugle and band hardly one of us dreamed of a while back, but such is progress that the most prominent "life extension society"—for purely business reasons—finds it profitable to organize this radio service—and who can predict what it will mean in better individuals, better communities, better cities and country—Read "At 6:45 in the Morning"—it presents a distinctly novel use of radio.

Letters from Our Readers

Indirectly our Cross-word Contests have brought about a contact with our readers that otherwise was impossible—we feel pleased at the many gracious compliments and next month, if time permits, we shall publish some of your valuable comments and suggestions. However we wonder what we have done to warrant this: "Painting a lily white is proverbially easy compared with constructive criticism in improving the service rendered by Wireless Age" and "It is difficult to improve the standard of your magazine from standpoint of general interest"—and "Wireless Age cannot be improved—Technical articles are lucid 'yarns,' are interesting and there is a human interest which is lacking in other radio publications" and "Reinstate the Questions and Answers; give us more articles like 'H.I.' in Broadcasting" and—well, next month we'll sum it all up and no doubt we'll have a bigger and better Wireless Age as a result.

Of General Interest

Read this month's fiction yarn by William West Winter, "Whimsy Williams" will surely amuse. "For the Love of Mike" and "The H. I. in Broadcasting" affords you intimate interviews with studio personnel and artists. The International Language problem and solution is ably presented by Dr. M. Talmey and we wish to express satisfaction at the appreciation on the part of our readers for their interest as manifested by letters received—the subject merits everyone's attention. "Radio Rose" we'll see in some future Yuletide season possibly just as described.

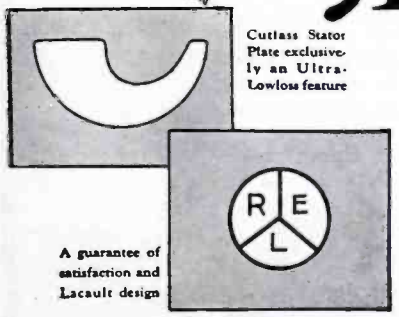
Technical

This month "Wireless Age" has its usual richness in technical material—there is only space to mention the various titles:—"Loud Speakers" by Dr. Minton; "Review of Development in Radio Telephony"; "Balancing Systems"; "De Luxe Radio Lyre"; "Power Amplifier"; "Portable Short Wave Transmitter"; "Receiver Noises" in addition to the usual features.

This issue contains a worth while cross-word puzzle and the subject to write about should prove interesting to you—judging from letters we've received already—try your skill this time.

—THE EDITOR.

As positive as Big Ben



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A guarantee of satisfaction and Lacault design

SET Big Ben at seven and at seven o'clock you're bound to get the alarm.

Just so, the Ultra-Lowloss condenser can be set at any wave-length—the corresponding station will come in clear and sharp. You know instantly where to turn, once a station of known wavelength is located. Makes tuning easy—direct—positive. Special Cutlass Stator Plates spread wavelengths evenly over a 100 degree scale dial so that each degree represents approximately 3½ meters.

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To Manufacturers Who Wish to Improve Their Sets

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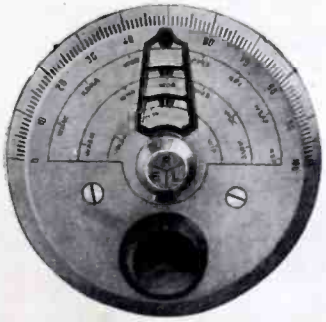

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"Quality Goods for Quality Readers"

VOLUME 12

Wireless Age
The Radio Magazine

NUMBER 9

Arthur Bagley conducting the "Tower Health Exercises" which are broadcast through three stations

At 6:45 in the Morning

The Tower Health Exercises

By Golda M. Goldman

ARE you one of those sleepyheads to whom the bugler is talking when he plays, "I can't get him up, I can't get him up in the morning?" Do you set the alarm clock carefully for seven o'clock, turn it off vindictively and go back to sleep until a quarter of eight, whereupon you swear at the clock, cut your face while shaving, swallow a cup of coffee and arrive at the office one minute after the boss? No more are you to know that pleasure of turning over for a forbidden forty winks, for the Tower Health Exercises will get you if you don't watch out. Of course you can throw the radio away or forbid your wife and children to tune in at such an ungodly hour, but they will probably only tell you that they are going to do their exercises even if you are too lazy to do them yourself. The trick of turning off the alarm clock, therefore, becomes permanently useless, so you may as well resign yourself to the following schedule, which is now accepted in all the well-regulated ultra-modern households of the Eastern Atlantic States:

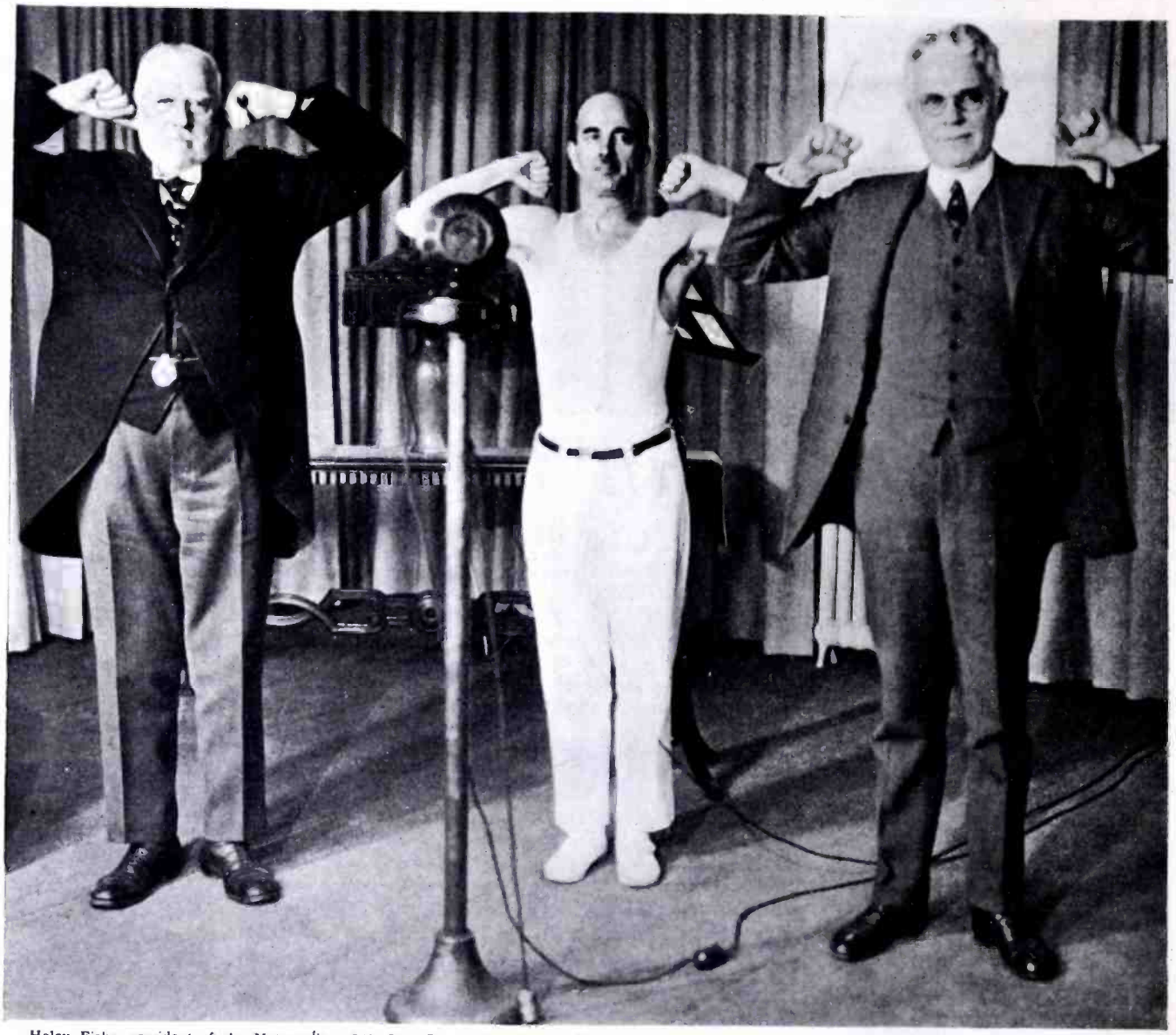
Wifey hops out of bed at six-thirty and runs about closing windows, etc. At six-forty she tunes into WEAF and five minutes later a piano is heard playing Irving Berlin's famous "Oh, How I Hate to Get Up in the Morning." If that isn't enough to get you right out of bed, it is immediately followed by a bugle blowing reveille. By this time, of course, you realize the utter futility of trying to lie in bed and so you undoubtedly go downstairs to watch your family making fools of themselves before breakfast. Of course, however, there is no use in your standing by watching them do the exercises incorrectly, so you just step out in the middle of the floor and show them how they should be done.

George McElrath and Raymond S. Hoyt of the WEAF staff testing the speech amplifier installed in the "Tower Health Studio"

Strangely enough, the next morning finds you listening with one ear, and the third day you abandon all pretense and pull your youngest son out of bed with disparaging remarks to the effect that if his "old man" can get up and take exercises every morning you should think that at twelve years of age nothing could keep him from such a morning's sport.

health exercises from which you may derive full benefit whether or not you happen to be a policy holder of the Metropolitan Life. Mr. Bagley, who has specialized in physical training work for twenty-two years, broadcast similar exercises of his own volition from WOR, in Newark, for many months. When the Metropolitan decided that they would use the far-

poisons by means of regulated morning exercises that Mr. Bagley found awaiting him an audience which had already been sold on the value of the information and instruction which he was pleased to give them. The daily exercises are divided into two thirty-minute periods with breathing space in between so that you may take either one or both of the groups. You will



Haley Fiske, president of the Metropolitan Life Ins. Co., Arthur Bagley director of physical culture, and R. L. Cox, vice-president of the Metropolitan, broadcasting the inaugural "Tower Health Exercises"

What is this all about? This is merely an introduction to the newest device whereby the Metropolitan Life Insurance Company hopes to prolong the lives and increase the general health and happiness of their millions of policy holders. A most delightful studio has been opened in the tower of the Metropolitan Life Building, at Twenty-third Street and Madison Avenue, New York City, and every morning from six-forty-five to seven-forty-five Mr. Arthur E. Bagley broadcasts

reaching power of radio for the dissemination of health information they had no difficulty in finding just the right man to do the work.

As soon as you become interested in this delightful and practical method of starting the day you may write to Mr. Bagley and he will send you a chart showing the positions to be taken in doing the exercises which he is broadcasting. So much has been preached to us of late years concerning the advisability of overcoming fatigue

find not only your body, but your mind, stimulated by Mr. Bagley, for his cheerful personality is as important to the listeners-in as is the actual work which he does with them day by day.

From some of the letters which Mr. Bagley receives—and it is amazing to note that within two weeks after the exercises were started over thirty thousand communications were received from listeners-in—the most interesting side-lights are cast upon the great va-

(*Turn to page 22*)

Leviathan Broadcasters

Nyda Westman, the popular star of "Pigs" as she appeared before the microphone aboard the "Leviathan"

The adorable Duncan Sisters (left to right) Rosetta and Vivien doing one of their harmony duets in the "Leviathan" studio

Rosalind Fuller, star of "Love for Love" was one of the galaxy of stage and screen artists who appeared on the "Leviathan" program broadcast through WGBS

Elvira Fernandez, soprano on the Radio Cultura programs

BROADCASTING in the Argentine

Celina Mazzocco, operatic soprano and popular broadcast artist

By Don Jose

BUENOS AIRES is a city of homes . . . not skyscrapers and apartment houses. This is a fact; but radio is making the fact more apparent. To the stranger it is noticeable on account of the numerous antennae seen floating over many homes. To the "porteña" wife it is more noticeable—but more of this anon.

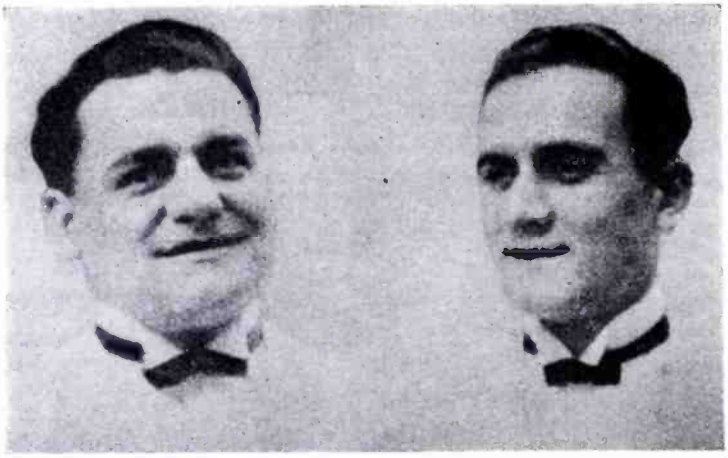
As the majority of homes are only one story high, with all the rooms opening on to a "patio"—or little garden, the casual pedestrian can easily see the ubiquitous antennae and judge the vast number of "aficionados"—fans—in Buenos Aires.

Radio has taken such a hold on the Argentine and increased to such an enormous extent within the past year, that Buenos Aires is only comparable to one of the more densely populated cities in the U. S. A. The population of Buenos Aires is almost three million people and it would be a conservative estimate to state that there are four hundred thousand — 400,000 — radio sets in operation.

The "extranjero" — foreigner—thanks to radio, no longer has that feeling of isolation that existed in pre-radio days. The American, for example, may sit at home leisurely in the evenings and listen in on KDKA, Pittsburgh 309 or other United States broadcasting stations with the same ease as if he were in an apartment on Park Avenue, New York. At six o'clock each evening he may hear the rise or fall of stock in Wall Street as well as the latest cablegrams of importance received by "La Prensa" without disturbing himself to go out and buy a newspaper. If Jack Dempsey gets in the way of Firpo's right Buenos Aires knows what has happened before Jack has time to be in the ring again, and the result of the fight is known before the first Gotham fan reaches his automobile.

And all of this without any detriment to the newspapers or to the theatre. On the contrary, radio stimulates our mind—acts as an appetizer. We want to READ all about what happened; and so—an increased sale for the newspapers; or we want to SEE the artist who captivated us, and the result is crowded theatres and greater fame for the genuine and worth while artist.

There are four powerful broadcasting stations in Argentina, and as many more minor ones. The "Estación Palermo," situated in the Rural Society Grounds at Palermo where horse racing is held. "Estación Sud America" in the heart of the business district. "Estación Radio Cultura" the most powerful of the four; and "Estación Brusa" a private broadcasting station from which interesting songs, dances and recitations are given nightly.



"Criollo" and guitar duets as well as songs are broadcast by these well known artists —M. Araujo and V. Giordano

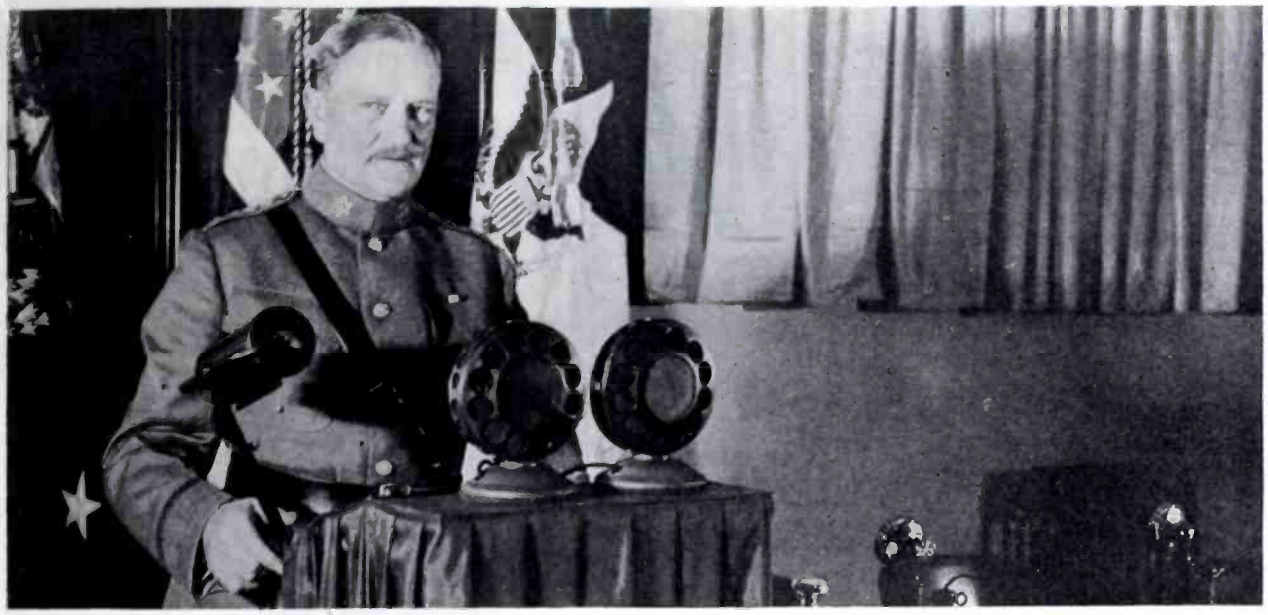
It is true that in Argentina there is not that amazing net of broadcasting that there is in the U. S. A., nevertheless there are sufficient stations for the needs of the country whose population is only about ten million inhabitants. What is lacking in quantity is made up for in quality.

"Radio Cultura" has been heard distinctly and accurately by radio enthusiasts in South Africa. From letters received in Buenos Aires it is known that the "criollo"—native—music and concerts have been heard in the city of Cabo from the "Palermo" broadcasting station. So too are the Buenos Aires broadcastings heard in the Canary Islands.

The Argentines like to listen in on broadcastings from other countries also. Perhaps the most popular foreign broadcasting station is KDKA, Pittsburgh. The first Argentine to listen in on KDKA was Senor J. J. Orfila with a three lamp set. Senores Carlos Braggio, from "Estación Bernal," and Eduardo Vigano from Mercedes—in the province of Buenos Aires — are regular KDKA Pittsburgh fans. Senor Vigano uses only a one lamp receiver. Several others are in constant communication with trans-Andine stations.

There are many difficulties encountered in the Argentine that are unknown in other countries, but they are growing less everyday, as the scientific radio experts are evolving newer instruments particularly adapted to the country's needs.

Artists who appear in front of the microphone are of the highest talent and reputation in Argentina. They are not near so numerous as in New York, but again, quality makes up for the quantity. There are the famous Argentine authors César Petrone, Roberto Firpo, and Rizutti; the reciters Senoritas Orelia Cisneros and Maria Teresa Gamba; the native folklore raconteur Vicente Forte; guitar and "criollo" songs by Spina—Araujo and Ruiz—Acuna; operatic arias by the famous sopranos Celina Mazzoco and Elvira Fernandez, and the German contralto Paula Weber; bedtime stories, Maria Eugenia de Elias; and so on with violionists, cellists and of course tangos galore. (*Turn to page 22*)



The solitude of the broadcaster is admirably presented in this view of Gen. John J. Pershing at a moment when he appeared before the microphone

FOR THE LOVE OF "MIKE"

By Mildred C. Smelker

DID it ever occur to you that your radio is the most consistently cheerful little playmate you ever had?

Glance over any local program and prove it. Instrumental selections, vocal music, or lectures—there is never anything to depress you.

There is beauty in all music, even jazz. All informative talks on topics of wide interest are given by experienced people. All discourses on commercial matters are put over on a good advertising basis and, therefore, have their best foot front. All the miscellaneous speeches are made with an effort to register approval with the unseen audience. In fact, everything is done to make you like what you hear.

For example just take last evening. As I rocked comfortably, my feet on a stool, my body relaxed, my disposition well above par, there came to me an hour or so of the "Little Symphony" from Carnegie Hall in New York. Delightful selections were interspersed with numbers on the pipe organ and solos by a pleasing soprano, not to mention the soothing effect of that announcer's voice—the one who rolls his R's so melodiously and pronounces French with such nasal correctness. I fairly purred with content.

Next I listened to a talk on the Coast Guard and Geodetic Survey and forthwith dismissed all misgivings concerning my safety should I ever really take that first trans-Atlantic voyage. I glowed with appreciation over my previous safe and sane coastwise jaunts due to the effective preventive work of this organization. More contentment.

Then a soprano sang somewhere out there and again I experienced contentment—supreme contentment with my own voice to be sure, but contentment nevertheless!

A piano solo followed full of cheerful tumbling runs and jolly boisterous chords and a jazz orchestra rounded out my evening. Though it brought me painful recollections of a recent dance when no one seemed to be light on their feet or mine either, it accelerated the speed of my rocker, set my feet to tapping and sent me to bed whistling.

Are all of my evenings, otherwise spent, as cheerful? Hardly! Only the other night I took in a movie. Before it was half over I had seen one operation, three crazy people, one murder and a suicide. A week or two ago I attended the theatre and, while much of the play was attractive, much was "heartrending" and left a bad taste in my mouth.

Not infrequently I engage in a game of so-called friendly bridge. The last one brought me a pitifully low score, one of those "inkling" partners, two talkative opponents, and a no-trump hound—the kind that always bids that when he has ten spot high in his hand.

I have already referred to the uncertainties of tripping the light fantastic.

And with it all there is that comfortable feeling that we can, at will, turn off the little old receiver any time we wish without losing a three-dollar seat, offending a friend, or lacerating the feelings of some clumsy Claude.

So much for optimism on the receiving end. How about the sending end? Still more cheer!

Behold a soloist unafraid of the gallery gods, a speaker, especially a Senator, with no interruptions, no heckling, no objections popping up, or any other broadcaster with no stage fright, no cold shoulders, no spot light to contend with.

The announcers are another happy lot. Late comers cause them no disturbance, an undertone discussion of Mrs. Blank's awful hat does not reach them, and early departures leave them in blissful ignorance.

As an alibi the radio, equipped with head sets, is second to none. When the family talks too much you can just clamp a pair of phones over your ears,

(*Turn to page* 54)

W the daughter of WHIMSY

By William

WE ALL on the Blue are mostly content to let the world waggle along about as she always has waggled, and we don't lay ourselves out to hustle her up none whatever. I am not no Methusalem myself, even if I am not no yearling neither, but I don't have to stretch my memory unduly back to the time when this here section of Arizona is mostly famous for what no one knows about it except those that aint anxious to tell. In those days there was a scarcity of sheriffs and such impediments and a superfluity of folks that hadn't no noticeable antecedents that they were willing to converse about. Those were the days when etiquette used to ride us rough. Folks was bred to tread soft and to speak with gentleness and consideration to each other, and fashions run a whole lot to equipments of Colt's pacifiers and Winchester pump guns. We was peaceful folks about nine-tenths of the time because when we all feels belligerent notions rising up within us and boiling over it was a hundred-to-one shot that there would be blood on the moon before them passions was abated.

Things have changed since them days and there aren't no more mysterious strangers on the Blue than there are in other regions and nowadays a sheriff can ride in on us and show his star open and unconcealed without having his light blown out through his backbone. It ain't even compulsory no more to strap a forty-five down to your leg or tuck it into the waistband of your pants. And likewise and due thereto, it appears like manners in these regions has suffered a decline. Young folks and some older ones is frequent and free with their arguments and prone to express themselves without no due regard to courtesy. Which when I'm a yearling such plays would most likely have resulted in someone getting smoked up like a ham.

You all can take it that I admits change and progress even here on the Blue and I don't discount none that said revolutions may be beneficial a whole lot. But take it altogether, and I allow that there is limits to these things beyond which they ought not to go. This here is a cow country and it doesn't appear to me that it is ever going to be anything else. There isn't any money in cows nowadays, but I don't know that springing a lot of modern improvements on us is going to increase the yield of beef neither nor jack up the price of it on the hoof. And that ain't to say that I turn my back on Progress and reverts complete to ancient ways. I am plenty willing to let them that hones for progress accumulate all such as they can assimilate.

It is Whimsy Williams that runs regardless on those paths and I don't never question his rights to do so, not even when he ain't content to ramble down to Globe and get run up a tree by these here automobiles, but has to come back hereaways with one of them he has invested in. Which he creates more panics among the cows and the horses hereaways than you can imagine. I reckon it might have been almost disastrous to the industry if it hadn't been that Providence heads off this folly to some extent by not providing any roads that will carry even this animated tin can that Whimsy brings home with him, barring a couple of trails running up the valley and heading in the Mogollons. So Whimsy doesn't find it feasible to ramble regardless through the range and scare all the stock out of a year's growth, which depresses him a whole lot.

Neither do we all object when Whimsy sends his daughter Mirabelle down to Globe to get education. We

considers him lucky to have the price and we allows that it doesn't hurt Mirabelle none and may improve her. It is when she comes back that I begin to feel some misgivings regarding all this culture that is creeping in on us. It ain't that I can't stand her wearing short pants and cropping her hair until it wouldn't offer no temptations to an Injun. I'm broad minded enough thataway and I read the magazines and go to see a picture show often enough to allow that according to the notions prevailing elsewhere she is plumb conservative and respectable. I even manage to remain unmoved when she sallies out one day bearing a little fried egg of a thing and straps it onto Whimsy's blue pony for to go and take a ride. Which this pony ain't never been brought up to no such freedoms as that and naturally takes advantage. I got my rope onto him in plenty time to prevent a slaughter and there is no harm done though there could hav' been aplenty.

It ain't, as I say, these new fangled notions that creates misgivings in me so much as her ambitions to make us move with the times. Which, as she is a right good looking young woman with just enough freckles to make her healthy and a trick of looking at you from under her eyelids when she converses, she has considerable successes along that line. I reckon if she keeps it up long enough she gets most of the young bucks round the Blue to considering these here golf pants and fixings of that sort before she is through with them. At any rate she has Slim Burgoyne and Shifty Pete Leathers

WILLIAMS and a "Peeled Dandy" Radio Set

West Winter

indulging in neckties and white collars before she has been home two months and there is some talk that Slim is figuring to send to Sears Roebuck for a pair of striped flannel pants to wear on Sundays and to dances. And all the time her debauched pa is going around as proud of her as if she was nickel plated!

IT IS when I am down to Globe negotiating with Eggie Simpson for me and Whimsy Williams regarding gathering a hundred head of feeders for him that this here Progress arises in its might and smites me hip and thigh. I am not thinking any of such things definite, being more or less low in my mind because Mirabelle has remarked invidious a few days before on my being what she calls "conservative" because when I sets out to step a little with her at a dance we all pulls off over to the Sandy Gulch School House I trips over my boot heels in an effort to follow her maneuvers in some sort of *baile* which she allows is called a tango and for the dancing of which she sets up a phonograph to play tunes which sounds like a mixture of a cat fight and a riot. Me, I can step out to the "Blind Child" and shake a nice hoof in the "Sand Trot" and the "Tarantula Bends," but this here tango thing sure has me backing up. And the worst of it is that Slim Burgoyne, being what Mirabelle calls of the New Generations, has picked up somewhat of these here girations the time he puts in a winter down to the smelters in Globe, and when I get hog tied complete, he rambles in and just naturally shines refulgent a whole lot thereafter. Likewise, in the conversations following he puts on a heap of dog with remarks aiming to show that there ain't no real culture lying loose around the Blue except what him and Mirabelle imports thereto from foreign parts. And as far as I can see he sure makes a hit with this pow-wow, in spite of the fact that if he was sold up tomorrow at public vendue he wouldn't fetch a dollar and six bits total.

What I chiefly recalls of this flourish of intellects over and above the general scorn coming my way is the regrets of Mirabelle, backed up by Slim Burgoyne, that there ain't no real music to be listened to on the Blue, us being generally content with old Shaky Jim Beazley's fiddle and the tunes he extracts therefrom; that and such phonographs as has drifted in to us. According to Mirabelle and Slim, who sets up as an authority, what we all needs is something they describes as a saxaphone. I ramble around and ask Shifty Pete Leathers, who is suffering most as much as me from the same frost bite, whatever is this saxaphone and he allows he don't know, but that if it is anything musical he aims to find out, Shifty being given to ambitions thataway and a sure jo darter on a mouth organ.

Me and Shifty passes a right mournful evening, the more so as we feel reluctant a whole lot to drift together and share our sorrows, each holding the other as a potential hostile. And likewise, after that play about the saxaphone, Shifty develops a heap of reticence and pointedly avoids me and discussions thereof. Which I knows therefrom that he aims to make some such play as gives him his name among us.

WHEN I am down to Globe this time, I don't have any notions at first until I run into Shifty, who has wandered down thataway for purposes of his own which he don't tell me none. So, naturally, I scouts him up and down until I trails him to a store where they sells horns and such to make music out of. And following this lead, it aint' any great trick to find out that Shifty is in there buying a sort of shiny dingus with a lot of keys running up and down it which the storekeeper identifies as one of them saxaphones. And, still trailing Shifty, who is staying at the same hotel as me, I hears him up in his room extracting of the dismalest noises ever I hear out of this here horn he has bought and I haven't no difficulty in concluding that he is sure setting out to make a center shot on Mirabelle with this evidence of culture.

Naturally, all this sets me thinking and I don't aim to be shoved plumb into the discard by these sports like Slim and Shifty. But I can't play even a mouth organ and I don't aim to try. Still, there is other instruments of Progress around Globe and if I do say it myself, there ain't many shorthorns on the Blue that is any sooner than I am. I read the magazines and I know what is what in the advertisements. Wherefore, I takes a *pascar* and unbelts my roll for the occasion and I purchases me a regular Jim Dandy of a radio set, one of them portables which you can pack around with you wherever you aims to go.

I sure allow that this here radio thingamajig is going to leave Slim Burgoyne with his striped pants and his tango dancing, and Shifty Leathers with his nickle plated tin horn wandering around in the chapparral while I occupy a seat by the fireside with Mirabelle. And the best of it is that I don't have to go to no undue exertions in the line of training for to exhibit this thing. Near as I make out when the storekeeper gets through instructing me how to turn the jiggers and shift the thing he calls a loop, all I has to do is jiggle her around until I calls up a number like a telephone and then some sport a couple of thousand miles away sings or recites to me right out of a horn which goes with her. It sure is a peeled dandy, as I am here to assert.

Of course, I packs this here modern miracle right careful and secretive and ambles back to the Blue like the cat that has stolen the cream, figuring how I am going to knock the eyes plumb out of Mirabelle and make every one of her freckles stand right out alongside her nose when she ties onto this radio. I figures to come riding in careless,

with this thing tied to the back of my saddle and unload her without no ceremony, kind of bored like and superior. Then I springs some opera stuff from plumb out Los Angeles way and throws her dead in her tracks. Following which, I little talk along personal lines, just when her admirations is most stirred, ought to fix Slim Burgoyne's and Shifty Leathers's clocks for them right. I even has visions of us two setting, heads together and arms all tangled up around each other, swimming in sentimental sentiments, which is what freckles and a sassy nose and eyes that sort of look up at you and dare you to start anything will do to a man, even when he's rising thirty like I am.

WELL, I rambled in on Whimsy Williams right away after I get back, figuring I had to arrange to gather them cows for Eggie Simpson. I ain't any too expert with this radio thing as yet and I figure to let her lay for a day or two before I spring it on them. And of course I ain't telling them anything in advance. I have already spoke to Slim Burgoyne, Shifty and two Mexicans regarding riding for Whimsy and me on this *rodeo*, and I figure that is enough. But Whimsy and me have got to discuss details seeing we are due to start riding in a couple of days.

All of which ain't here nor there except to account for how come I am over to Whimsy's late that afternoon. I talk arrangements over with Whimsy out in the barn and then I start back, figuring to ride around by his 'dobe and maybe pass remarks on the weather with Mirabelle and make comparisons between her eyes and the sky to myself. It ain't until I ride around by the front of the house that I see Slim Burgoyne's calico pony which he rides because he allows it makes him look like Tom Mix and not because it is a good cow horse. It is standing tied to the ground out by the fence and there ain't no sign of Slim until I glance at the house. There is too much sign of him then because just then I see him inside the window and he is surely kissing Mirabelle or I am a horned toad!

That there radio of mine right then and there loses all of its attractions and I would have sold it for the price of a sack of Durham. I only have one consolation and that comes of thinking of how Shifty Pete is going to get his money's worth out of this here saxaphone he buys and which costs almost as much as my radio set. I am that low in my mind that there is lumps in my throat and prickles in my eyes and if times was what they used to be I sure would have ambled right down to San Andros and sunk enough nose paint to embitter me to the point of shooting up the place. But seeing that such plays ain't fashionable no more all I can do is rowel that old horse of mine until he gets indignant and go racking homeward like I have got something to do in a hurry. And thereafter I remain in retreat until we all sets out to ride after them feeders ranching in the valley.

When me and these two Mexicans I hire packs the chuck wagon I recall this here radio set and in bitterness of heart I throws her in, aiming to entertain the surrounding landscape a whole lot when we camp with sad and salubrious selections picked out of the atmosphere if so be there are such being shaken out of the air. I ain't got no plans and I don't tell nobody about this thing because I am ashamed of it. So when we get together about ten mile up the valley from Whimsy Williams' rancho, meeting Slim and Shifty and Whimsy with the rest of the *remuda* besides what horses I have brought, there is no hint whatever of modern progress except the loud and gaudy silk bandanna which Shifty is wearing.

We sets out from there and camps for the night up on Elk Creek just below Clover Hollow where we aim to gather our stock if we can run in enough without riding further. And the next few days we all ride the range industrious, combing the draws and gathering such cattle as we run onto, branding what calves we see and driving in a good bunch of two-year-olds that fill the bill for Eggie Simpson. By the last of the week we have close to a hundred and fifty bunched in the Hollow, holding them for the drive down. It is a good thing that we have this hard work because it keeps me from getting too low in my mind for my health.

On Saturday, seeing we have almost enough with the culls to make the grade, Shifty Pete Leathers allows he'll take a few hours off and ride down to the valley on business of his own. It ain't right that he should do so, but Whimsy is easy that-away and don't put up any argument to amount to anything, so Shifty goes off, wearing his brand-new silk bandanna. He comes back Sunday morning looking like he owns the earth and casting superior and supercilious looks toward Slim Burgoyne. He and Slim, all this time, has been like two strange cats, each arching his back thataway toward the other.

"I get down and set that loop right for Angels, and then fish around with them jiggers that does the tuning"

THIS Sunday evening, still being right low in mind and with the worst of the work over, I draw my turn at night herding, and am setting in front of the fire feeding when there is a clatter and a rattling and over the trail comes that tin can of Whimsy's and no one else than Mirabelle a'driving it. How she gets up there is a mystery to me, but somehow she does. And seeing her, with Slim and Shifty both jumping up to help her down, I feel my heart go sinking right down to the bottom of my boots and tangle up with my spurs. I rise right up and start to slink off and get up my horse and go out and play night nurse to that bunch of beef out in the Hollow. I have ambitions to be alone and feel my sorrows thataway.

But Mirabelle glances around, as if for her father and she don't see him none, as he's out gathering some of the horses that have strayed along with the Mexicans. Then she comes up to me without no more than one glance for Slim and Pete.

"Jim Harkness!" she says, sharp, and curt, "are you any kind of a man?"

"Which there was a time when I imagines I am," says I, "but with the passin' of the years I'm losing my convictions. Which I feels more like a jack rabbit right now than anything human."

"And you act like one, also, says Mirabelle, with conviction. "However, if you've got a six-shooter and still know how to use it, I hope you keep it handy."

"Whatever for?" I asks.

"You wait and see!" she replies with a toss of her head. "All I'll say is that if you're a man in your own estimation you oils up that hog leg of yours and stands ready to vindicate yourself."

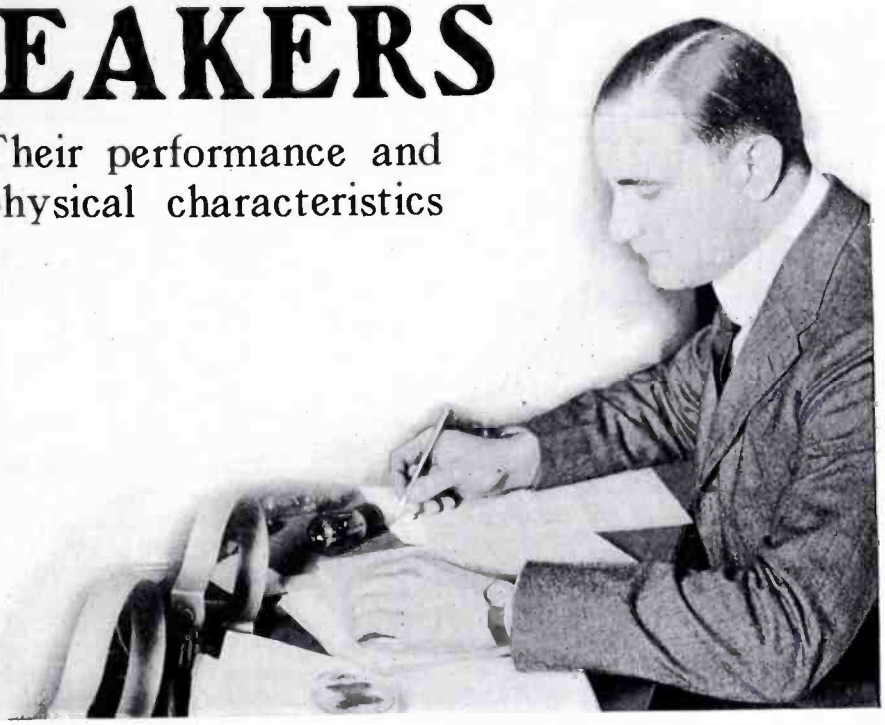
Of course, I am mystified a whole lot, but, as I am night-hawking anyhow, I go and get my six-shooter out of the wagon and tie it down. And seeing that there radio which has remained there all the time, it

(*Turn to page* 28)

Loud SPEAKERS

Their performance and physical characteristics

By Dr. John P. Minton



Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America, checking up some of Dr. Minton's work

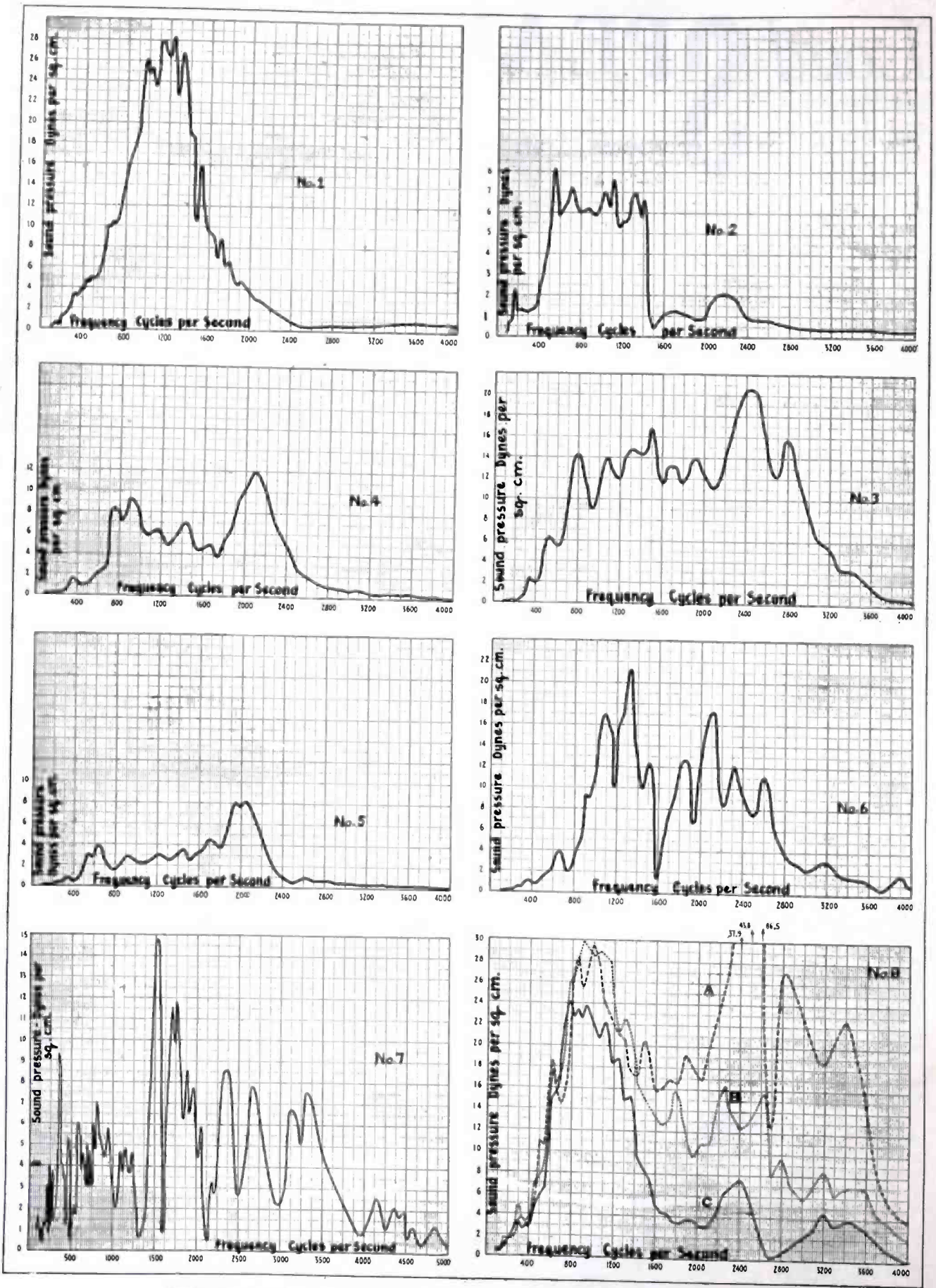
DR. ALFRED N. GOLDSMITH, Chief Broadcast Engineer of the Radio Corporation of America, has been one of our foremost leaders in developing the art of radio broadcast and reception. He was one amongst the very earliest who saw the possibilities which lay in the immediate future and for this reason he has built up an organization and equipment for radio research and development which are the best it is possible to obtain. They are the direct result of his "radio-vision," so to speak. Witness the evolution during the past three or four years from a required space of two or three rooms to the large Technical and Test Laboratory of the Radio Corporation of America. Here radio research problems of a highly scientific nature are being studied intensively, a large group of development problems are continually being worked out and many tests on radio receiving sets, amplifiers, loud speakers, radio circuits, etc. are performed. Here in this elaborate and new home of the Technical and Test Laboratories, of which Dr. Goldsmith is the director, a group of commercial types of loud speakers arranged for testing by a staff of skilled engineers have produced certain results. The performance of these loud speakers and their limitations will be the subject matter to be discussed in the present paper. The basis necessary for a thorough understanding of the factors involved has been presented in our preceding three or four papers. We can, therefore enter upon our task immediately. We shall show first a series of "frequency-response" curves, as they are called, for a number of ordinary commercial types of speakers and connect up these curves with the performance for signals of each particular loud speaker. Obviously, it would be unfair to give the manufacturers' names in these cases, and, for this reason, the loud speakers are referred to as No. 1, No. 2, etc. to correspond to the curves designated in a like manner. The method of obtaining these curves have already been described in a previous paper. We have also studied curves for the conical and exponential horns and are thus familiar with the story such curves tell us.

The first curve (No. 1) represents the intensity of the sound produced at various frequencies by what was stated to be, "One of the best loud speakers on the market," a year ago. We should remember that the curve for a loud speaker should be a straight horizontal line from the lowest to the highest frequency in order that we may have what can be termed "ideal reproduction." At a glance, one can see that the curve for loud speaker No. 1 is far from the ideal curve. Beginning at 100 cycles, which is a really low, deep tone in speech and music, the curve rises quite steadily to a decided maximum in the region of 1200 cycles. The curve then drops quickly to a minimum at 2400 cycles and shows that the loud speaker is relatively "dead" for the higher frequency region. The fineness of speech and the delicate discrimination required to distinguish one person's voice from another and one musical instrument from another will be absent entirely in this loud speaker. Yet the public is familiar and has been more or less contented, until recently with phonograph quality. Consequently, a loud speaker with these characteristics has given much satisfaction in the past.

Another loud speaker appeared on the market a couple of years ago. In appearance its horn resembled the one for No. 1 loud speaker discussed above. This similarity in horns, of course, was to be expected because two or three years ago little was known by the radio manufacturers about the performance of horns. This knowledge has only recently been acquired as a result of the research work going on under the direction of the Westinghouse Co., the General Electric Co. and the Radio Corporation of America.

The unit, however, of this No. 2 loud speaker was quite different from that of No. 1 in actual mechanical construction. The difference in the two curves, then, is due to the actual physical characteristics of the units. As indicated by curve 2 this loud speaker comes in abruptly at 400 cycles, is out again at 1500 cycles and does not come in again to any degree worth speaking of. It also has a single noticeable peak at 180 cycles which would cause to some extent a disturbing low frequency resonance. The single sensitive region from 400 to 1500 cycles is a most peculiar phenomenon, particularly the rapid rise and fall at the lower and higher frequencies. A loud speaker of this type, of course, would fail completely to give satisfactory results if they were all like the sample tested.

A loud speaker considerably superior to either of the two whose curves are discussed above was developed and placed on the market about two years ago. New improvements were introduced in the unit and the fundamental resonant frequency of the horn was so located, apparently, as to assist the production of the higher portion of what may be called the low frequency region. This loud speaker, thus, became one of the best the market afforded at that time. Even today, I would place it in this same class, although recent developments in loud



Graphic charts showing power output and frequency range of loud speakers tested by Dr. Minton

speakers have made better ones available and will, no doubt, make much better ones available in the near future.

The curve for this No. 3 loud speaker is shown in curve 3. As indicated by the curve the loud speaker reproduces those sounds whose frequencies lie between about 350 and 3600 cycles. The reproduction is not satisfactory above or below these limits yet the public, I think, would accept it as perhaps amongst the best of those available. This public reaction, of course, is a natural one. But let the people once hear speech and the beautiful low and high frequency notes of an orchestra reproduced by a really good loud speaker, they will be quick to detect the difference and demand the higher quality loud speaker.

ACOUSTICAL TESTS

One of the most important features of this No. 3 loud speaker as revealed only by these high precision, acoustical tests is the uniformity of the response at the various frequencies. As stated above, a loud speaker curve for ideal results should be a flat horizontal curve. The curve No. 3 is really not far from flat in the region, say, of 700 to 3000 cycles. To be sure there are variations in this region but variations of this magnitude are not serious. The task of improving this loud speaker resolves itself into bringing up both the low and high frequency regions without, of course, reducing the portion from 400 to 3000 cycles.

SMALL HORNS

In curve 4 is shown the results of our tests on one of the loud speakers of the small horn variety. It is a well known make and one of the less expensive varieties. Likewise, its performance curve indicates that it is one of the poorer quality loud speakers. Its range of response extends from about 700 cycles to 2500. All the low frequencies and much of the intermediate frequency region is eliminated. The quality of reproduction would be quite unsatisfactory if the loud speaker were subjected to a critical test of any nature. The low notes of a piano or an orchestra and the low and intermediate pitches of the voice would be absent. The voice would sound sharp, high pitched and quite unnatural. The beautiful, low orchestral notes would be lacking and the various instruments of the orchestra could not be distinguished with any certainty, whatever. That portion of the public which has reached the discriminating stage would hardly accept such performance, even as a gift.

Then again, this No. 4 loud speaker is not as sensitive as, for example, loud speaker No. 3. This is shown clearly by the relative heights of the two curves.

This lack in sensitivity is still further exemplified by the loud speaker whose curve is shown in curve 5. The average height of this curve is much, much less than that of curve 1 or curve 3, for example. I presume that either of these two latter loud speakers would fill with sufficient sound a room three or four times as large as loud speaker No. 5 would for the same signal input into the loud speakers.

This loud speaker No. 5 also covers a small frequency range, say from 500 to 2300 cycles which is a far too narrow range for even fair quality reception. Of course, this loud speaker is quite inexpensive. Because of this many of them are sold, but I doubt that they produce very many "thrills" except to the real novice in the art of becoming a "radio-fan." The general quality of performance of this No. 5 loud speaker will be quite similar to that for loud speaker No. 4.

We read *wonderful* statements in *wonderful* advertisements as to the *wonderful* performance of a really *wonderful* loud speaker. This is particularly claimed for a loud speaker if it appears to employ any new idea—be the idea a good one or a "wild" one. One of these ideas relates to the full, clear, round (so-called) tones produced by a loud speaker employing the reflection idea.

REFLECTION

Any one of my readers can understand that reflection of any sound from a surface means less transmitted. All of us are familiar with the fact that the reflection of light from any surface means less transmission of it. Similarly, in sound, any one of you know that if you want to talk to the person in an adjacent room, you don't try to talk to the separating wall, because the sound is not transmitted readily through it. On the contrary, you open the door separating the two rooms and then you avoid much reflection and allow more transmission through the open door.

Or, again, if you wish to talk to a person in the same room, no one would expect to put his face close up to a wall and expect someone in another part of the room behind them to recognize his voice as being perfectly natural. The various pitches are not reflected alike and there will result a distinctly noticeable quality change in the voice. Let one get in one corner of a room, face the wall and talk to someone behind them. Then turn around, face the person and talk again. Anyone can observe a marked difference in the naturalness, distinctness and loudness of the voice. The same sort of statements apply to the so-called reflection types of local speakers.

These types of loud speakers are characterized by a reversal in the direction of the sound flow. That is, the sound energy leaves the unit, passes along a narrow tube for 12 inches or so and then reverses itself to flow back through a larger cavity. Much of the energy comes back in the small tube itself and is lost as far as getting out into a room is concerned.

PAPER CONE TYPE

A curve for such a reflection type of loud speaker is shown by curve 6. The sound output is quite small up to about 800 cycles. Little high frequency is obtained above 3000 cycles and the curve is characterized by a number of maximum and minimum, particularly the minimum at 1600 cycles. A 1300 cycle tone, for example, would sound perhaps four or five times louder than a 1600 cycle tone. Of course, this sort of performance is to be avoided as much as possible. These remarks do not take into consideration mechanical or perhaps certain limited acoustical advantages this type of loud speaker may have.

Another type of loud speaker is the paper cone one. There are perhaps a half a dozen or more various makes of the cone type on the market. A sample curve taken on one of these makes is shown in curve 7. As far as uniformity of response is concerned, this loud speaker of the paper cone type has nothing to recommend it. The sound output is very large at 350 cycles and at 500 cycles the intensity has dropped to only one-thirteenth of its value at 350 cycles. At 1500 and 1600 cycles the ratio is even worse, being 1 to 18. A very low minimum is again observed at 2100 cycles. The peaks are numerous, very sharp and will distort to an unacceptable amount the original distribution of energy in speech and musical sounds. We might call this kind of distortion, *energy distribution* distortion. The other kind of loud speaker distortion being the actual introduction of tones not in the original sound. In later papers we shall have more to say about distortion.

MODES OF VIBRATION

We have already given a paper on the vibration of diaphragms and have explained the cause of the various *modes of vibration* observed with diaphragms. The paper cone is a special form of a diaphragm and must, therefore, possess its own characteristic forms of vibrations. Then, too, the unit has its various resonant frequencies. Both of these two parts of these cone loud speakers mutually affect each other and combine to produce the result as illustrated by curve 7.

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AIL Fundamental Principles and Further Illustrations of Ilo

By Dr. Max Talmey

THE previous articles on the AIL have given a historical outline and have shown the relations of Ilo to other systems offered as solutions of the problem involved. Intelligent study of Ilo requires also some knowledge of the logical principles which determine the essentials of the AIL, rendering it thus independent for the most part of the arbitrary decisions of authors. Those principles have been set forth exhaustively by the writer in a special essay on the subject.[1] Here only a summary can be presented.

Vocabulary

The vocabulary of the AIL is determined through two principles. The roots of the words must be as much as possible international, *i. e.*, common to the principal living languages — international words upon the principal of maximum of internationality; and if there be no international words for certain conceptions the latter are not to be rendered by words arbitrarily invented, but by words taken from some natural language, living or dead—national words, a posteriori principle.

The objection that a system composed of international and of national words of various sources would lack a uniform character and thereby be unfit for use is refuted by the example of the most powerful, richest, and most expressive language, English, which is composed of Germanic, Latin, French, Greek, and other root words.

Latin words are the most international ones. They will therefore predominate in the AIL, giving it almost a Romanic character. But not all Latin words are international—common to the principal living languages. Systems which would use exclusively Latin for the sake of uniformity do not comply with the internationality principle and therefore contain great difficulties for all those who are not experienced Latin scholars. Zamenhof's system is entirely rejectable, since it violates the principle in 35 per cent of its words, and a great many of them are altogether arbitrary.

John P. Callaghan, business manager of "La Presse," who broadcasts Ilo lessons to English fans through CKAC

The spelling of the words of the AIL must be phonetic. This means that a letter or letter combination (ch) is always to be pronounced in the same manner. The letter a, for instance, cannot sound once like in "palm," another time like in "pale." The former sound is the international one and has to prevail unexceptionally. Likewise, the letter c cannot be pronounced in two different ways, but must be replaced by the letter k whenever it has the sound of the latter. Thus we obtain the root "konstrukt" from the natural root (common to the natural languages) "construct."

The AIL must be euphonious. This excludes letters or letter combinations hard to pronounce and requires slight modifications of some natural words. For instance, the international sound of the letter c is that of the combination ts, as in "hats." Now, in some natural roots the letter c is preceded by s or by x=ks, as in "sceptr," "except." Phonetically, these roots would have to be pronounced stsepter, ekstsept. This is extremely difficult. The preceding s or x is, therefore, to be omitted, which leaves the roots cepter, ecept.

Slight changes of natural words are thus needed to comply with proper phonetics and euphony. But actual mutilations of natural words must never take place. Zamenhof, for instance, has deformed the natural roots cerebral, frontal, manual, etc., etc., into cerb, frunt, man, etc. Such roots must remain intact. It may be remarked by the way that his system has a very disagreeable sound owing to the repugnant frequency of the sibilants and of the endings aj, ej, oj, uj, ajn, ojn, ujn, as shown by the illustrations in the previous article.

The number of international words available is much too small for an efficient language. A great many national words have therefore to be added. In selecting such a word that language is to be preferred which possesses an adequate word for the conception to be expressed. For instance, we are seeking a word for the conception: to suffer or make suffer, perish or make perish through hunger. Only English possesses an appropriate word for that idea, namely "to starve," which furnishes for Ilo the verb "starv-ar." Or, we wish to express with one word the idea: to put something into the letter box or entrust it to the postoffice to be sent to its destination. English is the only language possessing one word for that idea, namely "to mail," which word in phonetic spelling furnishes the root "mel" for a verb "mel-ar." As a rule, a language richer than another one in general or in the case under consideration will possess the more adequate words so that the first one is to be preferred as a source of words needed in the AIL.

The alphabet for the words of the AIL must be very simple, no matter

[1] Logical Shape of the AIL., American Medicine, August, 1923; reprint obtainable from the author.

what their sources may be. Diacritic marks for letters constitute an unnecessary difficulty. Altogether excluded are letters that do not occur in any natural language. Zamenhof committed the gravest error by introducing in his system five "hooded" consonants foreign to any language and rendering printing of works in his system difficult and expensive. The Anglo-Latin alphabet is the least complicated of all alphabets and therefore the one appropriate for the AIL.

GRAMMAR

Great facility is an indispensable requirement for the AIL. This is the reason why we need the internationality principle discussed before; it renders the acquisition of the vocabulary as easy as possible. To obtain also utmost simplicity with respect to grammar another principle is needed, namely: the parts of speech must be recognizable through invariable characteristic endings. It can be shown that the most appropriate endings for the purpose are as follows: every word of two or more syllables ending in—o is a noun in the singular; in —i a plural; in —n the objective case; in —a an adjective; in —e an adverb; and in —ar, —as, —is,—os, —us, —ez a verb respectively in the infinitive, present, past, future, conditional, and imperative (optative). These grammatical endings have no meanings by themselves, they merely serve to indicate the grammatical rôle of a word in the sentence. The grammatical construction of the latter is thereby recognizable at a glance. All one needs to keep in mind besides is that the normal order of the parts of a sentence is: subject, predicate, object. For example: un granda fairo destruktis rapide un bela kirko en nia urbo=a big fire destroyed rapidly a beautiful church in our city. A sentence deviating from the normal order is made clear by putting the object in the objective case: konsolacon la letro ne bringis=consolation did the letter not bring.

The grammar must be free from all unnecessary difficulties.

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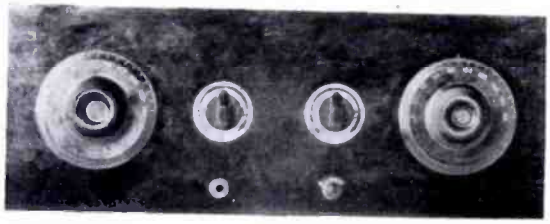
A. P. Beauchenim, teacher of Ilo in French at CKAC

Staff of CKAC, "La Presse," Montreal—Left to right, standing: Arthur Dupont, Asst. Announcer; Adrien Arcand, Radio Editor; Leonard Spencer, Technician; Jacques N. Cartier, Director of CKAC; A. Leban, "Master of Ceremonies." Sitting—John J. Callaghan, who fostered the station; Mary Brotman and Norah O'Donnell—Ilo lessons are broadcast twice a week from this station

The Deluxe Radio LYRE



A selective receiver that utilizes low loss parts to secure quality reception

By O. B. Scott

BROADCAST listeners in many parts of the country are becoming greatly concerned over the prevailing "ether congestion." At the present time it is necessary for several of the popular class "B" stations to divide their time. In Los Angeles alone there are six stations ranging from 500 to 1,500 watts in power, and more being planned. When all of these are on the air at the same time, many receivers of present design are paralyzed. It is sometimes necessary to tune in one station loud enough to drown out another in order to overcome the interference. The same condition exists elsewhere—even Chicago fans have been known to suffer from "too many broadcasters."

Selectivity and Low-Loss

Selectivity, then, is becoming an important consideration in the design of present day receivers. It can be obtained in several ways; by the use of two or more stages of tuned radio frequency amplification; by tuned radio frequency and regeneration; by the heterodyne method; and last, but not least, by the reduction of losses in the tuning circuits.

It is beyond question that high losses broaden tuning; the curve of signal strength becomes a broad hill instead of a sharp peak. The use of a large amount of dielectric in the field of a coil is one of the greatest sources of loss in any radio circuit. The radio market has been deluged with "low loss" condensers, but it is only of late that manufacturers have gone after the real offender—the coil with an enormous high frequency resistance because of an unnecessarily large amount of dope and dielectric.

The Circuit

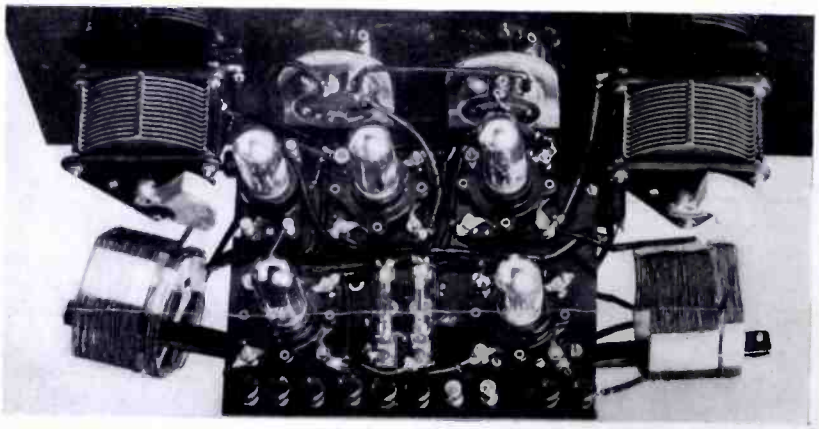
There isn't anything particularly new about the circuit of this receiver. It has been described in dozens of articles in the various radio magazines. It is the use of low loss principles that should primarily interest the reader. The requirements of low loss construction have been satisfied by high quality condensers, loose coupling and a minimum of coil dielectric.

These ideas were embodied in a receiver built along the lines of the "Radio Lyre" described in the December, 1924, Wireless Age. Our receiver, then, is the "Radio Lyre," with the following modifications:

1. Low loss coils, loosely coupled.
2. Tuned detector input.
3. Non-regenerative tube detector.

MATERIAL REQUIRED

- One 7" x 18" Panel Radion
- One Sub-panel 7" x 8"
- Two .0005 Variable condensers General Radio
- One Audio frequency transformer General Radio 231-A
- Four Cushion sockets for 199 tubes Benjamin
- One Socket for 199 (last tube—does not need to be cushioned)
- Three Daven resisto couplers with resistors, leaks and blocking condensers
- Two Metal brackets—Benjamin or Sear-de
- One 10-ohm rheostat
- One 20-ohm rheostat
- ¼ lb. No. 22 D.S.C.
- Jack, filament switch, condenser and grid leak mounting, dials, micadons, hard rubber strips, nuts and bolts, gummed paper tape, etc.



Rear view of the radio lyre showing arrangement of the parts

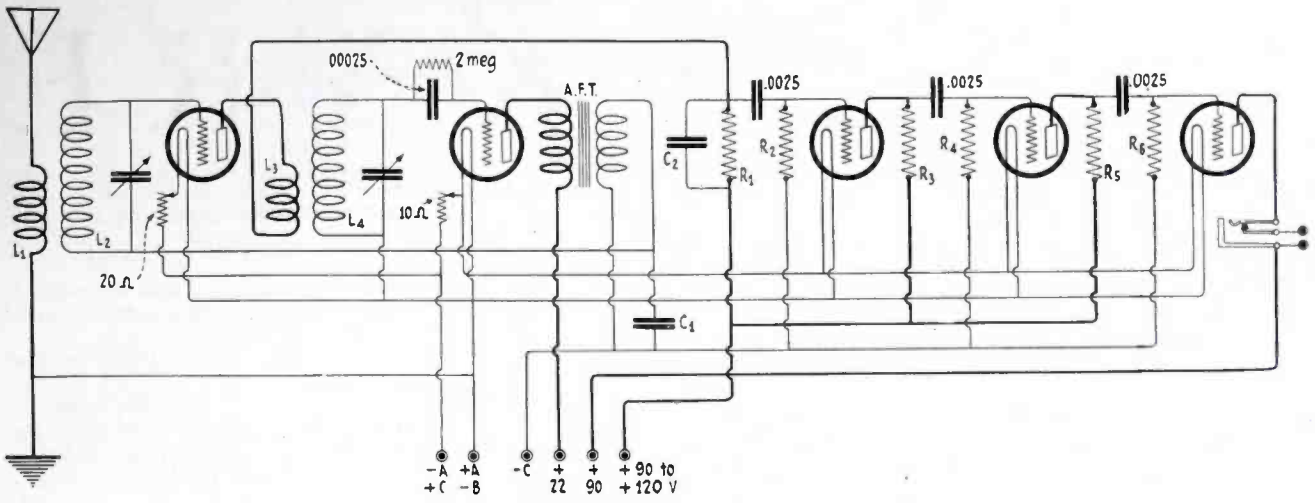
Quality Materials

Only the best of materials should be used in the construction of a receiver of this type. General Radio variable condensers are recommended, for they are excellently built and the plates are soldered together, reducing the high frequency resistance. A General Radio 231-A audio transformer was selected because of its well established quality of tone. Benjamin cushion sockets and Daven resistance units are recommended for their efficiency and convenience.

The Coils

The inductances L-1, L-2, L-3 and L-4 are the well known "pickle bottle" coils. Pickle bottles, however, seem to be very scarce at this time, so it is necessary to make one's own. This may be done in several ways—by fastening nails or dowels upright at the points of a hexagon marked off on a piece of wood, or by bending a piece of sheet aluminum or tin in the shape of a hexagonal solid of about three inches average diameter. This latter method is by far the most convenient. It is only necessary to lay strips of moistened, gummed paper tape (gummed side up) along three alternate sides of the prism and wind the wire on tightly. No. 22 is recommended, for smaller wire will not make a rigid coil. After the wire has been wound on, the strips of moistened gummed paper should be doubled back and securely fastened together.

Figure 2 and the illustrations show how the coils are wound and fastened. A word of caution—the glue on the strips should be thoroughly moist so that the wire will readily adhere to it. A three-inch coil with forty-six turns of No. 22 D.S.C. will cover the broadcast band very nicely with a .0005 mfd. variable condenser. These figures are for L-2 and L-4. The aperiodic antenna



Circuit diagram of the radio lyre

coil, L-1, consists of ten turns of No. 20 D.S.C. wound in the same fashion. The completed coils should be left in a warm, dry place for a few hours in order to remove all traces of moisture.

If extreme selectivity is desired, inductance L-3 may be ten turns of No. 22 D.S.C. placed alongside the filament end as shown in the illustrations. In remote districts, however, L-3 should be increased to fifteen turns and wound *over* the filament end of L-4. To do this, wrap a thickness of the paper around L-4 while it is still on the hexagonal form. Then lay three moistened strips along L-4 and wind on L-3.

Various degrees of coupling between these two coils were experimented with. It is recommended that the builder try them himself in order to obtain the most satisfactory arrangement for the conditions under which the receiver is to operate. Greater volume with some loss in selectivity was found to be the result of close coupling, that is, with L-3 of fifteen turns wound over L-4. When the ten-turn coil was used and placed alongside of L-4, good volume was obtained with a remarkable sharpness of tuning.

CONSTRUCTION

The first step in actual construction is, of course, to drill the panel. The sub-panel should then be mounted on the Se-ar-de brackets and attached to the main panel by the rheostat mounting screws. The condensers, jack and switch should then be fitted to the panel.

After this is done, it is an easy matter to arrange the sockets and first resisto-coupler on top of the sub-panel and the audio-transformer, second and third resisto-coupler, etc., on the bottom. Flat headed machine screws should be used in place of round, to facilitate the mounting of parts on both sides of the sub-panel. Daven condenser mounting clips will be found very convenient, and may be easily mounted beneath the sub-panel.

Each pair of coils is mounted and fastened to the sub-panel by means of two strips of 3/16" hard rubber, ½" wide, as shown in figure 3 and in the illustrations.

WIRING THE SET

Before beginning to wire the set, it will be well to remove the coils and variable condensers, for these connections may be completed last. This will leave the remaining parts readily accessible and the builder will find the wiring of the set much less difficult.

The filament connections should be completed first. One filament terminal of each socket should be connected to the positive "A" lead. The negative filament terminal of the reflexed tube should go to the 20-ohm rheostat, which is in series with the 10-ohm master rheostat. This should be inserted in the negative "A" lead.

After the filament connections are completed, the "C" battery, "B" battery and grid return connections should be made; then the plate and grid connections, and last of all, the condensers and coils should be mounted and connected. This method of wiring was found to be the simplest and to contain the least source of error.

THE RESISTANCE COUPLED AMPLIFIER

Plate resistances R-1, R-3 and R-5 should be 100,000 ohms. Grid leaks R-2, R-4 and R-6 may be 2, 1 and .5 megohms respectively. If distortion occurs, however, it may be necessary to reduce the grid leaks to 1, .5 and .25 megohms respectively. In extreme cases where the incoming signals are very strong or where there is close coupling between L-3 and L-4

(*Turn to page* 38)

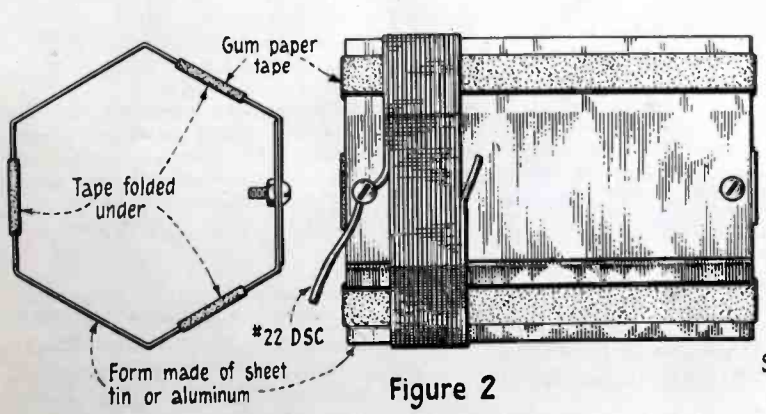


Figure 2

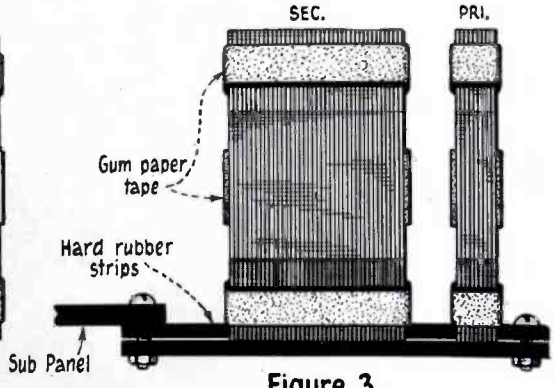


Figure 3

Form and method of winding the coil

Broadcasting in the Argentine

(*Continued from page 10*)

To appear before a little round black thing, full of holes, seems to frighten many of our Argentine brethren. They do not seem to fancy talking to no one and yet be told that they are talking to thousands. Very many speakers, even professional singers and orators have failed in their first appearance at the microphone. The only body of men who appear not to be afraid is the Congress. The Argentines keep a strict eye on their Congressmen by making them broadcast all their deliberations in the "Palacio del Congreso." That might do something towards conserving oil and other little things if it was adopted by the U. S. A.

However, radio is not all joy in Argentina. A new paraphrase of an old saying that seems to be appropriate would be, "When a radio set comes in on the door love flies out by the window." With the arrival of a radio outfit in many a home, discontent came with it, and on this account radio is none too popular with the married women—"las senoras." At first husbands were very wrapt up in this new form of entertainment, much to the satisfaction of their wives who saw in the radio a means of keeping their husbands from wandering at night. But radio has not yet the enticement or irresistible attraction of the café or club, with the result that those who remain at home are suspected of having a certain trouble—let us call it "radiolunacy," for want of a better word.

Sometimes husbands DO remain at home, but only to have a pair of earphones glued to the head and their hands wandering about in all directions over a little wooden box with lights in it. The poor wives are afraid to speak in case they might interrupt whatever converse their husbands seem to be having with the mysterious ether. To have your husband home and not to be able to speak to him is unbearable!

As an offset to the married women's antipathy, Buenos Aires is full of amateurs — people who want all their friends to taste the delights of radio; generous hearts and altruistic spirits. To prove he has these virtues the amateur will sacrifice himself to the bitter end in order to build receiving sets for all his friends. He understands—or pretends to understand—all the secrets connected with the air and earth around Buenos Aires. It is true that his home built set does not always work, but his place in the universal scheme of things is established. He develops radio fans who later—now they are radiolunatics!—will buy sets that are more perfect, more complicated and more expensive.

In Buenos Aires radio has made its impression on every walk of life; radio cigarettes, radio silk, radio whiskey—though it is not commonly called that! It has put Argentina on the map by putting Buenos Aires in closer contact with the "camp"—a term used to denote all the country outside of the cities. Buenos Aires is the Wall Street for all products; and since corn, flax, beef and hides fluctuate just as much as anything else—sometimes more so—a radio set, away out on the "estancia" or farm, is a *sine qua non* of the modern "estanciero"—farmer. Every night the closing prices are broadcast from Buenos Aires, so that the "estanciero" is no longer put to the inconvenience of waiting for the newspapers which in many instances, on account of the distance or condition of the roads, might take anything from three or four days to two weeks to arrive. Nowadays a troop of cattle is often on the road the morning after the closing prices have been heard over the radio, whereas formerly one would have to wait for the newspaper and through the delay involved perhaps suffer a considerable loss.

In art and industry radio is one of the most democratic institutions that has ever been known. From the dilapidated roof of a squalid tenement house with an antenna hanging from two broomsticks, as well as in the snug drawing room of some wealthy "estanciero" with an old gold collapsible or portable antenna, one hears the same music, the same song, whether from a circus ring or the Grand Opera of the Teatro Colon; and each and all may listen with the same ease and for the same price.

At 6:45 in the Morning

(*Continued from page 8*)

riety of people who take the exercises and the great variety of ways in which they find them valuable. You can see this best for yourselves by my quoting several of them for you. They are intimate to a degree shown by very few of the listener-in letters; but I quote them, except for the signatures, exactly as they came to Mr. Bagley:

"Dear Friends:

"My family, consisting of myself and husband, around 50, long, lean and lank (not fair, fat and forty), got up this morning to do the setting-up exercises. My spinster cat Priscilla had just breakfasted and retired to a cushioned chair for her early nap, but first thing we knew she was up, brushing around our legs, tail erect and purring, and when we got on the floor to do that part she laid down and rolled around, too, and thought it a great game.

Please send to my given address your chart.

"I think this Insurance Company is doing (and has been a long time), in its quiet and persistent, patient way, more good than can be realized.

"Such means as this will do more to make humans, young and old, come to a realization that a perfect body is better than a gold mine, and the glory of it is greater than the Temple of Solomon. I believe this is better solving of the 'Problem of Intemperance' (eating as well as drinking) and the menace of tobacco, where other means have failed, even the church. Why not spend more in keeping fit than in patching up? Why not take pride in this body, the 'Temple of God'?

"What a wonderful nation we would be if we worked with the natural laws of health!

"This is not a lecture, but please send the chart.

Yours truly,"

"P. S.—We did not keep time very good, but we had a good laugh, which we haven't been doing much of.

"Gentlemen:

"Having enrolled myself in your 6:45 A. M. 'Setting-up' class, I am writing, as advised, for one of your charts.

"Just at present I am a subject for a feather bed, or something soft, as I have gotten myself so stiff and strained from too strenuous a following of your directions the first morning.

"You tell us to smile—I'm glad you don't advise us to laugh heartily, as any such exertion, in my condition now, would make a grimace of what ought to be a happy face, and the laugh would end in a groan, I am afraid.

"Note this morning that the advice was for some of us to quit at 7 o'clock. I wish I had taken that advice just one day earlier, and today I might be able to get off my high stool in the office without an inward groan and a perceptible shuffling along, instead of that youthful, springy step we are all after.

"Hated to miss one exercise, as it was too good to let pass, it all being free, and I for one appreciate such a class, but will after this learn to imbibe just a sip at a time.

"Thanking you, and trusting to receive the chart, I remain,

"An appreciative member, not 30 years of age, neither 35, but sandwiched in between those ages."

"Dear Mr. Bagley:

"Kindly send me the chart which you mentioned over the radio this morning.

"It is usually quite difficult to get the children out of bed in the morning, but today they got up early without any trouble and did the exercises the best they could for the first time and surely enjoyed them.

"Your instructions were very clear and easy to follow and I think many more people will take exercises under your latest method than if they simply did so according to their own inclinations.

"Wishing you every success, I am,

"Yours very truly,"

The morning exercises are not, however, the only things which are broadcast from the Metropolitan Tower. An important part of the work will be the broadcasting of Tower Health Talks on Monday evenings. All of

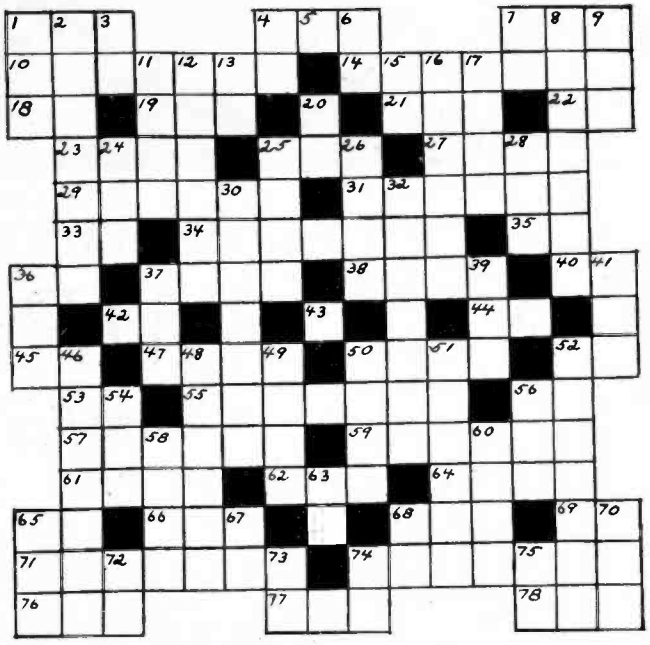
(*Turn to page 28*)

Cross Word Contest

First Prize—Wireless Age Radio Receiver; **Second Prize**—One pair Brandes Headphones; **Third Prize**—Two 201-A Radiotrons; **Fourth Prize**—A book, "Vacuum Tubes" by E. E. Bucher; **Fifth Prize**—A book, "Wireless Experimenters Manual," **Next Five Prizes**—Annual subscription to WIRELESS AGE—THE RADIO MAGAZINE.

HORIZONTAL

1—Broadcasting station in Charlotte, N. C.
4—Kind of transmitting set.
7—Large Radio company.
10—Inventor in Radio.
14—What you tune in on to hear radio concerts, etc.
18—New England state.
19—Uncovered (Poet.)
21—Broadcasting station in Cincinnati, O.
22—Dit, Dit, Da; Da.
23—Weary or fatigue.
25—Prefix meaning on this side.
27—An equal.
29—Force.
31—Mental conceptions.
33—Prefix meaning back.
34—Custodian of arms.
35—Ferrum (Abbr.)
36—Near to.
37—Broadcasting station in Milwaukee, Wis.
38—Evening (Plur.)
40—Rood (Abbr.)
42—Chemical symbol for selenium.
43—Indefinite article.
44—Belonging to.
45—Radiograms calling for Repetition (International code).
47—Broadcasting station in Toronto, Can.
50—Frozen.
52—Samarium (Abbr.)
53—Neuter pronoun.
55—Sticks fast.
56—Height (Abbr.)
57—Declines.
59—Man who attends horses at inn.
61—Found in storage batteries.
62—Nickname for one who stays up all night to hear DX.
64—Prefix meaning air.
65—Cuprum (Abbr.)
66—Eyes (Scotch).
68—Consumed.
69—Late Latin.
71—Separate.
74—Barren; unfruitful.
76—And so forth.
77—Unit of conductivity (Symbol).
78—Point on compass.



VERTICAL

1—Broadcasting station in Memphis, Tenn.
2—Apparatus for generating voltaic electricity.
3—Radio signal for "Position Report."
4—American Institute.
5—Radio signal for "Received."
6—Cesium (Abbr.)
7—New England state (Abbr.)
8—Swift and spirited horse.
9—Small insect.
11—Center of transformer.
12—Musical drama (Plur.)
13—Point on the compass.
15—Da; Dit Da Da.
16—Unit of current.
17—The tea plant.
20—Disarranged type.
24—Suffix meaning belonging to.
25—Flattened flower cluster.
26—Title of respect.
28—A sprite.
30—Earth terminals of circuits.
32—Radio contrivances.
37—Dit Da Da; Dit; Da Dit Da Dit.
39—Turf.
41—Unit of Resistance.
43—Indefinite article.
46—Complete path of current from positive to negative pole.
48—One who hauls.
49—Head cook.
50—Electrical conductor.
51—Property.
52—Rambles idly.
54—Nodule of earth.
56—Personal pronoun.
58—Run away from.
60—Sidelong look of malice.
63—Indefinite article.
65—Da Dit Da Dit; Da Dit Dit; Dit.
67—Province of Canada (Abbr.)
68—Nearby.
70—Sheltered side.
72—Victoria Cross.
73—Printer's measure.
74—Therefore.
75—Exists.

CRISS-CROSS

Composed by
Helen F. Dittus

Prize Conditions—Correct solutions accompanied by the best 50-word letters on "What I like best in WIRELESS AGE and why" will be awarded prizes in their respective order as specified above. The editor of WIRELESS AGE—THE RADIO MAGAZINE—will judge the letters on the basis of practical value, style and legibility. Closing date June 15. Solution will appear in July and winners in August.

APRIL RESULTS

FOLLOWING is the list of winners arranged in the order of merit:

Walter E. Housman, Scottdale, Pa.
Clifford R. Cooper, Wynantskill, N. Y.
*Mrs. F. W. Servais, Falls Creek, Pa.
*George C. Haseltine, Fort Stockton, Texas.
Henry A. Walker, Saratoga Springs, N. Y.
R. B. Blake, Nacogdoches, Texas.
Eldridge C. Barrett, Philadelphia, Pa.
Guinivere E. Barry, New Haven, Conn.
Inez V. Whitmore, So. Cairo, N. Y.
Mrs. Scott Campbell, Caro, Mich.
W. C. Greer, Detroit, Mich.
C. J. Rhea, Martin's Ferry, Ohio.
Philip T. Brown, Brimfield, Mass.

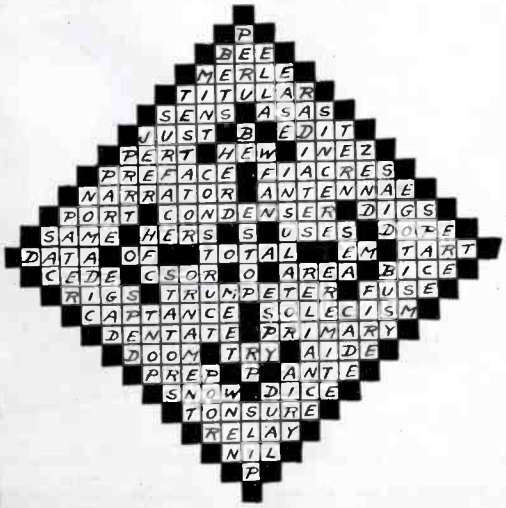
*Were also winners in previous contests.

THE following were necessarily rejected because of not complying with the conditions, the solutions being unaccompanied by a sentence made from the words:

E. Levern Godshall, Morwood, Pa. (Very neat solution.)
James Hoban, Detroit, Mich. (Very well done.)

SOLUTION TO MAY PUZZLE

Winners will be announced in July WIRELESS AGE

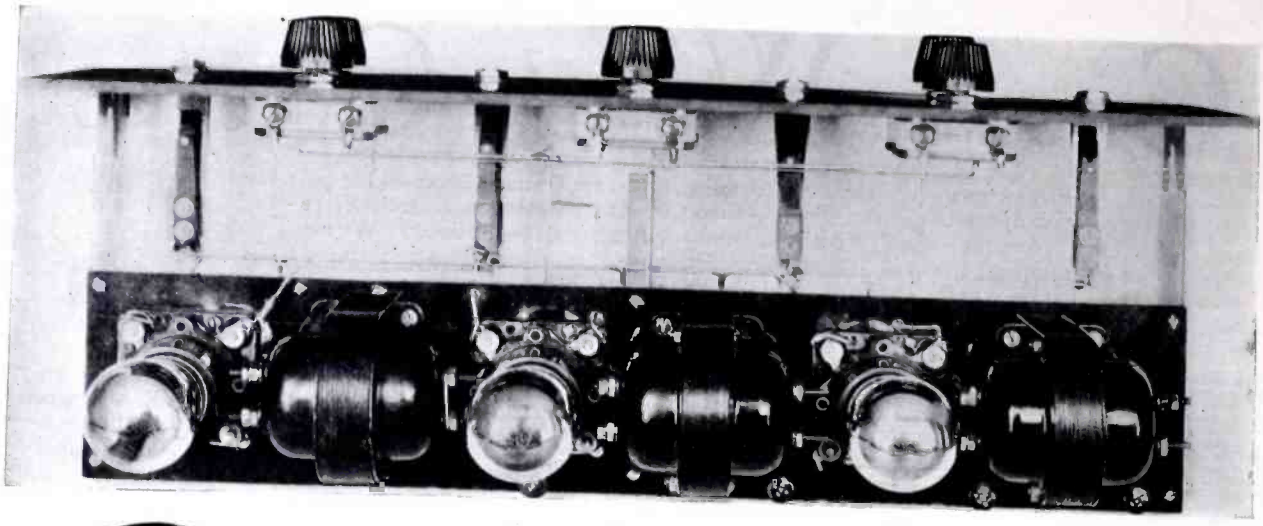


R. V. Thomas, Bucyrus, Ohio. (One of the neatest of all.)
John Wasilik, Jr., Franklin, N. C.
Grayce Wollgien, Chicago, Ill. (Lots of red ink, several errors and no sentence. Oh!)

THE following, although accompanied by creditable sentences are eliminated because of errors in the solutions:

Mary Manning, South Boston, Mass.
A. E. Madler, Hilbert, Wis. (Nice sentence; everything very neat, but—!)
Ernest Eastwood, Bridgeport, Conn.
Robert James, Oyster Bay, N. Y.
Mrs. J. O. Johnson, Medicine Lake, Mont.
Roger T. Lively, Atlanta, Ga.
Stuart Barney, Cuba, N. Y.
Carl E. Sonnemann, Radio Operator, S.S. Caddo.
G. W. Teale, Bethlehem, Pa.
Frank Ownes, New York City.
Joseph Willenburg, Baltimore, Md.

And numerous others, including Nelson Hargrove of Wills Point, Texas, who reminds us that he has SOLVED the puzzle, but whom we must remind in return that he has not, because we found ten wrong words in the solution.



an inexpensive POWER AMPLIFIER

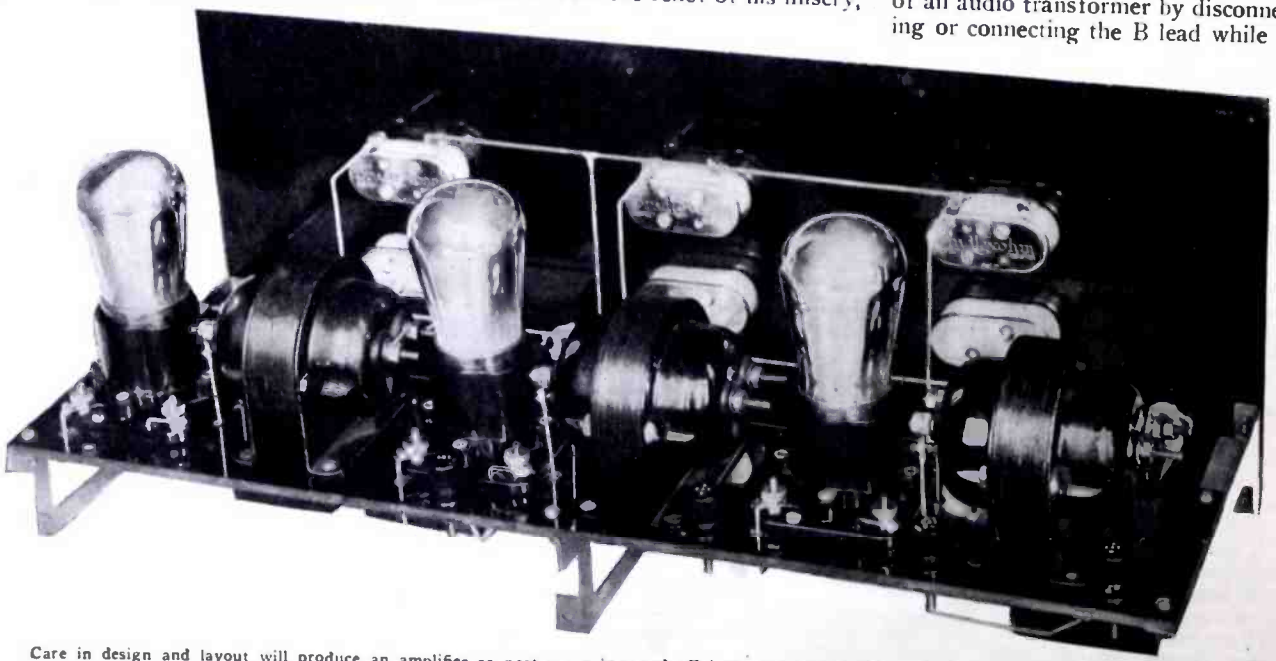
By R. A. Bradley

TO THE owner of the familiar three-tube or five-tube set all too frequently comes the sort of helpless desire, expressed by "Oh if I had had only one or two steps more 'kick' on that station, I could bring it in on the speaker." Some times he collects another tube socket and transformer and hooks it up. After listening for a short time to a high pitched whistle or a squeal, distortion and other connivances of the Evil One, he tears it down and continues to wish. When you know of such a person, kindly present our compliments to him and inform him that in the June issue of WIRELESS AGE the relief of his misery, the solution of his difficulties, and an amplifier after his own heart, capable of amplifying with superb quality—with power sufficient up to the carrying limit of the last tube is made known to him.

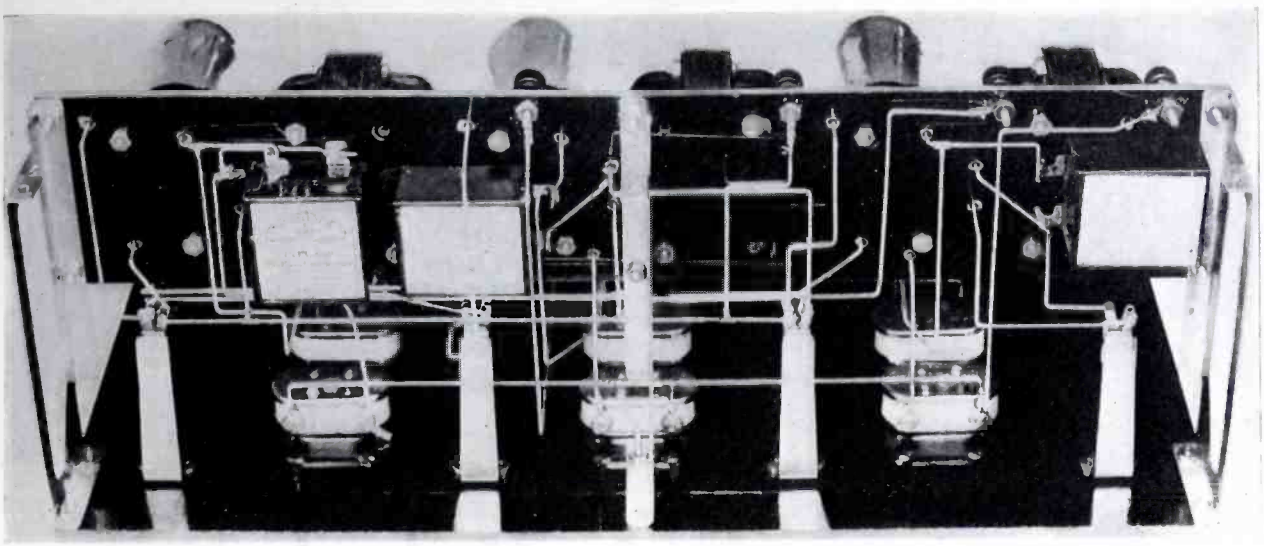
LIST OF MATERIALS

One Panel 7" x 18" Radion.
One Sub-panel 3½" x 17".
Three Benjamin Sockets.
Two Benjamin Panel Brackets.
Three Bradleystats.
Three Audio transformers (see text).
Three Two. mfd. condensers Dubilier.
Three Bradleyohms (50,000 to 500,000 ohms).
Four Eby Binding Posts.
Four Carter jacks (see diagram).

This wonderful do-all is a three-stage choke-coil amplifier employing as the chokes or reactances not an expensive hard-to-get instrument, but any old audio transformer which you happen to have lying around the junk box. All of us have had the hair-tearing experience of blowing the primary winding of an audio transformer by disconnecting or connecting the B lead while the



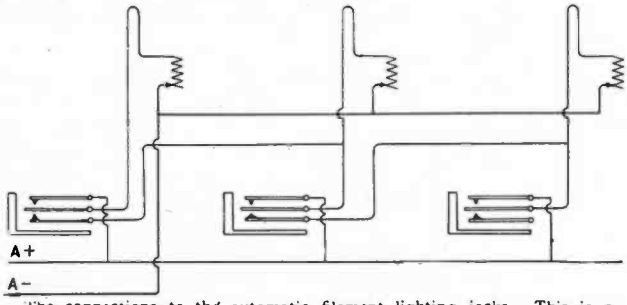
Care in design and layout will produce an amplifier as neat appearing and efficient as this one. Note how the leads to the transformers and tube sockets run through the sub-panel instead of on top of it



Connections to all instruments are made underneath the sub-panel. This is possible and desirable because of the unusual layout

tubes were lit. Here is a use for the transformer so maimed, providing its secondary winding is intact. Only the secondary winding is employed or, if you desire, you may use transformers whose primaries are not blown. The primary winding is not used, so blown or intact it has no effect on the operation. You will need three transformers or chokes. Rustle around to some of your friends and purloin as many as you need. You are going to require also three rheostats and three variable leaks having a range of 50,000 to 500,000 ohms. We used the Bradleyohm of that range and we are particularly partial to it. It is silent in operation and affords a perfectly smooth and steady control of the leaking action of the grids of the three tubes. We recommend them not for name's sake, but because they merit commendation.

Each stage, of which there are three, consists of a coupling condenser which may be either 1 mfd. or 2 mfds.; a Bradleyohm grid leak; a reactance or impedance which is your transformer secondary winding; and tube, socket and rheostat.



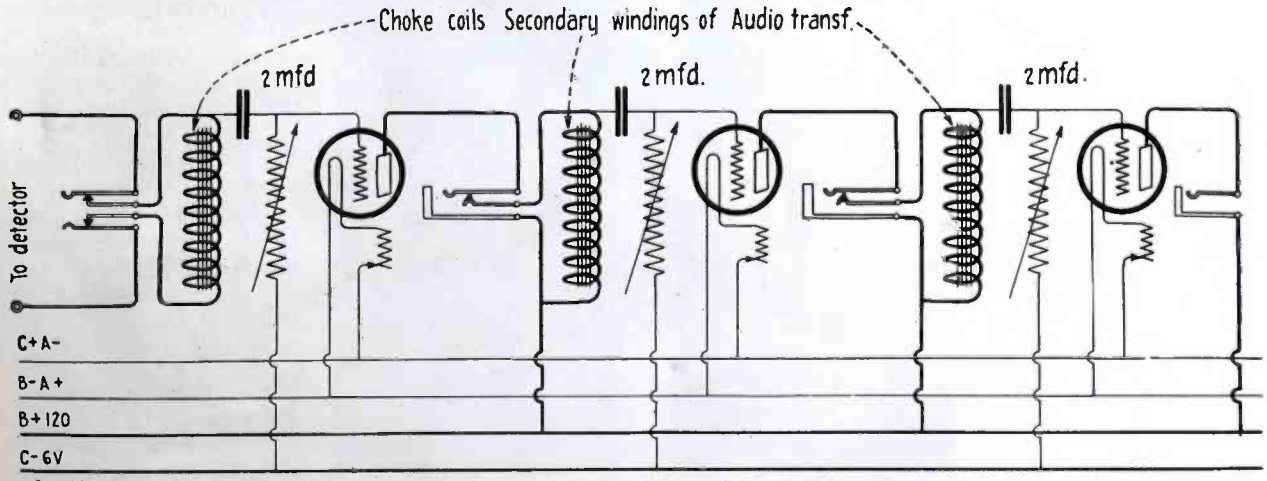
The connections to the automatic filament lighting jacks. This is a very handy and convenient addition to any set

Three stages will be sufficient so take this list of materials and seek out the junk box. Where it falls short the dealer will fill in at a minimum of expense. Unless you are thoroughly familiar with set construction it would be best to lay out and set up the amplifier on a board about 12 inches by 36 inches. Give everything lots of room and wire it up with bell wire. After you are familiar with its layout construction and operation then tear it down and construct as ours is here with a neat panel layout and short leads. We employed filament lighting jacks on this amplifier, as the adjustments on the rheostats should (after the lowest operating temperature is found) be untouched.

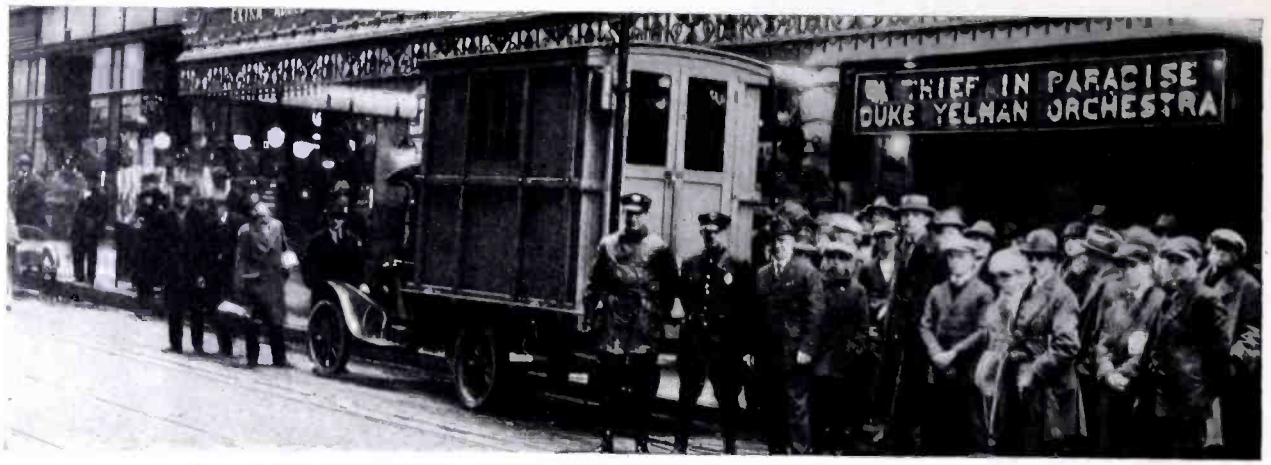
CONSTRUCTION

Procure all the necessary parts first. This is imperative and we want to put it as strongly as possible. There is nothing so disconcerting and annoying as to stop in the act of soldering a connection with an iron which has finally decided to tin, and run to the store for a fixed condenser or a rheostat. Leave the panel drilling and layout until the shelf assembly is finished. Mount alternately chokes and sockets on the 3½" x 18" shelf. Fasten these down with 6-32 screws and nuts. Next

(*Turn to page 38*)



In this circuit diagram the ordinary connections to the filament are shown. If the automatic filament lighting connections are desired follow this hook-up with the exception of the filament connections, then refer to the other diagram



Westinghouse short wave portable transmitter in front of the Million Dollar Theater, Pittsburgh, Pa.

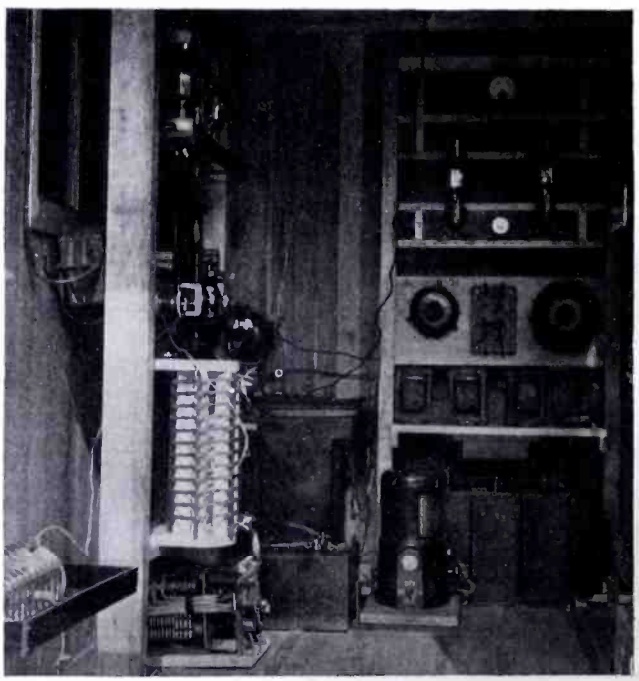
PORTABLE SHORT WAVE TRANSMITTER

By C. J. Burnside

OF THE millions of radio fans who nightly comb the ether in search of entertainment and amusement, few are in a position to know the problems that daily appear in this new business of broadcasting. It is hard to realize the difficulty of bringing to them that clear, sweet note of the violin, the soft tones of the human voice and the ever-popular bedlam of noise so dear to the ear of the lover of jazz. It all seems very simple. You turn your dials to a certain position and there it is, that music, lecture or bedtime story you knew you would find on the air, coming from your favorite station. The music and voice are so perfect in their quality and naturalness of reproduction that they seem to come direct from the orchestras or speakers themselves. The fact that the music and voice come so perfectly is made possible only through the untiring work and farsightedness of the engineers and executives of the radio profession.

Many problems arise daily in broadcasting work that bring out novel methods in their solution. To overcome difficulties encountered in picking up programs from remote places, where telephone lines for carrying the program to the station were either unobtainable or electrically unsuitable, the Westinghouse Electric and Manufacturing Company has developed a portable relay station to bridge this gap.

In many places, such as athletic fields, and outdoor concert platforms, lines are not always easily accessible. If programs are but seldom broadcast from such places, the expense of installing special lines for the occasion is prohibitive. Again, in many places where lines are obtainable, the electrical characteristics of these circuits make them unfit for use as radio pick-up lines. The use of such line results in the distortion of music and speech, with consequent loss of quality, so easily detected by a critical listener. No station which prides itself on a high standard of quality can afford to make use of such facilities. This was one of the problems which brought about the development of the portable short wave transmitter used by the Westinghouse Company in the Pittsburgh district.



View of the interior of the truck showing the transmitting apparatus

The requirements of this transmitter were that, first, it be absolutely dependable at all times; that it be able to go anywhere and work properly; that it make use of a wave length free from interference, and that it take up as little room as possible. Also, the personnel necessary for its operation must be be small. A belief that some of the details of its construction and operation might be of interest to the radio fans has prompted the writing of this article.

This transmitter is a quarter kilometer set, mounted on a one-ton truck and is complete in every detail. The power to run the set is obtained from the 110-volt lighting circuit in the building or location from which the program is to be broadcast. A flexible power lead 250 feet long is a part of the truck's regular equipment

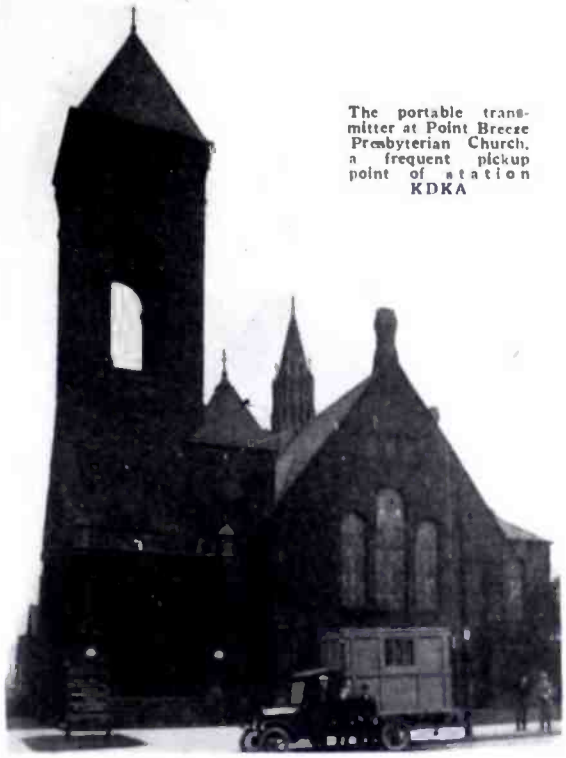
and brings the power from the building to the truck. As 110-volt A.C. power is available practically everywhere, this takes care of the problem of power supply.

A power transformer on the truck is used to get the necessary high voltage to operate the set. The power at this high voltage is passed through a vacuum tube rectifier, making use of two quarter-kilowatt air cooled rectifier tubes giving single phase full wave rectification. The output of these tubes is passed through a brute force filter of chokes and condensers, which delivers 2000 volts D.C. power to the transmitter. Means are provided for changing the voltage applied to the rectifier tubes to take care of variations in the voltage of the lighting circuit, thus assuring unvarying supply to the transmitter.

The transmitter itself makes use of the standard oscillator circuit with Heising modulation, using a quarter-kilowatt modulators. The tank circuit of the oscillator is a standard inductance of the usual solenoid type, wound with heavy copper strap, and an oil immersed variable condenser is used to tune this circuit to the desired wave. The wave band from 51.7 to 54.5 meters is the one used and the set is ordinarily operated on about 53 meters. The filaments of the oscillator and modulator tubes are lighted by large capacity storage batteries carried on the truck. As each tube draws 15 amperes for filament current, the drain of 45 amperes discharges these batteries at a very rapid rate. After each program the batteries are recharged by means of a charging outfit, which is a part of the equipment of the truck. It was found in operation that at the extremely high frequencies at which the transmitter was operated, the movement of the operator in the truck caused the wave length to shift, much the same as with an unshielded receiver. To overcome this difficulty the transmitter was completely enclosed in a shield of copper screen, only the necessary control switches being outside the shield.

The antenna system presented a problem of many angles. As the set was at times to be used in downtown areas where space is at a premium and overhead trolley and light circuits made guy wires and ordinary antenna construction impossible, a collapsible jointed antenna of the vertical oscillator type was used. This consisted of a copper pole in three sections, made up of heavy copper tubing, varying from three inches at the bottom to one and one-half inches in diameter at the top. When not in use, the pole was unjointed and stored in a rack under the truck body. When the pole is to be used it is first put together on the ground and then raised in one piece. It is mounted on the rear end of the truck, where it is held in two clamps insulated from the truck by porcelain pillar insulators. The three-man personnel of the truck, two operators and a truck

(Turn to page 53)



The portable transmitter at Point Breeze Presbyterian Church, a frequent pickup point of station KDKA

The Westinghouse portable s.w. transmitter in front of the Syria Mosque in Pittsburgh, another of KDKA's pickup points

At 6:45 in the Morning

(*Continued from page 22*)

this work will be done under the direction of Dr. Lee Kaufer Frankel, Director of the Welfare Division of the Metropolitan Life Insurance Company. Dr. Frankel's work is perhaps the most far-reaching of any medical man in America, for you must remember that one person out of every six in these United States, and it is rapidly approaching one out of every five, is a policy holder in the Metropolitan and is entitled to all the health aids which the company can devise and circulate. Under his direction in the last fifteen years about three hundred and fifty million pamphlets of a health educational type have been distributed, most of them directly to the homes of the working people, who are circularized about every two weeks by the company's agents, some sent in response to requests from policy holders and many thousands of them used in classrooms by teachers. In directing the Tower Health Talks on Monday evenings Dr. Frankel will give some of them himself and will have other great experts assist him. The talks will be on timely topics. For instance, on May Day, in connection with the nation-wide May Day Festival, undertaken in the Child Health Campaign, Mrs. Aida de Acosta Root, daughter-in-law of Elihu Root, talked on the value of such a festival for the nation.

In charge of the apparatus in the tower is to be found Mr. Raymond S. Hoyt. Mr. Hoyt, besides being the engineer in charge of the equipment, does the announcing and introduces Mr. Bagley every morning. He is a member of the regular engineering force of WEAF and has progressed from a clerical worker in the employ of the American Telephone and Telegraph Company to his present position of radio expert as a result of experience obtained by going to sea as a radio man. Mr. Hoyt finds himself in charge of one of the most delightfully situated stations in the country and if he has time to look out of the window he undoubtedly feels recompensed for the early morning hours which he must keep in order to be in the tower to attend to the broadcasting.

The exercises and talks are also broadcast from WCAP of Washington and WEEI of Boston, so that Metropolitan policy holders from Pittsburgh to Portland, Maine, and from Oswego to Richmond, Virginia, will be able to tune in.

You may if you wish, by writing to Mr. Bagley, not only receive your very necessary exercise chart, but you may also be enrolled in a regular exercise class, thereby receiving special instructions which will enable you to get the full health value out of the programs. The benefit which the nation at large may derive from this splendidly worthwhile contribution of the Metropolitan Life Insurance Company can hardly be measured. In regard to it Mr. Robert Lynn Cox, second vice-president of the Metropolitan, in charge of the radio and advertising work, says:

"We are beginning in a small way, but we plan to extend this radio health program just as far as our people want it extended. We won't have to rely only on letter writers to tell us whether we are giving them something they want and in the way they want it. From time to time we will conduct a house-to-house survey through our agency force and get some genuine radio audience information. By means of a questionnaire we plan to get the real *viva-voce* opinion of the policy holders, not only on our health program, but on radio programs in general."

If you do not get the full benefit from the Tower Health Talks and Tower Health Exercises, surely you will have no one to blame for it but yourselves.

Whimsy Williams

(*Continued from page 14*)

occurs to me that it may come in handy for company on the shift I'm riding. I never was much of a hand at singing and I am sort of hoarse at this time and feeling as I do I have a sort of idea that listening to this radio does me good and maybe soothes them beef steers a whole lot.

When I get up my horse and ride out, after fastening this here contraption to my horn, where it makes considerable bulk, I don't go past the fire close enough to interfere with anyone, but I see Whimsy Williams come in and strip his horse and then I get a glimpse of Mirabelle going up to him and throwing her arms around his neck, which rouses envious feelings in me. Likewise I see Slim and Shifty standing sort of uncomfortable near the fire and sort of glaring at the ground and at each other. And then Mirabelle looks up and around as if she was seeking some one, but I don't allow it is me and ride on, seeking solitude and soothing a whole lot.

It's maybe a mile up to the Hollow and when I get there it is almost dark. I relieve the Mexican who is holding the herd and settle down to the job. For a long time there is nothing to do but saunter around and keep the bunch together and there don't seem no likelihood that anything will start during the night since it is clear and the coyotes and *lobos* are right quiet. So I have plenty of time to think of Mirabelle and why she inquires about my manliness and asks me to pack a gun. And I imagine a whole lot about how she is sitting around that camp and exchanging looks with Slim Burgoyne. "Youth to youth," says I, "and it's plumb hell to be rising thirty-six!"

IT IS dark by now and a coyote tunes up over on the ridge, causing a feeder or two to snort and move. And here is this radio set standing neglected on an outcrop of rock nearby, where I have chucked it down. It is time to start rambling, but when I think of rolling round that bunch of beef, singing the "Blind Child" and such ballads to soothe them, I get a lump in my throat and allow I would stampede them *pronto* if I tune up. Besides which I am curious about this radio and what it does as a labor saver. So I get down and set that loop right for Angels and then fish around with them jiggers that does the tuning like the storekeeper shows me. And pretty soon there is a sound like pulling a rusty nail out of a hard board and the next instant I busts right in on someone singing from clear out on the Coast.

She is warbling something about Jerusalem, Jerusalem! Hark how the Angels sing! And she has a voice that sure ambles up and down the scales like a fireman climbing a ladder. I reckon this songbird is what they call a soprano and she is plenty shrill and vociferous about it, too. And the song she is singing, which is a sort of hymn tune, don't exactly appeal to me as the sort of thing which would suit a bunch of frisky young beeves feeling restless at night. But since I have started it I don't like to turn her off right away, so I climb on my horse and sit there listening before I take up the round.

I see the stock rising wherever they have laid down, and some of them begin to mill around and wander, stopping and looking thisaway with their ears pricked up. One of them tosses his head, paws the ground and starts to dive into the bunch. And I get a little dubious regarding this radio and modern progress as I see that. I don't dare take time to alight and turn the thing off. I have to start right there and then to circle that herd and hold them tight.

Just as I trot around on the side opposite the camp, that there songstress down in Los Angeles gets to a climax and she sure lets her out a-plenty. I hear her voice reaching and climbing and soaring right on up the ladder until it ends in a regular squeal that makes your ears ring.

"Hosannah!" she yells. "Hosannah IN the HIGH-E-E-EEST!" and she holds on until she rings it dry. And just then I hears what sounds like a shot from down around the camp.

IT DON'T do me no good to hear it. That there radio has already fixed my clock. When that lady in Angels leaps onto that high C and wrastles it flat, it shocks them beeves to distraction. They could have stood for *lobos* and coyotes, and even for a lion or two, but hymn tunes coming out of the air from a thousand miles away is too plumb modern for them. They wheels with one concerted snort of anguish and sets out from there on all fours. I see a hundred and fifty heads go down and a hundred and fifty tails go up. There is a sound of thunder and a cloud of dust and then hell swells up and blows off the lid!

I roweled my horse from shoulder to flank and wrapped my quirt around his belly. We was runnin' before I even thought about it and you can lay to it that I swung around that bunch with my horse's belly scraping the ground, he was going that fast. But them cows was going almost as fast and they was crowding each other in their hurry. I had to squeeze past quite a few of them and it was slow work gaining

(*Turn to page 36*)

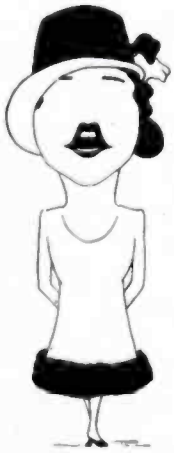
Broadcast Impressions

By Ed Randall

Walter B. Rogers is the Conductor of the Brunswick Concert Orchestra. At the moment of posing for this spirited delineation, he was holding 'em down in "Anitra's Dance" from the Peer Gynt Suite.

Isham Jones leads a steaming jazz band. "The Oil Can Blues" is intriguing in melody and title. Likewise, they played "Tell Her in the Springtime" and "Oh— How I Miss Her!"

Allen McQuhae is the jolly tenor who sang "June brought the Roses" and "Yearning" and then he sang "Down Deep in an Irishman's Heart." The troubled expression is to denote the feeling with which he sang "Yearning."



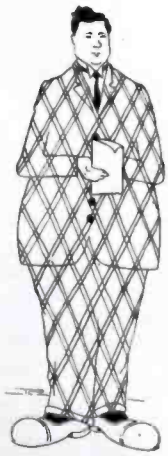
Jane Green is a pretty little girl with a most fetching bonnet and a sweet plaintive voice for "Why Couldn't it be Poor Little Me?" and "I'll See You in My Dreams."

The Brunswick Hour of Music

The Brunswick Hour of Music has occurred every Tuesday evening during the past winter, broadcast directly from the Brunswick Studios through WJZ at Aeolian Hall, New York City, and linked up with Stations WGY at Schenectady, WRC at Washington, WBZ at Springfield, KDKA at Pittsburgh and KYW at Chicago.

Irene Williams has a sweet soprano and sang "Oh! For the Wings of a Dove!" and "I Dreamt That I Dwelt in Marble Halls" from the Bohemian Girl. If her listeners could but see her pretty pink dress, it would knock 'em for a row of fashion magazines.

Frank Munn has a rotund "figger" and an equally stout tenor. He was most pleasing in "You're Just a Flower From an Old Bouquet" and "Memory's Garden."



Milton J. Cross is the genial, jovial announcer. He takes a big breath, and forthwith talks all over the United States.

Max Rosen rendered the "Rose's Complaint." Many listeners think that he is one of the coming violinists of the age.

Balancing Systems

A description of several devices that have been developed for the purpose of neutralizing the effect of atmospheric disturbances

By John R. Meagher

This article was prepared exclusively for WIRELESS AGE, the Radio Magazine, during the month of February, 1925, and is copyrighted by the author

THE underlying idea of practically every 'static eliminator' that has been devised is to oppose the static or other undesirable impulses in the tuner with similar impulses of equal strength, but opposite direction or phase so the two forces balance out or neutralize each other.

This is represented graphically in the diagram figure 1. Suppose the static force A was present in a tuner; it is shown to vary from positive 3 to negative 3 units of force (voltage) in a time interval of 1 unit. The voltage across the tuner at any instant will be at some value between positive 3 and negative 3. Now if at any instant a force B of equal, but opposite value is introduced in the tuner the resulting force will be zero. For example if at the moment the force of A is negative 3 units the voltage of B is positive 3 units, the resultant will be zero. If the force B is continued as shown so as to be of equal but opposite value during the time the force A is acting, the over all result will be that the forces balance each other and neither A nor B will affect the receiver.

In order that the forces may neutralize each other it is necessary that the device be capable of bringing about the following conditions:

First, the opposite forces must have equal intensity or voltage amplitude.

Second, the forces must be of exactly opposite direction or phase.

Third (this is more or less of a combination of the first and second conditions), the forces must have the same shape or form but in opposite phase. In other words they must be equally opposite at any and every instant.

If the forces are not equal the larger will predominate as shown in figure 2. A is one force, B the other. C, the algebraic sum of A and B, is the resultant or force that will act upon the receiver.

If the amplitudes of the forces are equal, but if the forces are not in exactly opposite phase they will not balance. This is shown in figure 3. A is one force, B the other. They are shown here in exact phase with each other. C, the algebraic sum of A and B, is the resulting force that will act upon the receiver.

Likewise if the two opposing forces have equal intensity, but different form or frequency they will not balance. This is represented in figure 4 where C is the resultant of the two forces A and B.

It is not difficult to arrange matters so the above conditions are fulfilled. Thus in figure 5 two antenna circuits are arranged with suitable tuning coils coupled to the secondary which is con-

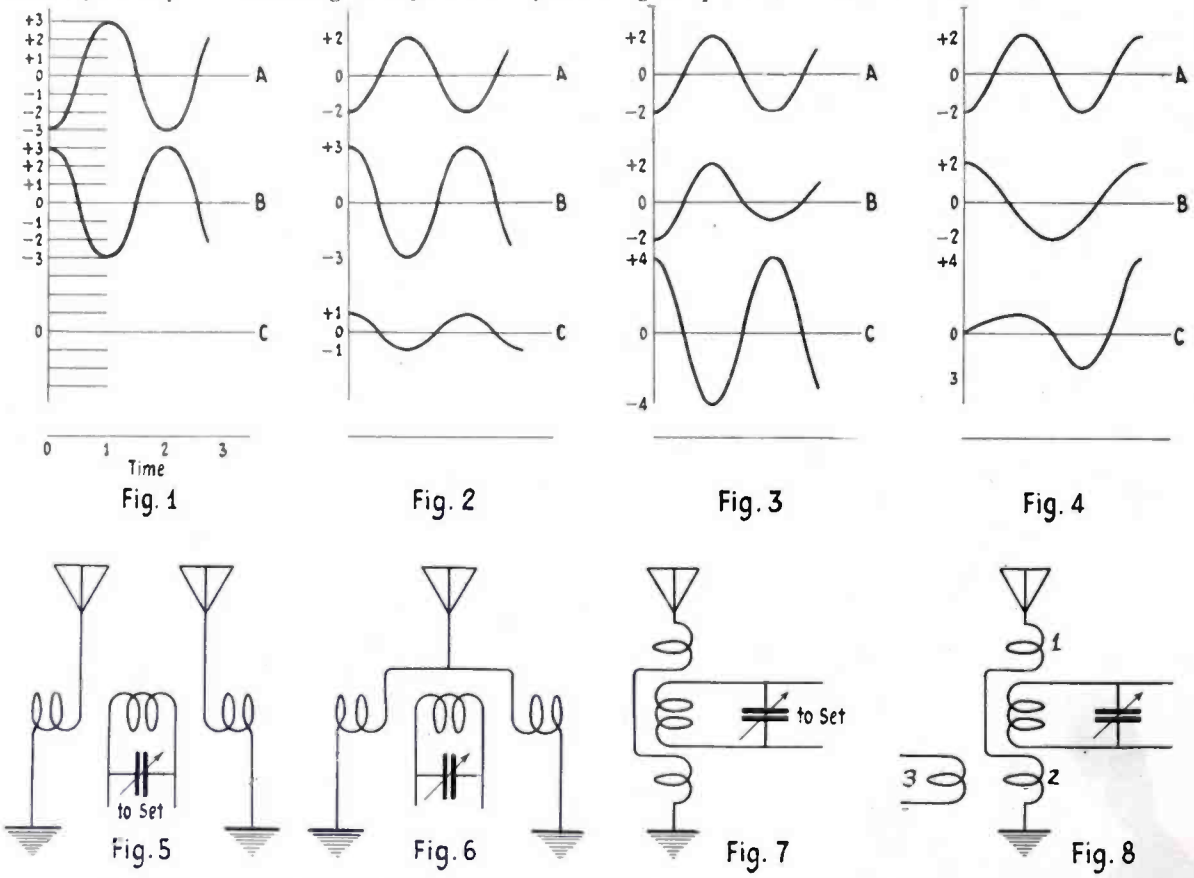


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Fig. 5 Fig. 6 Fig. 7 Fig. 8

Characteristics of certain impulses encountered in reception and various circuits devised to control these impulses

nected to the receiver. By adjusting the coupling the forces induced in the secondary from each antenna may be made equal and by correct connection the forces may be made opposite in phase so they will neutralize or balance each other. As a result the receiver will not be affected by either force. Figure 5 may be modified without change in operation to the circuits of figure 6 or 7.

These schemes are excellent 'static eliminators' but unfortunately they are also very effective signal eliminators because they act in the same manner for radio signals as for static. In other words when the circuits are balanced neither radio nor static will be heard! He claims that the static force in each antenna will be practically equal, but that the signal force in the higher will be stronger than the signal force in the lower. By opposing the forces in the two antennae the static forces, being equal, will balance out, but the greater signal force of the higher antenna will predominate over the signal of the lower antenna and the difference or resulting force will affect the receiver. (See figure 2.)

This invention is based on the assumption that the ratio of static to signal will be better in the higher than the lower antenna. But as we see it from practical experience the ratios will be about equal so that if at the balancing device the static force of one antenna is made equal to the static force of the other then the signal forces would also be made equal and when opposed both signal and static forces would be balanced out. This is what actually happened in a series of tests conducted by the writer.

The problem is to arrange a device in which a balance will exist for static or other undesired forces, but in which the signal force will not be balanced or neutralized.

It is in seeking a solution to this problem that the fun begins—and generally ends.

One inventor has been granted a patent on this idea: He uses the circuit of figure 5 and specifies that one antenna must be higher than the other.

THE TAYLOR SYSTEM

A much better system is credited to the engineer Taylor. Indeed this is one of the best ideas that has been developed thus far.

He proposes that one antenna of figure 5 should be of the Roger's underground type in which an insulated wire is buried a few feet beneath the surface of the earth. The other antenna would be of the coil or overhead antenna type. Taylor assumes, and there is good reason for the assumption, that the Roger's underground antenna has a better signal-static ratio than the regular overhead type. Or in other words, that for equal static intensity in the two antennae the signal force in the underground antenna will be greater than that of the other.

When the static and signal forces of one antenna are 'bucked' against the static and signal force of the other, the static forces, being made equal will balance out, but the stronger signal force of the underground antenna will predominate over the signal force of the other aerial. The difference in signal forces, sans static, will affect the receiver.

The only drawback that the writer can see to this system, aside from the

(*Turn to page* 45)

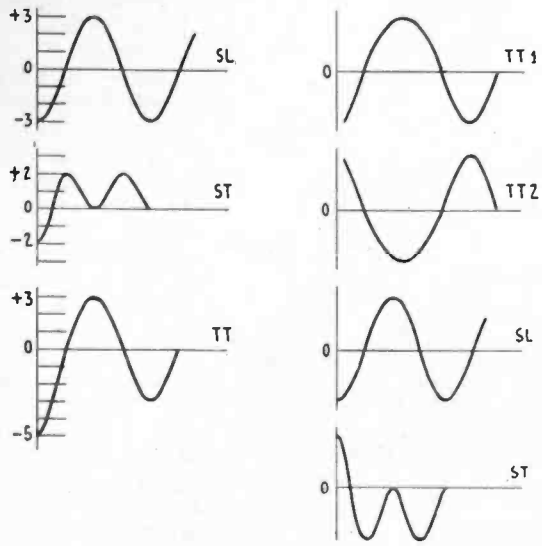


Figure 9

Figure 10

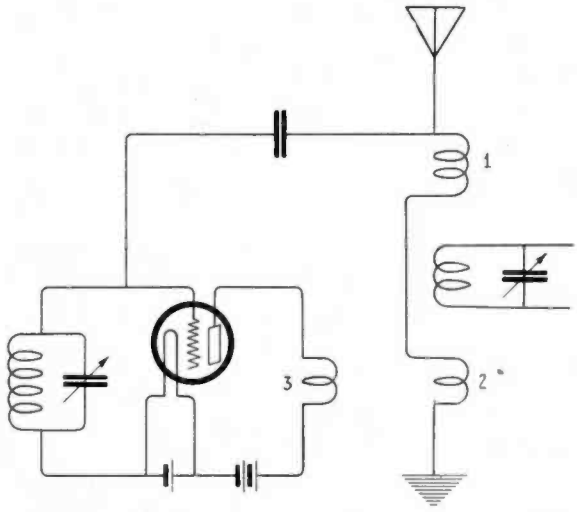


Figure 11

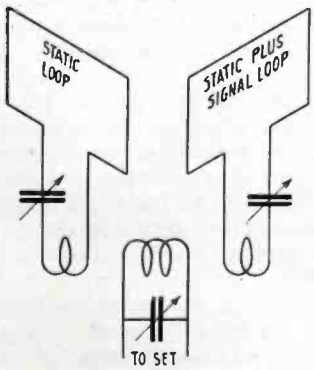


Figure 12

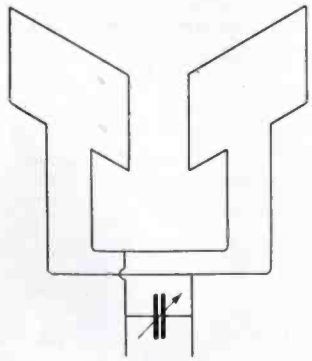


Figure 13

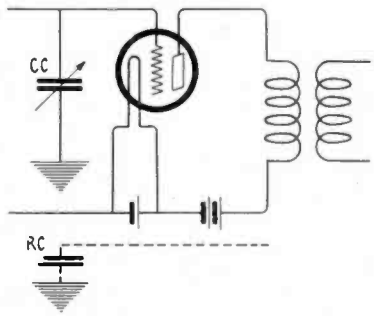


Figure 14

Circuit diagrams of various wave-traps to eliminate atmospherics

the radio experience of an ESKIMO GIRL

"The Arctic," a Canadian exploring ship, brings the marvels of civilization to the frozen North

By Richard Finnie

Assistant operator aboard "The Arctic"

THE anchor chain roared down and the Canadian Government Exploring Ship, the *Arctic*, came to rest at the Eskimo Village at Ponds Inlet, five degrees above the Arctic circle. Here at the northern end of Baffinland is a village of one hundred or so inhabitants, consisting of representatives of the Hudson's Bay Company, the Royal Northwest Mounted Police and Eskimos, but mostly Eskimos.

The arrival of the *Arctic* is the great event of the year. To the Mounted Police it brings the year's supplies and also new Mounties to take the place of those going out; to the Eskimo it brings the wonder of the white man's civilization—the gramophone, the moving picture machine, and now the greatest of all marvels—radio.

Two belles of Ponds Inlet, North Baffin Land—they are among the few Eskimos who have experienced the delight of "listening-in"

For a number of years a government movie operator has gone north with the boat taking pictures of the Arctic, its scenery, the seals, the walrus, the musk ox, the polar bear and also many pictures of the Eskimos.

For twenty years, Captain Bernier, Canada's veteran Arctic explorer, has been going into the Arctic; eight complete winters he has lived in the frozen North. All of the Eskimos know him and have conferred on him tribal names. So each year Captain Bernier has shown the Eskimos the pictures of themselves taken the year previous until now they take as much pride in their own movie efforts as Hollywood's greatest stars.

Their present reaction, however, is far different than it was the first time they saw movies of themselves. The first time they viewed themselves on the screen, they would gaze first at the screen and then around the cabin at the individual being shown, then one by one they crept up to the screen and felt over its surface to see if the individual shown was actually there. Today they are hard-boiled movie fans for they have viewed the white man's cities, the locomotive, the aeroplane and the submarine through the magic eye of the camera.

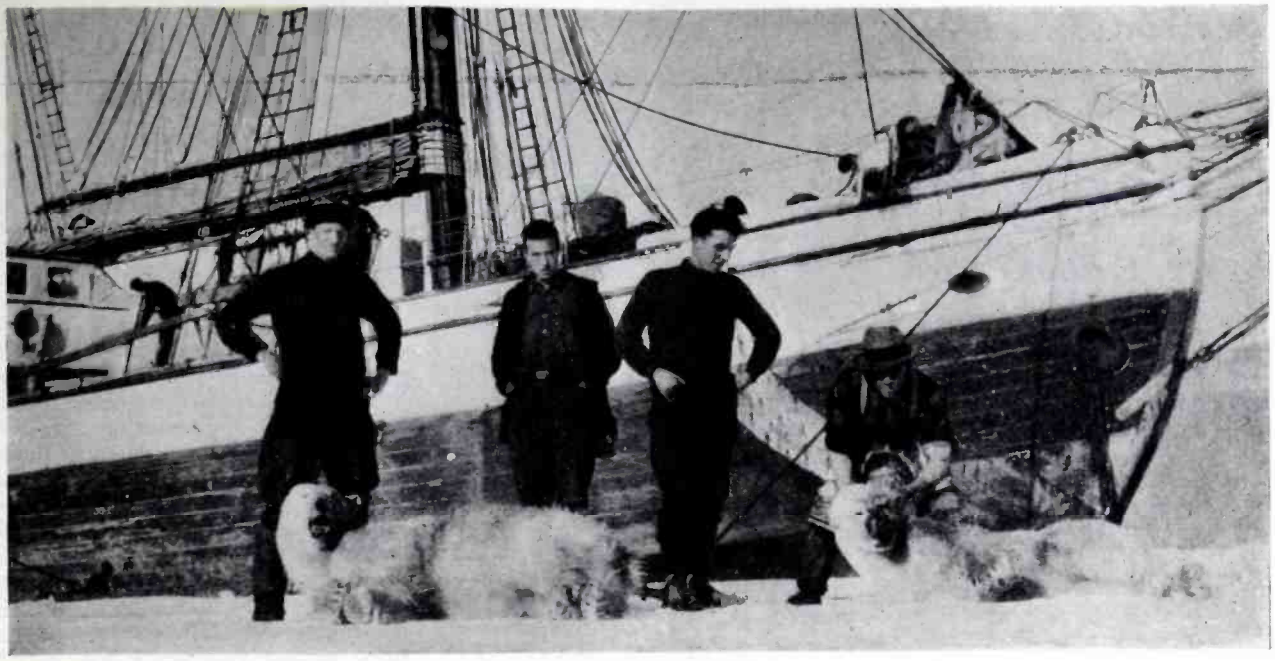
Richard Finnie taking a morning dip

Accordingly this year, Captain Bernier arranged for the annual party of the "Innuit" as the Eskimos call themselves. A part of the deck was covered with awning and sails to shut out the glare of the midnight sun, which in summer never sets in this far Northern latitude. The Eskimos began to arrive; some in the ship's launch and others in their kayaks or skin-boats.

Over the rail they poured—ugly old women and handsome young ones; women with children on their backs; old men with long hair and young men with bobbed hair. They seated themselves about the deck while the stewards served them with coffee and biscuit. This was a change from seal meat, blubber and caribo. For dessert they were given an orange, which they ate, skin and all.

Then the movies started. With shrieks of childish laughter they watched themselves on the screen until there was flashed a picture of two children, which had died the previous year, and then silence settled down and the mother, who was present, wept.

When the pictures were finished the phonograph was started and the dance was on in full swing. Here is an interesting thing to note. If you mention Eskimo to the man in the street, there appears instantly to him a vision of a race of savages living amidst a desolate land of snow and ice, knowing nothing of the pastimes and pleasures of civilization, but he would have been startled had he stood on the deck of the *Arctic* that August night. Around the floor couples gracefully glided, fox-trotting to the rhythm of "Doodle-doo-doo," and some of the Eskimo flappers certainly shimmied a wicked seal skin. They might well have been in a metropolitan cabaret, but for the frocks of the girls; they



The result of an early morning polar bear chase

were dressed from head to foot in furs, and were Eskimos!

Later in the evening one of the wireless operators with his partner, Amiroili, slipped away to sit out a dance. They went into the wireless cabin, and the head phones being adjusted, the receiver was put into operation and was carefully tuned to KDKA short wave.

Up to this time Amiroili had shown great interest in the proceedings, but had no idea what it all meant. Then there was a sharp whistle and "KDKA, East Pittsburgh, Pennsylvania," said a familiar voice. Soon came the strains of a popular melody played by a dance orchestra, loud and perfectly clear. Amiroili's face beamed. She sprang from her chair and kept time to the music with her feet as she listened. Though it was midnight, it was broad daylight and the midnight sun was shining. Nevertheless, the jazz from KDKA continued to flow distinctly in for several minutes, till, much to the disappointment of the Eskimo maiden, it faded and died away.

Then came the words of the announcer—"This is KDKA, the world's pioneer broadcasting station of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pennsylvania, signing off." It was useless to hunt further for radio broadcasting, as for weeks nothing, but the short wave radio signals from KDKA had been able to penetrate through the Arctic daylight to this far Northern point.

The radio operator of "The Arctic," Richard Finnie

Amiroili had been pleased at the performance of this strange device of the white man, the radio receiver—but she was not frightened or awed. Such is the manner in which the "Innuit" accept many of the white man's marvels. They do not attempt to understand them, but they are interested and unafraid.

The next day the boat lifted anchor and sailed North touching at Etah, and from there proceeded still farther North to Cap Sabine, within eleven degrees of the North Pole, at which point a new world's farthest North Radio record was made, when again the powerful signals from KDKA's short wave station came through to us bringing messages from our friends at home.

To you back in the States it is difficult to realize the effect of association with one's home affairs at such remote corners of the world as the Arctic Circle, but that it renews the impressions of wonder at the marvels of radio to even an old "op" you can rest assured has been the experience of the writer.

Review of Development in

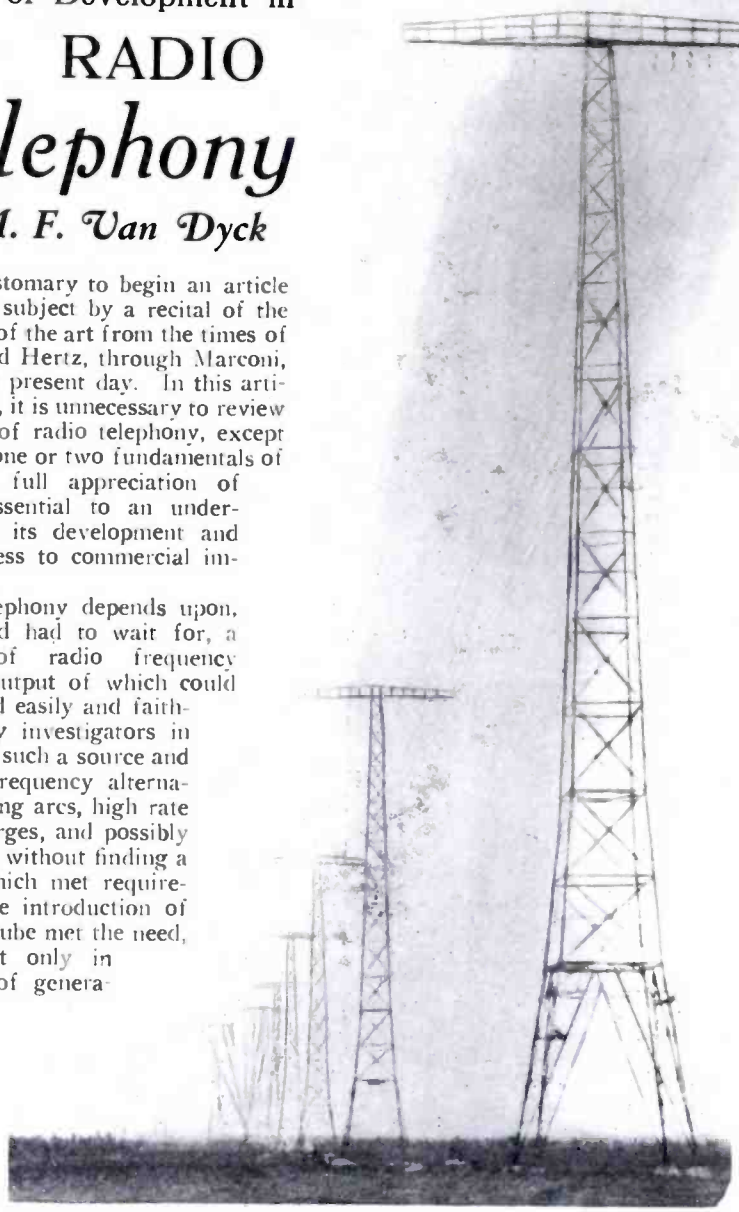
RADIO *Telephony*

Its various applications in every day affairs and its trend of development

By A. F. Van Dyck

IT IS customary to begin an article on this subject by a recital of the history of the art from the times of Maxwell and Hertz, through Marconi, down to the present day. In this article, however, it is unnecessary to review the history of radio telephony, except to consider one or two fundamentals of the art, a full appreciation of which is essential to an understanding of its development and rapid progress to commercial importance.

Radio telephony depends upon, requires, and had to wait for, a generator of radio frequency power the output of which could be modulated easily and faithfully. Early investigators in radio sought such a source and tried high frequency alternators, oscillating arcs, high rate spark discharges, and possibly other means, without finding a generator which met requirements. The introduction of the vacuum tube met the need, however, not only in the respect of generation of power which could be modulated easily and faithfully for telephony or telegraphy, but also in other respects, such as generation at any frequency which might be desired, steadiness of frequency and voltage, convenience and economy.



Antenna system of Radio Central transoceanic station, Rocky Point, L. I., where trans-Atlantic radio telephone experiments have been made

The preliminary development and introduction of radio telephony into service took place during the World War, in the years from 1913 to 1918. As a result of the pressure from war conditions and requirements, development was much more rapid than would occur usually during times of peace, and the technique of radio telephony was well established by the time of the Armistice, although confined strictly to military applications. Therefore, the art was ready, immediately after the Armistice, for a sudden introduction to commercial applications. The resulting commercial development was very rapid and its trend was naturally toward those applications for which there was most commercial demand or commercial promise. These applications, which will be discussed individually, may be listed as follows:

1. SHIP SERVICE.
2. TRANSOCEANIC SERVICE.
3. AIRCRAFT.
4. MOBILE LAND SERVICE.
5. BROADCASTING.

SHIP SERVICE

LET us consider first the application to marine service, including ship to shore and ship to ship communication. Radio telegraphy found its greatest usefulness in this service, and it was naturally supposed by those interested in the art during its early years that radio telephony likewise would have its greatest usefulness in this field. Immediately after the Armistice, commercial radio engineering facilities were applied to the problem of developing, manufacturing and installing the apparatus and equipment necessary to successful marine service. It was at once obvious that the greatest demand would be for service between passenger ships and shore, both for passengers and ship officers, and that since neither passengers nor officers would derive the full benefit of such a service from talking with a radio operator at some shore radio telephone station, it was practically essential that the shore radio telephone station be linked with the wire telephone system of the country. The problem was therefore to provide a system whereby any wire telephone installation in the country might be connected to the equipped ships at sea, partly by wire and partly by radio. Experimental shore stations were erected, apparatus developed and provided for shore and ship installations, and service tests conducted in the manner necessary to give reliable data on the performance characteristics of such a system. After full information had been obtained various facts were apparent. First, the number of channels available in the ether were rather limited for the conduct of a service sufficiently extensive to be economically justifiable. Second, the characteristics of radio transmission as it exists today, particularly in regard to interference from "spark" type ship transmitters, were such that telephone communication of the sort to which the public is accustomed over wire lines could not be provided over large distances. Third, no real public demand for the service had been developed up to that time. Telephony is used in general for business or social communications involving immediate action or instant reply. A considerable fraction of the persons at sea, by virtue of their circumstances, are not in need of communication facilities involving immediate action, and in the main are sufficiently well served by radio telegraph facilities. Likewise with ships' officers, necessary navigational instructions and communications can be so well effected by radio telegraph as somewhat to retard the growth of a

determined demand for radio telephone.

It has evolved from these conditions that mercantile radio telephony has not developed rapidly up to the present. The technique is ready to provide service, at least the service possible in a limited number of ether channels, but the demand for and promise of return from such a service have not as yet justified its introduction on a commercial scale. This is the picture of present conditions in this phase of the art, and it does not follow that this service will be unimportant in the future. It is likely that a change in conditions will make mercantile radio telephone service important, although it seems limited at this time.

Ship installation—duplex set and radio room aboard the S.S. America with Harold G. Porter, Manager of the Pacific Division of the Radio Corporation of America, using the transmitter

TRANSOCEANIC SERVICE

NEXT, let us consider transoceanic telephony. Here also many of the conditions found in marine service apply. The ether channels are very limited in number and the questions of interference and variations in signal strength with the time of day and year are even more serious than in marine service. Telephony for public service requires a small degree of interference, or in other words a small ratio of extraneous noise to desired signal. It is probable that such a service can be introduced with a very limited number of channels, by the employment of very high power transmitters and the most advanced transmitter technique. Experimentation is proceeding to test the possibilities of this service. Once established, such a service will no doubt serve a real public need.

AIRCRAFT SERVICE

IN THE field of aircraft, when commercial aviation becomes extensive, its radio as a public service will probably be in similar case with marine radio telephony, but there is a service use for radio telephony in aviation now, arising from the advantages of speech communication with the ground, for various navigational purposes, such as direction finding, landing directions, etc. This sort of radio service will probably become an increasingly important factor in aviation methods and possibilities. Naval and military aviation has many special problems. Special advantage is derived from the use of these problems and they form very special branches of radio.

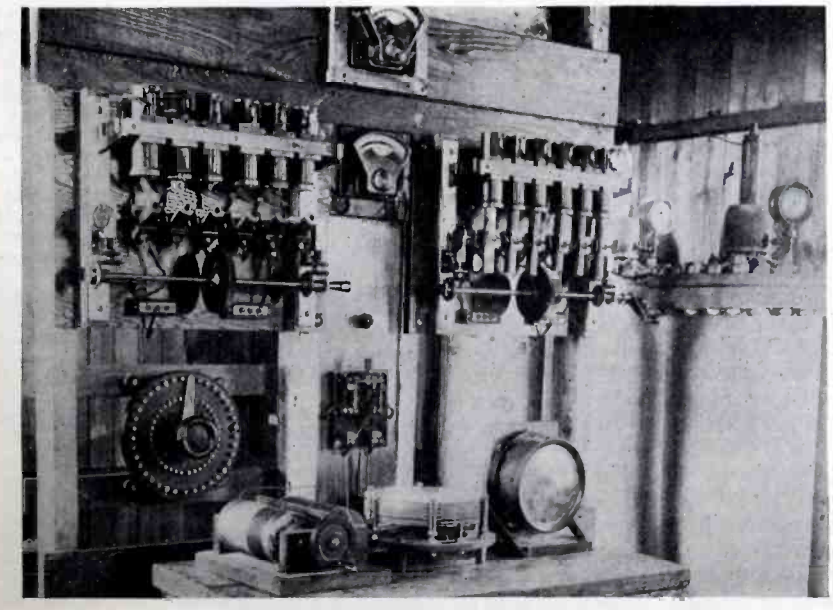
MOBILE LAND SERVICE

MOBILE land service telephony has not been employed extensively and does not promise at this time to have as wide usefulness as other branches of radio telephony. There are various divisions of this sort of service which are possible and which may come into fairly wide use. Examples of this work are communication with moving trains for passenger service or for train control, communication with police and repair crew automobiles, etc. Little can be said about this service at this time except that additional ether channels must become available before there will be room for many stations of this sort, and development must be accomplished in some respects to make it satisfactory.

BROADCASTING SERVICE

AND now we come to that application of radio telephony which is the most important one at the present time, and which promises to continue to be most important:—radio broadcasting. In the minds of the general public radio began with broadcasting. This is not true, of course, but it is certain that many new and difficult problems have been introduced by broadcasting, and these have been made more difficult of solution by the very rapid growth of the service. Broadcasting has many aspects, each important in itself and involving new problems in the radio art, and the major features of each of these aspects will be pointed out. Some idea of the complexity of broadcasting may be had from a consideration of the duties and tasks which face the radio engineer of today, as compared with those which he had to meet before broadcasting became a part of radio. In the old days, the problem of the radio engineer was almost entirely one of design of apparatus suitable for telegraph communication, and the apparatus was to be

(*Turn to page* 49)



One of the first radio telephone transmitters in this country, using the oscillating arc as generator of high frequency

Whimsy Williams

(*Continued from page 28*)

on them. It took me half a mile or more, running like a quarter horse, to range up to the head of that stampede, and of course I don't dare begin to shoot until I have them headed.

But I don't have much time to think. There is the camp on ahead and back of me, distant and faint now, is that radio shattering the Arizona atmosphere with sentiments to wit as follows:

"Jee-roo-salem! Jee-roo-salem!
Lift up your gates and sing!
Hosannah! In the high-e-e-est!
Hosannah to your King!"

And right ahead, around the fire, is a group of folks. There is Slim Burgoyne standing there with a gun in his hand and there is Whimsy Williams lying by the wagon. There is no sign of Shifty Pete nor the Mexicans, but Mirabelle is there wringing her hands over her pa and Slim is acting sort of wild like.

I come through that camp like a grass fire through a prairie and as I come I lean out of my saddle and pick Mirabelle out of the dust and take her with me. After me come a'rambling all that herd of steers, regardless of where they are going. And it is two mile down the gulch before I can pull out and let them wander on to wherever they aim to go. And all the time Mirabelle sobbing and clinging to me with both arms around my neck and me trying to make head or tail out of what she is saying.

"IT WAS that nasty Slim Burgoyne!" she chirps through her tears. "Oh, Jim, why didn't you kill him? And that awful Pete Leathers, too. I came up here to tell my pa that they both got fresh and kissed me and I was counting on you to run them ragged, Jim! And you went off and when I told pa he started to make war medicine and there was a fight and Slim—Slim—he—he shot pa! Oh, Jim, if you hadn't come when you did!"

"Hold on!" says I, dazed. "And where was Shifty Pete?"

"Pa run him out of camp," sobbed Mirabella. "He didn't have a gun—the coward! Oh! Jim, dear, whatever has become of pa!"

"I reckon he's still under the wagon," says I, sort of grim. "If he ain't otherwise hurt bad he's all right. But I'm sure afraid that this here shorthorn, Slim Burgoyne, has been driven into the ground all the same like a carpet tack. Which there was a hundred hefty steers going over him the last sight I had of him!"

And that's the way it was. I ain't saying it didn't eventuate all right, seeing that Whimsy was not much hurt and Slim was totally a loss, to say nothing of Mirabelle and me arriving at a sort of understanding. But even if it works to advantage in some ways I ain't none convinced that modern improvements like picking up song tunes are all they are cracked up to be.

AIL

(*Continued from page 19*)

The variation of the adjective, for instance, and the use of the accusative after the fashion of the ancient languages are superfluous as proved by the English language. These two unnecessary complications render Zamenhof's system so difficult that even people of good education cannot write it correctly.

DERIVATION

The mainstay of a logically constructed language is a regular system of derivation—of building new words from given ones. There are two modes of derivation. In one only the grammatical rôle of a word is changed, as in transforming a verb into a noun or an adjective into an adverb. This derivation is accomplished through the grammatical endings, which have no meanings by themselves, and is called the immediate one because the derivative does not contain an idea not contained in the original, the same idea, that of the root, being expressed in a different grammatical rôle. For instance, from the adjective "rapid-a"=rapid, we obtain the adverb "rapid-e"=rapidly, and from the verb "konstrukt-ar"=to construct, the noun "konstrukt-o"=construction, act of constructing, merely by changing the grammatical endings —a into —e and —ar into —o.

In a second mode of derivation an additional idea, one not contained in the original, is imparted to the derivative, the grammatical rôle remaining the same or differing. This derivation, called the mediate one because a new word is obtained by the medium of a new idea, can evidently be accomplished only through affixes which have meanings by themselves. For example:

Libr-o=book; suppose suffix —et=little, then libret-o=little book, booklet.

Rar-a=rare; suppose affix —u=person, then raru=rare person.

Amik-o=friend; suppose suffix —al=relating to, then amikal-a=friendly (relating to a friend).

Two principles determine logical derivation. One is Wilhelm Ostwald's principle of unequivocalness: Every element of a word, as root and affix, must have but one invariable sense which it must retain in all combinations it may enter into—one sign—one invariable sense. It follows that the meaning of a derivative must contain the meanings of all the component elements.

The other principle, which serves also as an easy test for the correctness of a derivation, is the writer's "principle of the additional idea": Every additional idea—idea not contained in the original—in the meaning of a derived word requires an additional formal element in the word. For instance, suppose from the word nav-o=ship (paper-o=paper), were derived a verb nav-ar (paper-ar) with the meaning "to send in a ship" (to provide with paper, to paper). One sees at once that this derivation is wrong. The idea "to send in" (to provide with) is not contained in the original nav-o (paper-o) and there is no formal element in the derivative nav-ar (paper-ar) to indicate that idea. Our principle determines also the meaning of a word composed of two or more other words. Thus "interakto" composed of "inter"=between, and "akto"=act, can only signify "act between," but not "pause," "intermission"; for this idea is not contained in the components "inter" and "akto."

Reading of a complete grammar is necessary for acquiring the ability to write Ilo. But to understand Ilo writings of others one needs only to keep in mind the principle of grammatical endings, as may be seen from the following illustrative Ilo texts.

Vere, il montras un nobla atitudo!
Truly, he shows a noble attitude!
El vidis un transitoria reyo di espero.
She saw a transient ray of hope.
Desistez fro ca projeto; ol ruinos tu.
Desist from this project; it will ruin thee.
Ho Sinioro, dismisez ni kun tua benediko! Belezo evanecas vertuo pering! Beauty evanesces, virtue enmanas. La yusti florishos velut la palmiero; lu kreskos velut un cedro en Lebanon. La populi sufras pro la mentii, quin diplomati konkoktis. La legi devas esar en la kustodio di honesta oficisti. La kordio pulsacas e pulsas la sango tra la tota korpo. Il sizis la yunino, snachis un kiso e departis.

O Lord, dismiss us with thy blessing! Beauty evanesces, virtue endures. The righteous shall flourish like the palm tree; he shall grow like a cedar in Lebanon. The peoples suffer from the lies which diplomats concocted. The laws should be in the custody of upright officials. The heart pulsates and drives the blood through the whole body. He seized the girl, snatched a kiss, and departed.

LA AMO DI UN MATRO

The Love of a Mother

da Washington Irving

by Washington Irving

La amo di un matro never exhausterdas; ol never chanjas, ol never fatigerdas. Un patrulo posible turnos sua dorso a sua filio, fratuli e fratini posible divenos inveterinta enemiki; spozuli posible desertos sua spozini, spozini sua spozuli; ma la amo di un matro permanas en omno; en bona reputateso, en mala reputateso, en la facio di la kondamno di la mondo un matro kontinuacas amar, ed ankore esperas, ke elua filio turnez su fro sua mala voyi e repentez; ankore el memoras la infantal rideti, qui olim plenigis elua sino ye delico, la gaya rido, la joyoplena klamo di lua kindezo, la apertanta promiso di lua yunezo; ed el never povas ormerdar pensar lu tote nediana.

The love of a mother is never exhausted; it never changes, it never tires. A father may turn his back on his child, brothers and sisters may become inveterate enemies; husbands may desert their wives, wives their husbands; but the love of a mother endures through all; in good repute, in bad repute, in the face of the condemnation of the world a mother still loves on, and still hopes that her child may turn from his evil ways, and repent; still she remembers the infant smiles that once filled her bosom with rapture, the merry laugh, the joyful shout of his childhood, the opening promise of his youth; and she never can be brought to think him all unworthy.

Radio Rose re-broadcasting

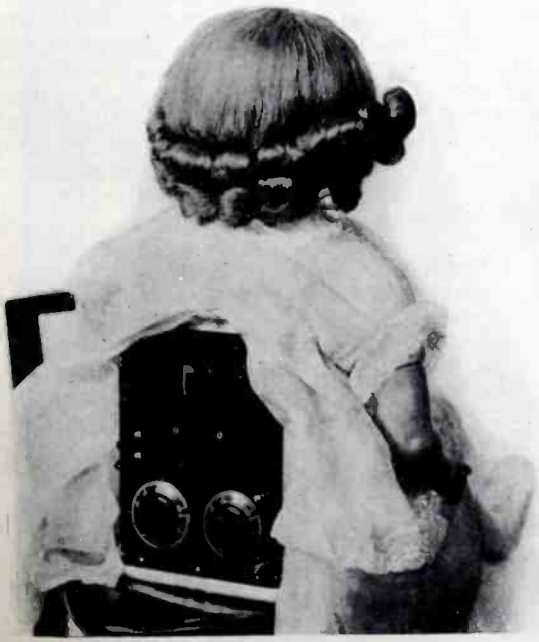
RADIO ROSE

This dolly totes a 3-tube receiver and loud speaker

By Mary Gray Reed

Miss Beulah Louise Henry

THE field of invention is one in which women have not been particularly numerous; so it was with the greatest of interest that I kept my first appointment with Miss Beulah Louise Henry, who has earned for herself the title of "Lady Edison." I expected to find, of course, a rather "cut and dried" little lady who was interested only in the very mechanical scientific things of life. That description however, would be the last one that I would now think of applying to Miss Henry. What I found was a very golden-haired person from "sunny Tennessee." She was about to broadcast from WGBS, New York, and as she talked I jotted down some of the things which she revealed in her radio interview.



View of the 3-tube receiver as installed—the loud speaker is located in the head

When she was nine years old, little Beulah first showed signs of becoming an inventor. On one of her morning walks she observed a gentleman who was having difficulties in reading his newspaper while he carried home some purchases. The little lady went home and designed a belt which fastened around the waist and had attached to it a hold for a newspaper, thus leaving both hands free while the paper could be perused with ease. Her inventive instincts then seemed to have gone to sleep for some time and it was not until she was nearly twenty that it returned to her.

The things that she has since invented are numerous. Her first real start on the path of success came several years ago when she and her parents left Tennessee to come to New York so that she might have more opportunity to carry out her ideas. It is seldom indeed, that one finds a family so imbued with belief in a member of that family. Her father, Colonel Walter R. R. Henry, gave up his law practice, and her mother gave up their southern home, and now we see why they are Miss Henry's ardent admirers and co-workers.

The first thing which was really successful was a "snap-on" umbrella. "Why," says this lady, "should one own only a green umbrella. Sometimes I want a red one, sometimes a brown. So it occurred to me that there should be some simple method of providing me with all of these." Her invention in hand she came to New York and for days she went from place to place trying to sell her idea. Since her greatest asset is courage and determination she resolved not to give up and finally she went into the shop of Mr. H. H. Bernard, an umbrella manufacturer. He seized upon her idea and helped her to market it.

Meanwhile, Miss Henry's brain is busy with other ideas. Rubber hair-curlers on the pneumatic rubber tire plan, a protection for an electric fan, inspired by the fear that her pet cat Chickadee would be caught in one Cross-Country game, which brings into play all the railroads of the country, and dozens of others follow in short order, and then she invented dolls.

First came Miss Illusion, who changes her wig and her eyes from blue to brown, and her dress which is reversible, and even her bonnet so that baby has not only a blonde doll in one costume, but a brunette in another. Then it occurred to her that dolls are too easily broken and disjointed and so the "Spring-limbed doll" came into being. Some of these stand over five feet high. There are cats, and monkeys, and rabbits, all of them with roller-shade springs so that they may be twisted and come back as good as new. The tiny tots were favored with a sponge doll known as "Dolly Dip" who carries a cake of soap in her body and produces a delightful lather when played within the bath-tub, and now

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Loud Speakers

(*Continued from page 17*)

One advantage of this particular type of cone loud speaker is that the lower frequencies are reproduced with more intensity and greater purity than is the case with most of the present commercial loud speakers available on the market. This is a very valuable addition, of course. In fact, much of the recent loud speaker development has had as its aim the reproduction of low frequencies without sacrificing any high frequencies, at all. It is not enough, of course, to merely introduce low frequencies. They must be reproduced with at least fairly uniform intensity over the whole of the low frequency region, which may be considered to include all frequencies below 350 or 400 cycles. This particular cone scarcely reproduces any particularly wide frequency-region with any degree of uniformity and for this reason it is far from an ideal loud speaker. Nevertheless, when operated under the proper conditions, as all loud speakers should be, it must be given a high rating.

The variety of horns seen amongst the usual commercial types of loud speakers is no doubt misleading to the public. The average person is inclined to believe that horns are made different just for distinctiveness and identification of a particular manufacture. Perhaps, to a large extent, this is true. Nevertheless, many companies make a sincere effort to produce a loud speaker which possesses good acoustical properties. They do not always succeed, of course. For example, recently a loud speaker was being tested when one of us clasped the hand tightly around the small section of the horn. To our surprise, the sound intensity decreased to a large and quite noticeable extent. Upon removing the hand, the sound immediately returned to its original value. The same phenomenon was observed repeatedly with this particular horn. What caused it? The answer is simple enough to any one—the hand absorbed some of the energy and less of it got out, therefore, into the surrounding space. The wall of the neck of this horn was made too light and thin. For this reason the wall vibrated, and some of the sound energy was lost in producing these vibrations. As soon as the hand was clasped around the horn, the hand and arm absorbed still more of the sound energy transmitted through the wall by means of the wall-vibrations. If the wall of this horn had been rigid, that is, would not vibrate under excitation by the varying sound pressure, this phenomenon would not have been observed. Furthermore, the loud speaker would have given more intense sounds, particularly for the lower frequency region. This point simply serves to illustrate that it is necessary to consider more than distinctiveness, individuality or identification for a loud speaker horn.

Horns, then, do make a great deal of difference in the performance of a loud speaker unit. To illustrate this point further, I have included a group of curves, No. 8, which show the performance of the same unit when used with three different makes of loud speaker horns. Curve *a* is the best, *b* the next and *c* the poorest. No difference was observed up to 800 cycles, but above this the horns showed a marked difference. *a* would represent quite a satisfactory loud speaker, *b* would be fair, but *c* would not be so good. Of course, we would have difficulty in development work if we had to depend on our memory, but just such curves as these make it possible for this work to advance steadily and be based upon a sure foundation.

These remarks show that the horn has a great influence upon the performance of a loud speaker. We observe amongst the various advertisements that various claims are made for loud speakers, based upon the material of which a horn is made. This is, of course, true. I simply question the correctness of such claims, if they refer to particular superiority. The loud speaker will not resemble a violin simply because the base of it is shaped like the body of a violin. On the contrary, the loud speaker is far more apt to sound differently than a violin just because of this construction. The important thing to remember is that the walls of the horn should be rigid, so as to prevent the absorption of energy, if we desire to have a loud speaker with sensitivity. If we desire to modify the air chamber characteristics, we can do so in various ways, but I doubt the wisdom of doing so by changing the construction of the horn to introduce sound absorption by the walls of the horn.

Radio Lyre

(*Continued from page 21*)

it may be advisable to increase the last plate resistance R-5 to 250,000 ohms and to cut R-6 to 25,000 ohms. These values can be determined best by experiment under actual operating conditions. The blocking condensers may be .0025 mfd.

Operating the Receiver

After all parts have been mounted and wired, the circuits should be tested, and if they are found satisfactory, the batteries should be connected. The filament battery should be two sets in parallel each of three cells in series for UV-199 tubes. The plate battery should be 90-120 volts.

One of the important considerations in the operation of this receiver is the correct value of the capacities C-1 and C-2. C-1 should be about .0005 mfd. with a General Radio type 231-A transformer. C-2 may be from .0001 to .0025, depending on the quality of tone desired. The higher the value of C-2, the more mellow the tone of the receiver will be, for this shunt capacity tends to cut off some of the high audio frequency harmonies. The builder is strongly advised to try various capacities at this point, selecting the one giving the tone most pleasing to his ear.

The receiver is very economical on batteries, and is extremely simple to operate. There is no tendency toward oscillation; in fact, the set is as stable as any carefully built crystal reflex.

The volume obtained will often be more than is desired, and may be reduced by turning back the rheostat on the reflexed tube. The surprising feature is that with this tremendous volume the tone is clear, sweet and undistorted.

Power Amplifier

(*Continued from page 25*)

fasten the Benjamin panel brackets on each end and in the center of the shelf. If a strong sub-panel is used the center bracket may not be necessary. However, our chokes were very heavy and the center bracket was required. These panel brackets are most convenient and a pleasure to use. They are accurately made and conform to standard panel sizes. We know of nothing which has contributed more toward making set construction easier, than these devices.

The three Dubilier 2 mfd. condensers which couple the various stages must be mounted somewhere underneath the socket shelf. There are two tabs fastened to the casings of the condensers. These are fastened to the shelf by two 6-32 screws and nuts. Remember that they should be located near the grid terminal of each socket and place them accordingly. Now drill the panel and mount the Bradleystats and Bradleyohms on the panel and also the jacks. The first jack on the left is the input jack and is connected across the first choke. The others are respectively first, second and third stages. An input jack is used instead of binding posts as it is quicker and simpler to plug in or out.

Now connect up all grid and plate leads first. The negative filament leads next from socket to rheostat to binding post A. Now the automatic filament lighting jacks come into the picture. These are the three extra prongs on the jacks. The connections are shown in the circuit diagram. This completes the set, and it is ready to be used.

Operation

The operation is as follows. The

(*Continued on page 42*)

"Quality Goods for Quality Readers"

The H. I. in Broadcasting

By Dorothy Brister Stafford

MR. H. L. MENCKEN, in a recent issue of the *Mercury*, quotes the aphorism, "Fine art is universal in its appeal," and then adds the truly Menckenesque touch that he should like to observe the reaction of a gang of northwestern lumber-jacks around the Venus di Milo. We caught something of Mr. Mencken's idea the night of the farewell Victor concert, while watching the puzzled expressions on the faces of Mr. and Mrs. Tony Chiesa and the little Chiesas, sitting among the bananas and listening to Werrenrath's rendition of "Danny Deever." They loved the "Pal-yatch," nodded to the lilt of "Mandelay," but "Danny" was a total loss, and we fear likewise to a great many more listeners.

Personally, we didn't like the make-up of Mr. Werrenrath's program, and wish he had selected for his first radio appearance one or two other lovely things he does so well, such as "The Gipsy Trail," instead of the so-called "popular" numbers he sang.

It is doubtless very bad taste to look a gift-horse in the mouth, and the Victor people have provided us with some such glorious hours this winter — but one can scarcely refrain from commenting upon a very funny thing that crept into this concert. The waiting millions must have been as astonished as was this listener, when the gentleman who introduced him informed the audience that Mr. Werrenrath was a good swimmer! What in Handel, did he think that vast company of people, listening patiently for the golden voice of the popular baritone, cared about the artist's athletic prowess? There seems to be some hypnotic influence about a microphone that causes the sanest people to say the most absurd things. No one would ever dream of referring to Reinald Werrenrath's aquatic activities when presenting him upon the *concert platform*, so why do it on the air?

In addition to being a great swimmer, and a "fair" baritone, one might add that Mr. Werrenrath is the only singer in the United States who knows how to pronounce "Moulmein."

△ △

ONE cold night in January, the Sophisticate draped himself over the end of the gate-leg table, and regarded the loud-speaker with suspicion.

"I never expected to find you listening to a bed-time story," he commented, and began to whistle "What Do We Get From Boston?"

"But it is not the usual bed-time story, and it isn't from Boston. Listen." The well-modulated voice and perfect English would have attracted us had the speaker been giving Kansas City quotations on yearling lambs.

"Well, may I ask where, in these United States, outside of Harvard, you will find that accent? I suppose you will tell me it's Jefferson City."

"That's the point. It isn't these United States. It's Canada. *There* is the educational value of radio. Can you imagine a child listening to perfect English like that and not absorbing some of it? And can you imagine any normal child not listening to what he is telling them? He is talking to them as though he liked them.'

And then we listened, and every Wednesday night thereafter at seven o'clock we tuned in on CNRO, Ottawa.

It was our introduction to "Uncle Dick"—otherwise Mr. Norman R. Cole. traveler, speaker, newspaperman, poet and specialist extraordinary in all that pertains

Norman R. Cole, "Uncle Dick" of CNRO, Ottawa

to children's interests and development. If you have never chanced upon him, you have missed one of radio's most unique features. His work no more resembles the "Now-kidlets-I'm-going-to-tell-you-a-itty-bitty-story" school of juvenile entertainers than Renee Chemet's violin technique compares to the acrobatics of a fiddle-scraper down in Arkansas. One might recommend a course of intensive listening-in on Mr. Cole to many of the people who are attempting to do this sort of work in this country.

"Uncle Dick" is an Englishman, as one may guess from his accent, and from his voice we know he has had many years' experience in public speaking. He is now in the Canadian Government Technical Service, and his radio work with the children is his hobby and greatest joy. He is a poet and special writer of considerable note in his adopted country, and for a number of years conducted a young folks' department on a Montreal newspaper. He writes most of the stories and poems he repeats for the children, and the amazing seriousness and responsibility with which he regards his work is set forth in the following extract from a letter:

> "I spend hours polishing up the details, for nothing sloppy is allowed to reach the children, as I realize the tremendous influence of the radio. I may be *making or marring that priceless possession—'character'—and so I really work in fear, lest I should harm and not bless some unknown, unseen little one."*

Can you think of anyone who is bringing a finer feeling into this extraordinary jumble of radio entertainment than this sincere poet from across the border? We know a number of parents who refuse to have a radio set in the house, simply because they do not wish their children to absorb the general run of mediocre—if not always harmful—matter which pours indiscriminately into their young ears. This class will welcome the day when more purveyors of radio entertainment approach their work with the sincerity of "Uncle Dick."

Mr. Cole began his work at CNRO in January, and in the first two months had more than one thousand letters from children. They feel he understands them, he says, and therein lies his power to help and interest them. He is "passionately fond of children," is brimful of ideas for developing the child mind and forming character by radio talks, and no one with his vision and enthusiasm—combined with the manner in which he comes over the air—can fail of accomplishment.

Better get the young hopefuls in the habit of tuning in on CNRO on Wednesday nights. Even if they don't absorb a great deal of "Uncle Dick's" philosophy, they will at least hear their mother tongue properly spoken for once in their young lives.

△ △

THERE is a studio outfit at WTAM, Cleveland, that puts on a three-hour show every Saturday night that is worthy of mention; and while they *do* read telegrams, the announcer contrives to do it in such a way that it doesn't detract from the entertainment. This organization features a banjo-picker, who is not the worst we have heard, by any means.

And there are hundreds of others including the many well known acts appearing constantly at the metropolitan studios, which space forbids us mentioning. Every day we hear queries:

"Do you know where Fred Fogarty's singing this week?"

Who Else Wants to Earn $50 to $200 a Week in RADIO?

PROOF!

$405 In One Month

I cleared up $405 in one month recently. Not so bad—is it—for a fellow who just completed your course a short time ago. I sure have been coining the dough. I never will regret the money I paid for your course.

Emmet Welch,
Peculiar, Mo

From $15 to $80 a Week

Before I enrolled with you I was making $15 a week on a farm. Now, I earn from $2,080 to $4,420 a year and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.

(Signed) George A. Adams,
Tamaqua, Pa.

Triples Salary

I am earning three times as much as before enrolling and I have clean interesting work that takes me to all parts of the globe. I tell you, boys, it's Radio for me.

Arthur Herke,
Vancouver, B. C.

Earns College Education

I entered the maritime service of the Radio Corporation of America and served several months on board ship. I not only had the advantages of visiting foreign countries at no cost to me, but I was also able to save enough money to pay for my tuition to college.

G. E. Rogers,
Troy, N. Y.

Do short hours, big money and easy work appeal to you?

RIGHT now thousands of men are "cleaning up" in Radio. Right on this page you can read the signed statements of men who have made big money in this "wonder-field." Men, who, a few months ago, knew nothing about electricity or Radio now hold fine positions and earn more money in one week than they used to get in a month!

Every day thousands of Radio sets are being sold; broadcasting stations are being established; Radio stores are springing up everywhere. People all around you are getting rich in this splendid-paying profession—Why Not You?

You can train for this "big-money" field in your own home—in a little spare time. No electrical experience is necessary. Men and boys of all ages—14 to 60, have mastered this famous course in a few months. What others have done, you can do.

Radio has come to stay. It is the fastest growing industry in the world today. But remember—the "cream" will go to the shrewd fellows who get in on the "ground floor." Employers are constantly writing to the National Radio Institute asking for Radio Operators, Salesmen, Radio Engineers, Radio Mechanics, Broadcasters, etc. Many of our students, even before completing their course have received offers of fine positions at twice their former salary. In fact, most students make so much money in their spare time on Radio work that this Course Becomes Practically Free.

What Is the Secret of this Amazing Method?

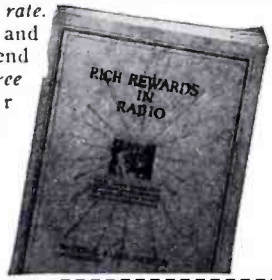
The National Radio Institute Course is acknowledged by Radio executives to be the best obtainable at any price. The whole success of the Institute is based on its advanced methods. This is the absolutely complete course now being offered which will qualify you for a government first-class commercial license and really get you one of the bigger paying jobs in Radio.

Free Instruments

The Institute furnishes free of charge all instruments necessary for practical instruction at home—you "learn by doing." That is one reason why National Radio Institute graduates get ahead so quickly, and obtain the Government License easily.

Send for "Rich Rewards in Radio" and Special Short-Time Offer

This interesting book will tell you the full story about the wonderful opportunities in Radio. You will see for yourself just how much you can expect to earn in this great profession. It will tell you of the adventure and big money that awaits the ambitious man in this fascinating field. Those who mail the coupon at once will be offered a *special reduced rate.* Act promptly and save money! Send today for this *free book* and our special short-time offer. National Radio Institute, Dept. 46HB, Washington, D. C.



FREE Instruments for practical training at home

This is the world-famous Natrometer—one of the three instruments given for scientific and practical home training in mastering the code.

These parts with instructions are given for experience and practical training in making and operating regenerative receiving apparatus.

These parts with complete instructions are given for practice in building a receiving set of the more simple kind.

National Radio Institute, Dept. 46HB
Washington, D. C.

Send me the 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-trician so I can get one of these splendid positions, and how your Free Employment Service helps me to secure a good position. Also, details of your Special Short Time Offer.

Name..... Age.....

Address .....

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

Power Amplifier

(*Continued from page 38*)

output of a detector tube is fed across the choke coil and the voltage drop across this reactance charges the coupling condenser. The charge leaks off through the Bradleyohm back to the filament by way of the C-battery which, by the way, is only necessary if plate voltages over 100 are used.

This is because this amplifier modulates downward reducing the plate current from normal with loud signals. Consequently this amplifier is much more economical to run than other kinds with the noted exception of resistance coupled which operates on a basis similar to choke coil amplification.

ADJUSTMENT

Set your receiver going and tune in a loud signal. Now get a short single pair phone cord with tips on each end. Connect up a Weston or Pacent plug. Plug in the output jack of the detector and the input jack on the amplifier. Turn on the rheostats of the tubes and adjust the Bradleyohm for best quality. This amplifier can be used after a detector and one stage of transformer-coupled audio if desired. It will be found then, that only one or two stages of the choke coil will be necessary to give exceptional volume. The last stage is used only on the weakest signal. This amplifier is capable of large volume, no distortion and great flexibility.

Information Desk

F. R. Reyward—Why did you specify 67 volts on the plates of the radio-frequency tubes in the D-Coil Receiver?

It so happens that 67 volts proved to be the optimum voltage on the original model and also on the general run of sets. We have found that this varies according to the tubes, the set, and its layout. It is recommended that you start with 22 volts and work upward until you have reached the point where little advantage is realized for a further increase in voltage.

R. G. Whitney—I find it necessary in tuning my receiver, to advance the tickler coil to almost 100 degrees in the vicinity of KDKA while I use only 20 or 30 degrees for other stations.

This effect is noticed on single and three circuit tuners to a considerable extent. It is due to the absorption by the antenna system at its fundamental of energy from the oscillating circuit. When the antenna circuit and oscillating circuit are in resonance the former puts a load or drain on the grid circuit, hindering its ability to oscillate. It can be overcome by detuning the antenna circuit by inserting a small .00025 mfd. fixed condenser in the antenna lead.

D. A. Wordham—I find that upon connecting the ground to my home constructed receiver that it decreases the volume and distance which I can obtain without it. Is this true of any set?

No, by no means. It is a certain indication that something is wrong. It generally indicates that the circuit is grounded elsewhere besides the regular ground connection and you are probably shorting a portion of the circuit by putting on the regular ground. Trace over your connections carefully and if you are using shielding look for a grounded B or A battery, jack or binding post.

F. H. Shelley—Can a neutrodyne be adapted or changed in any way to receive both the amateurs and broadcasting?

No, not without seriously interfering with the operation of the receiver. Turns can be removed from the transformers so that it will be possible to tune down to the amateurs, but the upward limit will not include the broadcast waves. Better employ a receiver built just to include the amateur band and leave the neutrodyne intact. Remember a receiver can only do a certain number of things well.

R. B. Dawson—Will I gain anything by erecting counterpoise underneath the antenna and using it instead of a ground on my set?

Yes, a counterpoise will certainly improve reception unless the counterpoise is not well insulated and unless the present ground is exceptionally good. It will sharpen tuning and the increase selectivity is, of course, advantageous.

A Federal owner writes:

"About six months ago I purchased one of your receivers. Since that time I have had no end of pleasure. I have listened to the best music concerts and operas; I have heard President Coolidge, governors from several states, the President of Cuba and many other notable speakers. I wish to thank you heartily for making this pleasure and entertainment possible to me and my family."
(Name on request)

Choose the Federal model that fits most perfectly into your home. "Exclusive but not expensive."

The New Federal is made in four beautiful two-tone models, designed to blend with the decorative schemes of better class homes: a table type without loud speaker—a table type with enclosed loud speaker—a complete console with batteries and loud speaker enclosed, and the de luxe console for the palatial home.

A permanent top is an added advantage in the New Federal. The complete set, suspended upon ball bearings, slides out like a drawer for changing tubes, etc. This eliminates the old style lift top and leaves a permanent flat surface for flowers or other decorations.

Your Federal will give this SAME *pleasure to you*

because:

1. Each part is designed, made and guaranteed by Federal
2. Each part is matched—for perfect team-work
3. The set is not limited by tubes—any tubes may be used
4. All precision parts are enclosed in sealed container—as insurance against dust or injury
5. The final factory test is for tone quality—a big point beyond mere volume, selectivity and distance range.

FEDERAL TELEPHONE MANUFACTURING CORP.
BUFFALO, N. Y.

Federal

Standard RADIO Products

"Quality Goods for Quality Readers"

Receiver NOISES

Locating and eliminating external and internal receiver noises

By K. M. MacIlvain

THERE are two general classes of receiver noises, namely, those that originate within the receiver and its associated circuits and those that originate externally and are picked up by the receiving antenna.

The method of procedure in the elimination of the former is one which involves locating the source and removing the cause.

The method of procedure in the second case is somewhat more involved, for, although you may be able to locate the source you will probably find that it is something over which you have no control and will therefore be unable to eliminate the cause. Failing in this respect, the next best thing to do is to eliminate the effect.

If you are experiencing undesirable noises in the course of reception, the logical thing to do is to attack the problem systematically rather than employ "hit or miss" methods.

The first thing to do is to determine whether your interference is internal or external. One way to do this is to remove the antenna and ground connections from their respective binding posts and carry the leads to a point 10 or 15 feet away from the receiver. Then connect a short piece of wire between the two input binding posts on your receiver. (Antenna and ground).

With the phones plugged in one of the output jacks, turn on the tubes and proceed the same as you would in normal operation, and listen carefully to see if you still hear the particular noises which you wish to be rid of. If you do hear them you can feel satisfied that they originate within the receiver or its local power supply apparatus. If the noises no longer manifest themselves you will know that they either originate in the ground lead, the antenna lead, the antenna itself or somewhere beyond.

Depending upon your analysis so far, you have either one of two paths to follow. You either trace the trouble from the antenna-ground binding posts in or from the same point, out. We will consider the former, first.

Without changing any connections and with the set still "turned on," start looking for loose connections within the receiver. Gently shake all external battery connections, and listen to see if you note the aggravation or cessation of your trouble. It is quite possible that it is a loose battery connection.

The trouble might originate in the batteries themselves. With this thought in mind, disconnect all batteries from the receiver and proceed to test each one separately.

First, connect the phones across the "A"-battery terminals. A click will be heard as the circuit through the battery and phones is completed, but, if you have made a good connection between the phones and battery there should be no further noises after that first click.

Listening in the phones, shake the battery gently and with the fingers, apply a little pressure to each of the terminal lugs on the top of the battery. The trouble might be due to the fact that one of these lugs was not securely welded, if such does happen to be the case you will hear clicking sounds in the phones as you apply pressure to the defective lug.

If you find that the "A"-battery is OK, it would be wise to test each one of the "B"-batteries in a similar manner. It is also important to make sure that the "B"-batteries are not in a run down condition.

If you want quiet receiver operation I would advise you not to use a 22.5 volt "B"-battery that has dropped to 17 volts nor a 45 volt battery that has dropped to 34 volts.

One or more of the tubes in your receiver may be the source of undesirable noises and one way to determine if this is the case is by a process of substitution. Take a tube that you know to be OK, and substitute it for each one

(*Turn to page* 56)

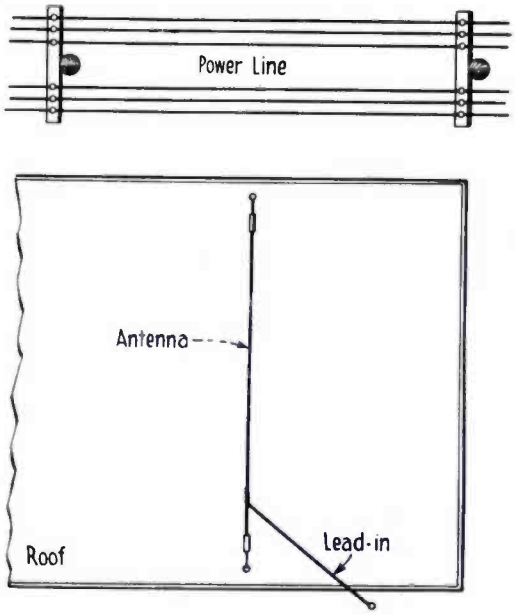


Figure 1—Proper installation of antenna system adjacent to parallel power lines

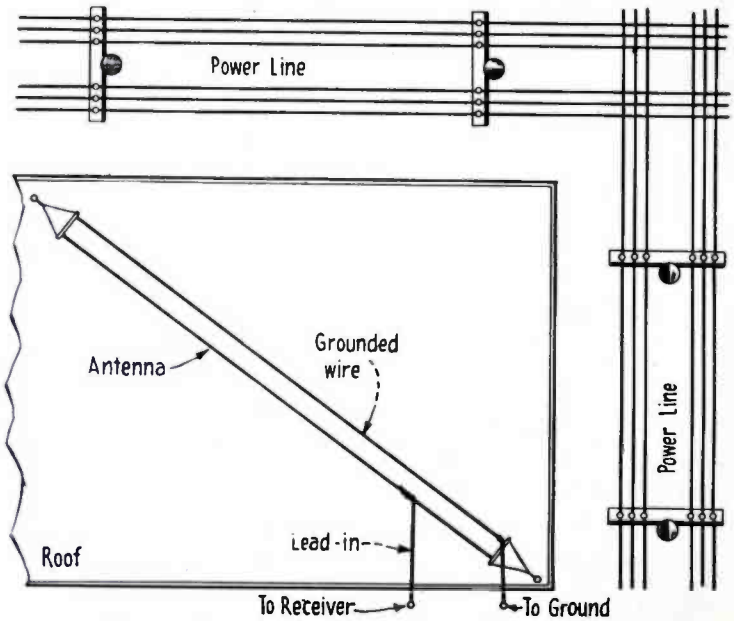


Figure 2—Proper installation of antenna near power lines running at right angles

Balancing Systems

(*Continued from page* 31)

difficulty of installing an underground antenna is that because of the separation and difference in form between the antennae, the static force of one antenna might not be an exact counterpart of the static force in the other antenna so they would not balance exactly. (See figure 4 in which one force is not of the same form as the other.)

In actual practice the Taylor system works quite well though only at a considerable sacrifice of signal strength. It can be improved considerably if, as in the author's system, advantage is taken of directional properties.

The 'Repeating Tube' Device

One other static eliminator or antistatic device deserves mention not because it is successful, but because it has been described in a popular magazine as being very effective despite the fact that its operation as a static eliminator is theoretically impossible. The writer has conducted tests with this system and found it to be useless in practice. An explanation of the reason of its inoperation may be of interest.

The inventor employs a circuit similar to figure 8. Coils 1 and 2 are arranged to induce equal and opposite forces in the secondary, the resultant of course is zero.

If the force from 1 is eliminated the force from 2 will act upon the receiver, and vice versa. The force from 1 or 2 may be eliminated by balancing against either another force of equal and opposite value. Thus if the coil 3 introduces a force equal and opposite

(*Turn to page* 47)

Appliances and Devices

Battery Clips

THE Valley Electric Co. of Saint Louis, Mo., has just perfected a battery clip known as the Valley Clip, which has positive grip and is acid resisting. The action of the jaws is such that it prevents side bend, the two jaws working on a hinge. All parts of the clip are electroplated with an acid resisting metal. This process pene-

trates the clip itself and for this reason resists corrosion better than other types of battery clips. The coil spring is very strong and the teeth hold tightly and make a perfect electrical contact. Attaching battery leads to the Valley Clip is very easy. An oval head screw is provided for securing the lead wire to the clip, then lugs hold the insulation after the wire is attached to prevent frayed insulation.

Mica Fixed Condensers

SANGAMO ELECTRIC CO. of Springfield, Illinois, whose electric meters are known all over the world, have added to their line of radio products a Mica Fixed Radio Condenser that is guaranteed to be accurate within 10 per cent. of the marked capacity and to sustain its original accuracy under all conditions.

The manufacturers report that in laboratory tests these condensers have been boiled for hours and then frozen in ice without affecting their accuracy. Their accuracy is likewise not affected by the heat or acid used in soldering.

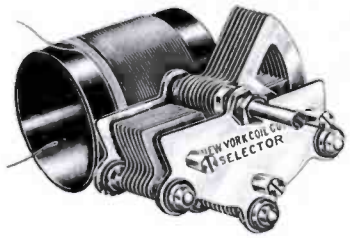
In all circuits these condensers show up to the very best advantage because of their high degree of accuracy. It is coming to be realized more and more that accuracy in a fixed condenser is highly important and that reason influenced the Sangamo Company, with their wide reputation for accurate manufacturing, to undertake the manufacture of these condensers. It is one of a line of radio products that will be put out under the mark "Sangamo Accurate Radio Parts."

The new condenser is completely sealed in a smooth brown bakelite case which makes it impervious to atmospheric changes, including the salt air of the seashore, which plays havoc with poorly made condensers. It presents a very neat appearance, which adds to the dressiness of careful workmanship in the set.

They are made in all standard capacities, and are also supplied with grid-leak clips at a slight increase in price.

New Tuning Unit

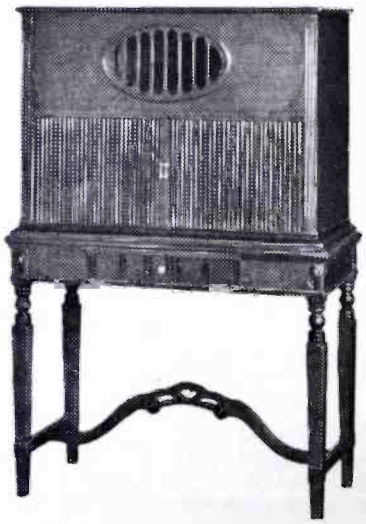
THE five-tube receiver, consisting of two stages of self-balanced tuned radio frequency, a detector and two stages of audio amplification, is a combination that is both sensitive and selective. It does not squeal or radiate. Three units that constitute the main elements in this receiver are supplied by the New York Coil Co. They consist of



a special low loss grounded-rotor "Selector" condenser, having a capacity of .00035 (17 plates), on which is mounted a special low loss coil, wound on a genuine bakelite tube, assuring much more permanent construction and reliability than the flimsy constructed so-called self-supported coil. These coils are wound with double silk covered wire. The number of turns, size, shape and relation of primary and secondary all combine to bring about the self-balancing feature, entirely eliminating the use of potentiometer, neutralizing condensers and similar devices.

Super Speaker Highboy

IN THE "Super Speaker Highboy" the Jewett Radio and Phonograph Co. presents a new ideal in the housing of radio. The Highboy is a handsome, graceful cabinet, self-supporting and with ample room to contain your radio receiver, its batteries, storage or dry, and all connecting wires. The Highboy also contains as a built-in part the famous Jewett Superspeaker. It therefore becomes a complete radio unit, transforming your radio equipment from a group of separate and more or less unsightly



units into a single piece of fine furniture. The Superspeaker Highboy can be obtained in African mahogany or in American walnut.

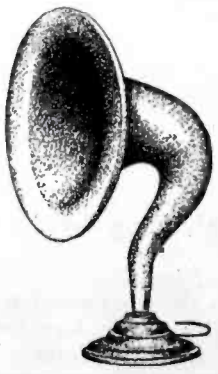
Toroidal Radio Frequency Transformer

THIS new coil, manufactured by the Reichman Company, is radically different from what we expect in a transformer. Used as a coupler in any kind of a radio receiving circuit, it will improve the circuit

and it is a decided advance in the science of radio reception. The coil is the result of lengthy laboratory work. The mechanical field is entirely confined and the coil itself will not pick up any stray signals—only the desired energy brought in through the antenna system. Its staggered winding greatly reduces its distributed capacity and it is extremely low in its losses.

Kellogg Symphony Reproducer

THE principle of this new reproducer is two-fold. The contour of the horn itself is one of the features. But the magnetic unit of the reproducer is the secret



wherein it excels. This unit is adjustable to any set, gauged upon the "output requirements" of that particular set. The improved results are instantly noticeable.

The Symphony is shaped acoustically correct, and it is made of neutral material which neither accentuates the sound waves by vibration, nor absorbs or dulls them.

Balancing Systems

(*Continued from page 45*)

to that from 2, the latter force will be eliminated and the force from 1 will affect the receiver. If the force from 3 is not quite equal to 2, the latter will not be eliminated entirely; that is, some portion of 2 will remain. But this portion of 2 will not now be equal to the force from coil 1, consequently they will not balance and the resultant of these two will act upon the secondary.

Now the force in the antenna at any instant is the algebraic sum of the signal and static forces. This can be represented graphically in figure 9. Here SL is the signal force, ST the force resulting from a pulse of static, and TT the algegraic sum of SL and ST. TT is the form of the energy present in the antenna.

The total antenna force may be broken up and arranged, as in figures 5, 6 and 7, to induce equal and opposite forces upon the secondary so the receiver will not be affected. Now if, as in figure 8, we can disturb or upset this balance with another force from 3, several things can happen depending upon the form of the force from 3.

If the form of the force from 3 is the same as the signal force SL (or the signal force component of the total force TT) in 2, it will, when opposed to 2, balance out the signal force in the latter coil so only the static force ST (or static force component of the total force TT) will remain in coil 2.

This is represented in figure 10. TT1 is the combined signal plus static force in coil 1. TT2 is the opposite signal plus static force in coil 2. SL is the original signal force present in coil 3 and which is introduced into coil 2. ST is the resultant of the combination of TT2 and SL. As TT2 is made up of the signal (SL) plus static (ST), then when it is opposed by another SL force, only ST will remain and ST of course is the static force.

Now in coil 2 there is present only ST while in coil 1 there is present ST plus SL or ST in 1 and ST in 2 are equal and opposite so they balance each other and only SL, the signal, remains.

This sounds very good thus far, but unfortunately the inventor has slipped up on one little detail that renders his device useless.

The inventor specifies that the signal energy in coil 3 is to be secured in the manner shown in figure 11. Here a vacuum tube amplifier, termed a repeater, is coupled to the antenna so that a replica of the antenna energy is present in the coil 3. By suitable coupling the energy induced in coil 2 from 3 may be made exactly opposite and equal to the energy already in coil 2 by virtue of its position in the antenna circuit.

In some utterly unexplainable manner the inventor has reasoned that the signal force only will be present in coil 3. As a matter of fact the force in coil 3 will be a more or less exact duplicate of the force in the antenna and the force present in coils 1 and 2. Consequently the explanation given above will not hold true because there it was assumed that only signal force was present in coil 3. Instead the action will be like this:

When the coupling between 3 and 2 is properly adjusted the force from 3 which is TT or static plus signal will exactly oppose the force TT in 2. As a result the forces of 3 and 2 will balance out and only the force of 1 will act upon the receiver.

But as the force in 1 is TT or signal plus static, the static will not be eliminated; not even diminished from its antenna ratio. The effective forces of signal and static in the receiver will be the same as if the coil 1 alone were present and coupled to the secondary.

The Meagher System

We make these criticisms only because we have developed a solution for the problems of defects set up in each of these devices.

Our system for a static eliminator is shown in figure 12. Here two loops are used. One is set with its plane of winding at right angles to the direction of the desired transmitting station: It therefore picks up a minimum amount of signal energy. The other loop, pre-

ferable of the same size and shape as the first, is to be set with its plane of winding either parallel or at some angle less than 90 degrees to the plane of direction of the desired transmitting station: It therefore picks up a maximum amount of signal energy. But both loops being situated close to each other and, if necessary, with their planes of windings at some angle less than 90 degrees to each other, will pick up static force almost equally well.

When the forces from both loops are properly coupled to the secondary or receiving set, the static energy will be balanced out but there will be nothing or very little to oppose the signal force in the loop which is not at right angles to the transmitting station. This signal force, minus static, will predominate and act upon the receiver.

Because the loops may be placed close to each other and because they may have the same dimensions and other characteristics, the static form in one loop, as well as the signal forms, should be an almost exact duplicate of the static force in the other loop. This means they will balance out perfectly.

Analysis shows that directional pulses of either static or signal forces will affect the receiver only from an arc of about 20 degrees; that is, if there is such a thing as sharply directional static it will, for a given setting of the loops, cause an excess of static in one loop only when it is coming from a direction limited to less than 20 of the possible 360 degrees. This is an elimination of about 95 per cent. If the directional static is also steady in direction, this percentage can be increased to almost 100 by suitable manipulation of the loops.

In operation if the loops are fixed relative to each other at some angle less than 90 degrees, a desired station will be heard only when the static-pick-up-loop is within about 5 degrees of its proper right angle (to the plane of direction of the transmitter) position. In other words the double loop system is also of value for eliminating interference from stations that are separated by some arc greater than 10 degrees; the receiver location as axis.

There are numerous possible arrangements of the loops and of course other types of directional antennae may be used provided, however, that the static in each has practically the same form.

One of the simplest modifications is shown in figure 13. Here the loops are connected in parallel so their forces oppose. The static forces being practically equal, will balance out and the signal force in the one loop will predominate and act upon the receiver.

It is necessary in using the loops to overcome the capacitive antenna pick-up effect of the loops by making the capacity from one side of the loop to ground equal to the capacity of the other side to ground.

This may be done with a compensating or balancing condenser as shown in figure 14. Here RC represents the residual capacitance coupling between the set and the ground. This capacity is generally greatest on the filament side because of the size and position of the filament and plate batteries.

To balance RC a compensating condenser CC is connected from the grid to ground. CC must be adjusted equal to RC. When this condition is attained there will be no difference in signal strength when the loop is revolved 180 degrees from a given setting. This is because the capacitive pick-up or antenna effect of the loop is eliminated; this energy cannot then aid or oppose the energy picked up by the loop proper as its phase is reversed in moving the loop 180 degrees. That is when the capacity to ground is not balanced, a certain amount of energy is picked up that remains constant in phase no matter how the loop is rotated. This energy will aid the energy picked up by the loop when the phases are alike and will oppose the energy when the phases are not alike.

If the loops are close together the shielding and inductive effects of one loop upon the other will balance out in most cases.

Radio Telephony

(*Continued from page 35*)

handled and maintained by operators trained to the work. Today the radio engineer must be a composite of radio apparatus expert, telephone apparatus expert, musician, artist, furniture designer, economist, and on occasion several other things as well.

The most serious problem in broadcasting today is that of finding a sufficient number of channels in the ether to accommodate all those stations which desire to broadcast. It is obvious that, no matter how important broadcasting may be, there are other radio services which are entitled to channels in the air. Marine service, transoceanic communication, and government service are essential branches entitled to communication channels. Much study has been given to the problem of assignment of channels or wave lengths to all these services, and it has been worked out as best for present conditions that broadcasting should be done in the frequency band of 550 kilocycles to 1,350 kilocycles, corresponding to wave lengths of about 550 to 220 meters. A radio telephone station does not operate on a single frequency, but requires a band of frequencies, the width of which depends upon the quality of the station. A station cannot be considered good in present practice unless it occupies a band of frequencies about 10 kilocycles wide and some of the very best stations are capable of using efficiently and justifiably a band nearly 20 kilocycles wide. It is obvious that if each station requires a channel 10 kilocycles wide there cannot be accommodation for more than 80 stations in simultaneous non-interfering operation. Since over 500 stations are now operating in this country, it is obvious that the problem of assigning frequencies to them is not simple, to put it mildly. Attempts have been made to assign the same frequency band to two or more stations separated by large distances. This scheme is not successful, however, because very great interference exists despite great distance between the stations. Such an arrangement results in very large areas of reception wherein satisfactory signals cannot be received from either station. It has also been tried to obtain more channels by allowing only 5 or 7 kilocycles to one station. This attempt was unsuccessful partly because even 7 kilocycles width of channel is not sufficient for a good station, and also because it is not possible to maintain the frequency of a broadcasting station absolutely constant except with special apparatus and highly skilled personnel. Consequently, the frequency, or the wave length, radiated by many stations varies slightly, and with assigned frequencies only 7 kilo-

cycles apart it is readily possible for two stations to drift so close together that they are on practically the same frequency, which causes interference in all regions where both stations can be heard. The situation today, therefore, is that many more stations exist than can be accommodated without interference under any scheme which could be proposed, and the degree of interference which exists is very serious. It is found by field observations that in practically every part of the country approximately 50 per cent. of the stations which can be heard in that section cannot be listened to enjoyably and therefore do not give service, because of interference from other stations on practically the same frequency. It has been the hope of those interested in the healthy growth of broadcasting that many of the present broadcasting stations would be discontinued, and that only the better class of stations would continue, so that a separate channel might be given to each such station to the total number of 70 or 80 stations. This has not come about up to the present time, and, as stated before, the present situation of interference between stations is very serious.

Everyone is familiar with the general nature of broadcast service and the sort of programs and events which are covered by broadcasting. It should be appreciated that the activities of the modern broadcasting station are not confined to performances in its studios, but that it often broadcasts events taking place anywhere in the same city or often in far distant cities. This, of course, adds to the usefulness of broadcasting service enormously, but also adds to the complexity and difficulty of the technical requirements. Wire telephony for the transmission of speech communication requires a certain degree of faithfulness of transmission which is not as high as that required for broadcasting. A telephone line can be made as good as it is desired to have it, but the cost of high quality is such that it is not economical to provide a higher quality of transmission than is necessary to meet the demands of the service. Therefore, while the wire telephone network of the country has been arranged to give the quality consistent with economical operation, broadcasting wire networks require better transmission than does ordinary wire telephony and special broadcasting networks have been arranged. By means of such networks it is possible to cover a large part of the country simultaneously through several stations, and this possibility of broadcasting is bound to grow in usefulness.

The transmitting apparatus used in broadcasting stations has been improved greatly since broadcasting began. A broadcast transmitting station may be considered to have four parts, the wire network used for connection of the station to the source of the program, the audio frequency apparatus including the "pick-up" or microphone device, the radio frequency apparatus, and the antenna system. The first of these has already been mentioned, that is, the wire network, and its importance is enlarging the field of usefulness and variety of program of the station indicated. The audio frequency part of the transmitter is largely responsible for the "quality" of transmission from a station, and a great deal of research work is being carried on in the effort to improve this part of the system. To appreciate this problem, one must understand that we are attempting to duplicate exactly the transmitters and receivers which nature has given us, that is, our voices and ears. The human voice, and the musical instruments which we have invented to fit our senses, cover a tremendous range of tonal pitch, or frequency. This range is, approximately, from 30 to 10,000 cycles per second. The fundamental tones of a bass voice, and the low notes of an organ, are at one end of this scale, and the overtones of the voice and various instruments reach the other end. If the lower frequencies are not correctly picked up and transmitted, the piano sounds "tinny,"

the baritone voice becomes a tenor, and the speaking voice, while quite intelligible, sounds thin and unnatural. On the other hand, if the higher frequencies are not transmitted, the violin sounds like a flute, orchestras give a jumbled and incomplete impression, and the voice, particularly if feminine, sounds muffled and indistinct.

In addition to frequency range, there is another characteristic of sound transmission which is important. The ear is capable of hearing and evaluating an extremely great range of loudness of sounds. One can hear and understand a faint whisper and also an almost deafening shout. It is not easy to obtain devices for the conversion and amplification of sound power to electrical power of the necessary magnitude, which will reproduce all of the original tones and also preserve their relative loudness. It is interesting to note that the power of the human voice, in loud speech or song, is about one one-hundredth of one-millionth of one watt. Since the power of the average broadcasting station is about 500 watts, the amplification of power by the station from the original sound to the antenna power is about fifty billion times!

The solution of these problems at present is in the development of high grade microphones and high quality vacuum tube amplifiers. Microphones used for broadcasting have many features not found in the ordinary ones used for wire telephony, and several new and special types have been developed for this use. The design of the amplifiers which amplify the microphone output up to values high enough to modulate the radio frequency power tubes has to be carried out with the best technique in many details. This part of the system has most effect in determining the quality of the signals sent out by the station, and it is in this part that many broadcasting stations of today are, unfortunately, more or less deficient. The best stations of today are highly developed in this respect, but there is still room for improvement, particularly in microphones, and much work is being done which should improve the stations of the future.

The radio frequency part of the transmitting station, and the antenna system, are determined largely by the value of the power which the station is to radiate. In this respect, broadcast stations have been unfortunate in having had too much influence from the design of transmitters used in other radio services under totally different conditions and requirements. The radio telegraph transmitters in use before the time of broadcasting used powers of one-half to one kilowatt for marine service, which was the largest and most important service in operation. When

the need for broadcast transmitters arose it was natural to provide transmitters of the same power, in lieu of definitely known requirements for anything different, and this was done. It is apparent now, however, that this was a mistake, and that much higher powers should be used for good broadcasting stations. This is true because broadcasting differs from communication traffic in one respect which depends solely upon power. In communication service a very considerable amount of interference noise from other stations, from "static," and from electrical disturbances of various man-made sources can be tolerated. Also, such stations can usually be located where conditions are favorable. In broadcast reception even a slight degree of interfering noise from any of these sources reduces the value of the reception considerably. In other words, good broadcast service requires that the ratio of strength of the desired signal to the strength of interfering noises on the same wave length shall be large. Good service is often defined quantitatively at present as that where interfering noise—or background noise—is no louder relative to the signal than the phonograph needle scratch is to phonograph reproduced sounds. It is important to note that this factor is almost entirely independent of the quality of the receiver used—it is the ratio of signal strength to noise strength which must be large to permit good service.

The good service range of broadcasting stations having one-half kilowatt power, as most of the present day stations do, is approximately twenty-five miles, considering year-round conditions. Such stations often can be heard over hundreds of miles, and sometimes thousands of miles, but the *dependable service range* must be defined as that over which good clean signals can be had at any time of day, night, or year. Since such a range of transmission means that stations can cover only a very small area each, it has come about that broadcast listeners are compelled to try to receive at greater distances, and of course obtain weak signals. It is therefore very desirable to increase the strength of signals which are given to listeners at reasonable distances from the stations, and the only way in which this can be accomplished is by increased power at the transmitting station. This movement has begun, and there are now in operation in this country, or shortly will be, nearly twenty-five stations having power of five kilowatts. This will afford considerable improvement over present conditions, but the final development will undoubtedly be the use of still higher powers, so that receivers even at distances of perhaps 200 or 300 miles, may be supplied with signals strong enough to dominate static and all the man-made electrical disturbances such as elevator motors, trolley cars, etc., which exist and must continue to exist. Such stations should be located a sufficient distance from centers of population, so that persons in those centers will be able to receive from other stations when they desire, but this can, of course, be done readily and without any disadvantage.

Radio Rose

(*Continued from page 37*)

comes the most marvelous of all dollies, "Radio Rose."

Rose, as many have seen from her pictures is a very good-looking young lady much after the style of her own creator, boasting blonde hair, brown eyes and pink cheeks. Front view she is a very proper young person, but part her dress at the back and behold! we have a radio control board. Lay your ear against her little chest and instead of a heart you will find a loud speaker. That is how it comes about that "Radio Rose" can receive and broadcast, both as she is doing in her picture. Her skull is a loud speaking unit carefully packed in cotton-wool, so that she cannot get a cold in her head when operated outdoors in winter. When she sits in front of a microphone she can send

back on the air exactly what she has taken out of it; but marvelous female as she is she never says any more than she is told. "Radio Rose" will not however, be the last doll invented by Miss Henry, for she will soon have a successor known as Pinette whose unique feature will be that she will not possess just an ordinary doll's face but will be an exact replica of a real live baby.

Miss Henry has a most peculiar power of visualization. She is neither a scientist nor an engineer. According to her own statement she cannot claim credit for her inventions; they just come to her. For instance, at a radio exhibition at the Grand Central Palace to which she was invited as a guest of honor, she was walking around with a radio bulb in her hand with the conviction that she was going to invent something connected with radio. She did not know what it was, but around that bulb grew "Radio Rose." It is in this strange manner that all her inventions are developed. Not, she insists, that she is in any way a clairvoyant or a mystic; merely she has this remarkable power of visualization.

One of Miss Henry's favorite pastimes is the writing of essays. She has published a volume entitled "Silent Chords." Each essay is meant to strike a chord in your heart which may have been silent for years. So there you have her, energetic, optimistic, not at all conceited, devoted to her mother, who is as blonde and young looking as she is, crazy about her gray and white cat, Chickadee, and of the type who will always remain young because of her constant interest in new and daring ideas.

Portable Short Wave Transmitter

(*Continued from page 27*)

driver, can assemble and raise this pole in about three minutes. The pole is 33 feet in length, weighs about 175 pounds and, in position, its bottom end is two feet above the ground. The counterpoise used is of the crowfoot type. It consists of heavily insulated flexible cable, spread out on the ground in a fan shape under the rear of the truck. The antenna tuning inductance and antenna ammeter are mounted inside the rear of the truck, to make them easily accessible to the operator for tuning this system and to keep them where inquisitive bystanders cannot touch them and receive a serious burn. When not in use, the counterpoise is rolled up and stowed away inside the truck.

An announcer's microphone, with its accompanying speech amplifiers, are mounted in the truck for test purposes. When relaying a program, however, the microphone and amplifier in the place where the program is being picked up are connected to the trans-

mitter by means of a flexible shielded lead.

All this equipment is mounted in an especially built truck body five feet wide, nine feet long and six feet high inside, solidly built to withstand the jar and movement of the truck in motion. It was found necessary to support all the equipment in the truck on thick cushions of felt, so that the jar of traveling would not injure the transmitting tubes and metering equipment.

I have mentioned this set as a relay transmitter and it may be of interest to know just how it is operated in the process of broadcasting a program. The truck is taken to the spot from which it is desired to broadcast and here the power lead is run in and attached to the city power mains, the antenna and counterpoise are erected and the microphone or speech lead is run into the building or the platform. The set is now ready for operation, this preparation taking about fifteen minutes. The program is now put on the air on 53 meters. At KDKA a special short wave receiver is used to receive the signal, which is then amplified and put into the regular transmitter at KDKA and broadcast on 309 meters.

During the time that this short wave transmitter was in the stage of development and test, some very interesting data was obtained. The set was designed so that a range of wavelengths could be tried out, and tests were made on both 33 and 70 meters, besides the regular 53-meter wave. Short waves, though capable of greater attenuation than longer waves, are more easily absorbed by objects near the transmitter. It is thought that steel in the structure of the buildings forms a circuit nearly in tune with the transmitted wave. This tuned circuit absorbs the energy from the transmitter. At one place, where the set was tried out, the tin gutter pipe system on a nearby building seemed to affect the set, and to obtain good operation, it was necessary to move the truck some distance away. At another place the truck was placed in the courtyard of a large church, with the church structure surrounding the truck on two sides and standing between the truck and the receiver at KDKA. It was necessary to move the truck to the other side of the church and some distance from it to get suitable operation.

For the Love of Mike

(*Continued from page* 11)

feverishly tune in on something or nothing, take on a far away, rapt expression and listen to most anything—or nothing at all. A Maxim silencer couldn't be more effective. The family argument goes on in an undertone, or ceases, newspapers are manipulated

carefully, and magazine pages are quietly turned. A lapse on the part of any member may be brought up short by a lifted hand denoting "hark," a frown registering annoyance, or a peremptory "shush." And I believe that I am safe in saying that this is the one and only time you can shush the family and "get away" with it.

This same radio receiver is very often a hostess' life saver. When some chronic bore drops in for a conversationally hopeless visit, at the end of say fifteen minutes she may, with propriety, blithely trip over to the radio and the day is saved. Or when a party is in full swing and it happens that two constitutionally and temperamentally opposed guests land at the same table, a little timely jazz from Chicago may offset most anything that might otherwise occur. That same Chicago jazz may furnish free music to those few restless guests who forever want to dance—their enthusiasm always being in inverse ratio to the size of the apartment in which they are being entertained.

Dinner music from a local hotel, wafted into a newlywed's dining-room, may keep the attention from the scorched potatoes or cause hubby to forget to urge a third dish of exhausted ice cream on the man he brought home, unannounced, to dinner.

"Mike" is leading Dan Cupid a merry chase these days. Just think of the soulful tenors he is introducing to susceptible listening maids, the heart stirring violinists he casts to the four winds, the romantic heroes he sends out upon the ether waves to unknown ports—not to mention those Gamby and Doug matches he makes right in his studios.

Given time, radio should do much to curb divorce by keeping the combatants at home and out of mischief. And as soon as radio-photography reaches the state of perfection when one can see the chorus as well as hear the music from The Follies, "until death do us part" will be in much wider use than it is today.

There are many other services that the radio performs, I have elaborated on only a few. We must not forget that it is the invalid's stage, the convalescent's tonic, the blind's light, the shut-in's window, and everyone's broader education.

Each individual has his or her own ideas for improving its service. The housewives would welcome more daytime broadcasting to speed their mending, dusting and the like, the diligent readers would revel in added book reviews, the flappers in still more jazz and beauty hints, the "tired business man" in even lighter entertainments, and so on.

So much is in the air for the tuning, and still more would be there for the

asking, that we can't hope to catch it all, neither can we afford to miss too much of it. If we would just put *what we want* and *what we need* on a fifty-fifty basis we would go a long way toward making the most of our opportunities.

Little mechanical "Mike" is a true benefactor for he gives absolutely all that he gets, and there are precious few of us humans who operate on even a small percentage of that basis.

When "Mike" takes the air the whole world's atune. Interference after all, is only the raucous swan song of some ethereal joykiller going steadily down to defeat before the rapid march of science.

Receiver Noises

(*Continued from page* 44)

of the tubes in your set, in turn, noting whether there is any decrease in noise.

If the source of trouble is found to be outside of the receiver the first thing to do is to go over the ground lead, making sure that the lead is not broken and that the connection to ground is a good one.

Look the antenna lead-in over carefully. In most instances the lead-in wire is of the rubber covered type and although the wire may look OK, to all outward appearances, still, there may be a break in the wire somewhere within this covering and the two ends may be rubbing together thus causing undesirable receiver noises.

The connection between the lead-in wire and the antenna should be well soldered, as otherwise, when corrosion occurs, the result is liable to be a poor electrical connection with subsequent undesirable noises in the receiver output circuit.

One cause of interference, external to your installation, may be due to the proximity of power lines which are supplying 60-cycle alternating current power to your neighborhood. The current flowing through these wires sets up an appreciable field which spreads out from the power lines in a direction at right angles to the direction of the lines.

If your antenna is anywhere near parallel to these power lines, the field from them will loop through your antenna system, inducing emf's which will produce an alternating current in your antenna ground circuit of the same frequency as the current flowing in the power lines and the value of this induced current will depend upon the strength of the field set up by the power lines and the degree of coupling between them and the antenna.

It being impossible to eliminate the cause, the logical thing to do is eliminate the effect and that is done quite easily by reducing the degree of coupling between the antenna and the

power lines. This is done by relocating your antenna at right angles to the lines as shown in figure 1.

An extreme case of this sort is shown in figure 2 where there are power lines running at right angles to each other and one way to minimize their effect is to put up a two-wire antenna in the direction shown in figure 2, the two wires of the antenna being insulated from each other.

Connect the wire farthest from the source of interference to your receiver and ground the near wire. The position of the antenna thus constructed serves to minimize the coupling between the interfering field and the antenna and the grounded wire serves as a shield for the antenna.

Faulty insulators on power line installations have been known to cause very serious intermittent interference. It is quite difficult to detect interference of this sort during the daytime, by eye, but at night, especially during damp rainy weather, the faulty insulator may be seen to have an electric discharge taking place over its surface or from sharp points thereon.

There is one thing that can be done immediately in this case and that is to notify the power company of the trouble and its location. This is sure to produce action, as the power companies are only too glad to co-operate to the fullest extent in all cases where their lines are causing interference to radio listeners-in.

If you are not lucky enough to locate the faulty section of the power line and therefore cannot proceed to eliminate the cause you will have to be content to eliminate the effect.

This interference may be of radio-frequency and if such is the case it will tune to one particular point. You can determine what the frequency is in this case by noting what broadcast stations tune at or near the same point. With this data at hand connect a condenser across a coil, the values of the condenser and coil being such that the combination will tune to the undesirable frequency, then insert the combination in series in the antenna lead-in. When this trap is tuned to the interfering frequency, the latter will be eliminated.

If this type of interference is of audio-frequency, a couple of stages of radio-frequency amplification ahead of the detector should solve the problem.

If the elimination is not complete, connect a high resistance across the antenna-ground binding posts of such a value that it will offer a lower resistance to the passage of audio-frequency currents than the input circuit of the receiver.

This last case only applies in the case of receiving sets having a tuned input circuit. In operation, the primary circuit is tuned to some radio-frequency and will therefore be way out of tune for the audio-frequency interference. Such being the case the input circuit of

the receiver will offer a higher resistance to the interfering current than the resistance unit across the antenna-ground terminals. At the same time the resistance unit should not be of a low enough value to shunt any appreciable amount of radio-frequency energy to ground.

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

Of WIRELESS AGE published monthly at New York, N. Y., for April 1, 1925.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. H. Reber, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the WIRELESS AGE and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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

Publisher, Wireless Press, Inc., 326 Broadway, New York City.

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H. H. REBER,
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Sworn to and subscribed before me this 18th day of March, 1925.

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1 BKU Henry Kulikowski, 482 Main St., Ansonia, Conn.
1 BKY Philip M. Seal, 81 Beaconsfield Road, Worcester, Mass.
1 BLN Robert L. Henderson, 177 Hillside Ave., Needham Heights, Mass.
1 BSN Boy Scouts of America..Winsted Road, Norfolk, Conn.
1 BWM Raymond E. Groebe, 440 E. Broadway, Silver Beach, Milford, Conn.
1 CJK Wilfred Hardman..116 Lincoln St., Lowell, Mass.
1 CMF Walter S. Keith....88 Pleasant St., Whitman, Mass.
1 UU Sidney B. Coleman.....11 James St., Bangor, Maine
1 AAL Raymond S. Brown, 25 Belmont Ave., Worcester, Mass.
1 AFC Richard A. Hilferty..135 Main St., Maynard, Mass.
1 AOL George C. Blackwood, 108 Warrington St., Providence, R. I.
1 AOM Ivan H. Small....Main St., South Harwich, Mass.
1 APQ William H. Hall High School, Raymond Rd. & Sims St., W. Hartford, Conn.
1 ASU Clarence J. Green, 11 Greendale Ave., Worcester, Mass.
1 ATQ Wilmot Graham.....629 Main St., Malden, Mass.
1 AXY Jesse N. Sargent, Jr., 61 Columbus Ave., Sommerville, Mass.
1 AZD Stanley W. Lang, 1121 Tyler St., Pittsfield, Mass.
1 BAT William W. Chamberlain, 4 Alaric St., W. Roxbury, Mass.
1 BBH Earl W. Houghtaling, 324 Lincoln St., Lowell, Mass.
1 BHO Leo Marchetti, 54 S. Border Road, Medford, Mass.
1 BLB John V. Ghigli..95 Merrymount Road, Quincy, Mass.
1 BTQ Frank M. McLaughlin, 7 Court St., Farmington, Maine
1 BXA John H. Gough, 40 Shirley St., E. Milton, Mass.
1 CBS Walter N. Vanderbeck, 63 Goshen St., Hartford, Conn.
1 CEN Clarence H. Warwick, 6 Corwin St., Dorchester, Mass.
1 CJ Ralph M. Dennis.....Wharf St., Gloucester, Mass.
1 DP Thomas H. Bell, 23 Quincy Ave., Pawtucket, R. I.
1 FE Thomas A. Corcoran, 101 Putnam Ave., Cambridge, Mass.
1 GH Arthur W. Curran..36 Frederick St., Newton, Mass.
1 UK Joseph H. Washburn, 75 Winchester St., Medford, Mass.

Second District

2 LR George L. Graveson, 266 Forty-sixth St., Brooklyn, N. Y.
2 JL Walter A. Cohen..126 Woolsey St., New York, N. Y.
2 ADP George H. Phelps, 810 Hudson St., Hoboken, N. J.
2 CWX Frank N. McCoy, Jr., 227 North Broad St., Peekskill, N. Y.
2 AOB Bethune Jones.....661 Boulevard, Westfield, N. J.
2 APN Stacy W. Nichols.....158 14th St., Hoboken, N. J.
2 LB Meyer Knoll..559 Tremont Ave., New York, N. Y.
2 KH Carl D. Short..1305 Nelson Ave., New York, N. Y.
2 KW N. Y. Telegram & Evening Mail, 73 Dey St., New York, N. Y.
2 AOM Julius H. Fruitman, 2029 65th St., Brooklyn, N. Y.
2 MC Charles T. Manning, 27 Mitchell Place, East Orange, N. J.
2 AOF Benjamin Schlachter, 2053 61st st., Brooklyn, N. Y.
2 AOR James L. Whittaker, Cottage Place, Alandale, N. J.
2 AOC Herbert F. Koenig, 693 South 18th St., Newark, N. J.
2 KN Alfred E. Olson, 273 E. 175th St., New York, N. Y.
2 NR Francis A. Holt, 2 North 20th St., Jackson Heights, N. Y.
2 KS James L. Murray, 290½ South 20th St., Newark, N. J.
2 APC Jacob Smolen, 542 E. 139th St., New York, N. Y.
2 LQ George W. Hoehn, 805 Prospect Ave., Brooklyn, N. Y.
2 ANT Wallace F. Keller, 567 E. 3d St., Mount Vernon, N. Y.
2 ANO Nathan Steinman, 1411 Townsend Ave., New York, N. Y.
2 TR George C. Kimble, 284 No. 6th St., Newark, N. J.
2 LK Emery H. J. Lee, 5424 Avenue M, Brooklyn, N. Y.
2 CUV Lawrence E. McDonough, 716 Charles St., West Hoboken, N. J.
2 CDS Chester R. Underhill, 38 St. Lukes Place, Montclair, N. J.
2 AMF Albert J. Bischoff, 75 Yantleaw Ave., Bloomfield, N. J.
2 LW Fred W. Schramm, 315 Marlborough Road, Brooklyn, N. Y.
2 LC William J. Rooke, 787 Elton Ave., New York, N. Y.
2 AOQ William Filler, 4031 3rd Ave., New York, N. Y.
2 AOP Ernest Paul Hufnagel, 879 South 18th St., Newark, N. J.
2 KZ Richard B. Wright, 591 W. 178th St., New York, N. Y.
2 APW Howard Pecheux, 159 North Miller St., Newburgh, N. Y.
2 AOU Henry W. Anderson.....Perrinerille, N. J.
2 LP Maurice L. Prescott, 29 Sacandaga Road, Scotia, N. Y.
2 ARA John E. Burrell, 82 Cypress St., Maplewood, N. J.
2 TS Theodor E. Schreyer, 27 Wheeler Ave., West New Brighton, N. Y.
2 DU Joseph E. Engrstrom....76 4th Ave., Brooklyn, N. Y.
2 CDH Joel B. Ennis, Jr., Van Buren Ave., Castleton, N. Y.
2 ANP Thomas J. Hickley, 312 Elberon Ave., Allenhurst, N. J.
2 IL Carroll M. Loper, 109 Bayview Terrace, Port Jefferson, N. Y.
2 AMW Arthur Greenberg, 402 E. 136th St., New York, N. Y.
2 LF Fred J. Gutberlet, 1916 Grove St., Brooklyn, N. Y.
2 VR Charles S. Rosentahl, 732 Hancock St., Brooklyn, N. Y.
2 MS Paul J. Hoffman, 23 Lindhurst Place, Rockville Centre, N. Y.
2 JP Herbert Reichers.....1050 81st St., Brooklyn, N. Y.
2 AOH Thomas Thorn.....Perry Place, Bronxville, N. Y.
2 AOV Frank E. Bruckman, 1011 Pacific St., Brooklyn, N. Y.
2 LJ Andrew Wohlers, 10710 Jamaica Ave., New York, N. Y.
2 ANR Fred Madlinger..110 Kingsland Ave., Brooklyn, N. Y.
2 AMZ John E. Hagmayer, 2789 Pond Place, New York, N. Y.
2 JQ Walter C. Dux, 227 Waverly Place, New York, N. Y.
2 AND Henry F. Kroupa..1771 W. 11th St., Brooklyn, N. Y.
2 BBE Joseph M. Boguckl, 1057 Grant Ave., New York, N. Y.
2 DAC Benjamin Adler, 70 Haven Ave., New York, N. Y.
2 AMH Benjamin H. Russ..642 Fox St., New York, N. Y.
2 ALI Philip Arnold.....291 High St., Newark, N. J.
2 AJP Richard Guthridge, 129 Longview Ave., White Plains, N. Y.
2 AKM George Law.....1 Avenue C, Brooklyn, N. Y.
2 AKR Henry Crowley, 493 Delafield Ave., West New Brighton, N. Y.
2 HK Richard C. Gaine, 1109 W. 5th St., Plainfield, N. J.
2 HH Henry Panzer, 6111 Tyndall Ave., New York, N. Y.
2 AKD Ludwig Leal, 50 Gramatan Ave., Mount Vernon, N. Y.
2 AKZ Joseph A. Anderten, 94 Rossmore Place, Belleville, N. J.
2 HP John North.....16 5th Ave., Cedarhurst, N. Y.
2 HX James J. Belounay....4103 7th Ave., Brooklyn, N. Y.
2 CYU Ferdinand J. Mann, 45 20th St., West New York, N. J.
2 CLN Myron B. Skraly..1734 Weeks Ave., New York, N. Y.
2 BWB William L. Jepson....998 Union St., Brooklyn, N. Y.
2 CZQ Arthur W. Blume, 50 Palmer Ave., Port Richmond, N. Y.
2 AKK Forrest Knox, 571 Delafield Ave., West New Brighton, N. Y.
2 AJU Chester E. Tendzegolski, 194 Holland Road, Schenectady, N. Y.
2 AKW John H. Frazer, Stony Brook School for Boys, Stony Brook, N. Y.
2 ALO Joseph Zaliskas, 217 Manhattan Ave., Brooklyn, N. Y.
2 AKI Sam Rosenberg, 1663 Washington Ave., New York, N. Y.
2 AHH Charles R. Ulrich, 757 Ridge Road, Lyndhurst, N. J.
2 VA Frederick M. Schussel, 405 Jamaica Ave., Astoria, N. Y.
2BQC Franklin A. Korn, 15 Lyon Place, Elizabeth, N. J.
2 HZ Arthur F. Clough, 1991 Broadway, New York, N. Y.
2 BR Anthony C. Lopez & J. Wilbur Baldwin, 485 Central Park West, New York, N. Y.
2 CPY James Edward Reagan, 61 So. Munn Ave., East Orange, N. J.
2 HL George J. Cook..9024 78th St., Woodhaven, N. Y.
2 WC Stanley P. McMinn, 30 Linden Ave., Brooklyn, N. Y.
2 BAU Harry L. Klingman, Union & President Aves., Rosedale, N. Y.
2 AJT Lucius Hobbs..1202 Tabor Court, Brooklyn, N. Y.
2 HI Charles A. Butler, 24 Covert St., Brooklyn, N. Y.
2 AJN Robert S. Helman, 1658 Washington Ave., New York, N. Y.
2 AKG Israel J. Newman, 1663 Washington Ave., New York, N. Y.
2 AWV Ralph Iadarola....162 Chapman St., Orange, N. J.
2 BXW James E. Cullen.....Main St., Altamont, N. Y.
2 AAR William Noonburg, Oakland Road, Pompton, N. J.
2 BVU Charles Manda.....6 31st St., Woodcliff, N. J.
2 CU Henry B. Von Thun, 7 Utica Ave., Brooklyn, N. Y.
2 HG Whitman W. Kenyon, Jr., Smithtown (Oaksido), N. Y.
2 ZL J. O. Smith, 61 South Carll Ave., Babylon, N. Y.
2 IQ John C. Bolen, 555 W. 171st St., New York, N. Y.
2 AMN Stephen M. Fox, 318 Fisher Ave., White Plains, N. Y.
2 IT Charles J. Carbenter, 29 Way Ave., Corona, N. Y.
2 AMA Max Buch, 1443 Boston Road, New York, N. Y.
2 AKT William V. Mumford, 542 Westfield Ave., Westfield, N. J.
2 AME Stanley Walderman, 828 Dawson St., New York, N. Y.
2 ALC Gustave A. Klein, 23 Manhattan Blvd., Yonkers, N. Y.
2 HD Alfred Tripone, 40 Washington Ave., Bergenfield, N. J.
2 AKY Edward A. Falkenbach, 267 Prospect St., Long Island City, N. Y.
2 AJX Henry Marcus, 537 46th St., Brooklyn, N. Y.
2 IP John J. Byrne.....109 Centre St., City Island, N. Y.
2 HU Joseph T. Fetsch Jr., 15 Eagle St., Schenectady, N. Y.
2 AMP Belleville Amateur Radio Club, 357 Dewitt Ave., Belleville, N. J.
2 SX George C. Cannon, 183 Drake Ave., New Rochelle, N. Y.
2 AHK Nelson Palmer..1 Balding Ave., Poughkeepsie, N. Y.
2 AKU Laurence D. Luey, 120 Murray Ave., Port Washington, N. Y.
2 JE Augustine J. Gironda, 2 Murray Ave., Larchmont, N. Y.
2 PV Herbert H. Ammenheuser, 300 Delaware Ave., Albany, N. Y.
2 AFO Charles Brown, 103-26 109th Ave., Richmond Hill, N. Y.
2 CEZ George Baumann, 716 Garden St., Hoboken, N. J.
2 CYM Frank H. White, 26 Myrtle Ave., Spring Valley, N. Y.
2 BKA Edmund G. Smith..41 Kenwood Road, Verona, N. J.
2 AII Richard B. Murray, 157 William St., Catskill, N. Y.
2 HX James J. Belounay, 735 41st St., Brooklyn, N. Y.
2 EE Gerald Margolish..320 E. 176th St., New York, N. Y.
2 ID Samuel Reiner, 1266 East New York Ave., Brooklyn, N. Y.
2 IH Richard Stewart, 130 Post Ave., New York, N. Y.
2 AOZ Samuel Weiner, 30 Hinsdale St., Brooklyn, N. Y.
2 ALX Isidore Antopolsky, 248 Liberty Ave., Brooklyn, N. Y.
2 AMM Frank J. Bennett, 874 E. 15th St., Brooklyn, N. Y.
2 ALP Allan Swayze, 1001 Anderson Ave., New York, N. Y.
2 AMT Robert P. Austin, 1848 New York Ave., Brooklyn, N. Y.
2 KP N. Hagmann.....Mitchell Field, N. Y.
2 HT George I. Tuggs, 702 E. 10th St., Brooklyn, N. Y.
2 IZ Joseph E. Hamilton, 16 West Broadway, Port Chester, N. Y.

2 AKE Isaac Katzman, 626 E. 136th St., New York, N. Y.
2 ANL James Vincent Derwin, 433 E. 134th St., New York, N. Y.
2 ALH Russell Tighe, 66 E. 120th St., New York, N. Y.
2 ALL Henry B. Kroger, West 231st St., New York, N. Y.
2 ANJ Joseph F. Depue, 18 Wayne Ave., East Orange, N. J.
2 AKP Ernest S. Lundie..4015 59th St., Woodside, N. Y.
2 AKF James H. Ross, 1492 E. 18th St., Brooklyn, N. Y.
2 AMR Jacob Ketchler, 619 E. 140th St., New York, N. Y.
2 AMJ Frank Lester, 851 Tinton Ave., New York, N. Y.
2 AOA Joseph W. Conn, Jr., 320 Eastern Parkway, Brooklyn, N. Y.
2 ANV Harold D. Whitney, 41 Southern Blvd., Albany, N. Y.
2 AOG Fred L. Seufert, Jr., 344 Valley Brook Av., Lyndhurst, N. J.
2 AFC Louis Cardaneo, Jr., and Milton Selcow, 25 W. 45th St., Bayonne, N. J.
2 KG John T. Guymon, 2382 Chauncey St., Astoria, N. Y.
2 AGA George N. Scott, 319 Glen Ave., Port Chester, N. Y.
2 BDO William Britton, Lexington Ave., Franklin Sq., N. Y.
2 VY Richard W. Carlisle, 3657 Broadway, New York, N. Y.
2 PK Harry Reifel, 959 3rd Place, Woodcliff, N. J.
2 AWP Albert A. Badian, 76 Greene St., New York, N. Y.
2 AEP Edward Stroetz, 2530 Baltic St., Maspeth, N. Y.
2 ABJ Edgar Messing..91 Crystal St., Brooklyn, N. Y.
2 PV Herbert H. Ammenheuser, 300 Delaware Ave., Albany, N. Y.
2 WH Ralph Venegas.....East Hampton, N. Y.
2 AKH Ralph F. Hunter, 12 North St., Catskill, N. Y.
2 AMD John M. Murray, 157 William St., Catskill, N. Y.
2 ANN Henry E. Crossman, 62 E. 120th St., N. Y. C.
2 IY Cecil R. Hornby, 31 Belmont Ave., Jersey City, N. J.
2 UK Ralph E. Thomas..421 Dennison St., New Brunswick, N. J.
2 JS Charles A. Wild, Jr., 35 Belmont Ave., Jersey City, N. J.
2 ALQ Henry Kashowitz, 938 Longwood Ave., New York, N. Y.
2 ANE Carl Walter, 313 E. 141st St., New York, N. Y.
2 AMC William Haupt, 533 E. 147th St., New York, N. Y.
2 LY Harry J. Weigand, 624 Broadway, Brooklyn, N. Y.
2 AMK Israel C. Heilman, 1658 Washington Ave., New York, N. Y.
2 AMV Howard H. Meyer, 2103 Ocean Ave., Brooklyn, N. Y.
2 OAE Troy High School Science Club, Troy, N. Y.
2 JT Raymond S. Hoyt, 275 Hicks St., Brooklyn, N. Y.
2 HM Will J. Madole, 1111 Woodrow Road, Princes Bay, N. Y.
2 ANH Jeremiah W. Russell.....Roslyn, N. Y.
2 PY Henry L. Bogardus, 253 Grove St., Montclair, N. J.
2 ANB John F. Longley, 81 Hickory St., East Orange, N. J.
2 ANU Erasmas Hall H. S. Radio Club, Flatbush & Church Aves. Brooklyn, N. Y.
2 KO Edgar L. Sypher, Jr., 217-11 103rd Ave., Queens Village, N. Y.
2 CTK George E. Oros..36 Willett St., Schenectady, N. Y.
2 BHN Russell S. Ohl, 2315 Andrews Ave., New York, N. Y.
2 BYO Moe Joffe.....1818 E. 15th St., Brooklyn, N. Y.
2 RM Frank A. Mahr, 1150 College Ave., New York, N. Y.
2 CWZ Edward R. Schultze, 177 Monticello Ave., Jersey City, N. J.
2 AXP James O. Maher, 38 Palmer Ave., Bronxville, N. Y.
2 AKJ Vincent Suhoski.....8 Ford Ave., Freehold, N. J.
2 BMA Walter C. Von Brandt, 3149 Boulevard, Jersey City, N. J.
2 CTH Clifford M. Rowe, 600 Pawling Ave., Troy, N. Y.
2 CKY Harold C. Van Winkle, 750 St. Nicholas Ave., New York, N. Y.
2 TP Herman G. Mustermann, 8 Pauiln Boulevard, Leonia, N. J.

Eighth District

8 ABR K. S. Sherman..2108 E. 96th St., Cleveland, Ohio
8 ACC Shannon D. Foltz....319 Sherman St., Galion, Ohio
8 AGV Robt. Laurenson, Emanual Rectory, Hastings, Mich.
8 AHO Robt. J. Wood.....Tioga, Knoxville, Pa.
8 AMV Donald L. Otis, 455 Fillmore Ave., E. Aurora, N. Y.
8 ANH Charles I. Hodgson, Jr., 342 W. Main St., Batavia, N. Y.
8 AQU Thomas McDuffee....523 Eaton St., Hamilton, Ohio
8 ANQ Ron. L. Wollard..143 Fleek Ave., Newark, Ohio
8 AYP F. Douglas Reynolds, 1680 Third Ave., Huntington, W. Va.
8 BCK Jacob Walter, 3201 W. 88th St. Cleveland, Ohio
8 BHS Clarence E. Dengler.....Wautoma Beach, N. Y.
8 BMN Ray Schweinsberg....Erwin St., Boonville, N. Y.
8 CCI Lester C. Davis, 110 Aldridge Ave., Altoona, Pa.
8 CFZ Carl F. Mueller, 12700 Beachwood St., Cleveland, Ohio
8 CGR William P. Staubach, Jr., 110 W. 69th St., Carthage, Ohio
8 CGW Clifford Wolcott, 417 Front St., Northumberland, Pa.
8 CGZ Radio Supply Shop....Box 359, Cambridge, Ohio
8 CHT South Haven High School, Broadway Ave., South Haven, Mich.
8CHZ Howard Brokate, 217 Washington St., Port Clinton, Ohio
8 CIR James F. Miller, 657 Wildwood Blvd., Williamsport, Pa.
8 CIZ Lyle I. Amos, Sr., 703 Main St., Springfield, Ohio
8 CJT William Duckwitz..312 Stimson St., Cadillac, Mich.
8 CJU Raymond Canfield....211 Cedar St., Niles, Mich.
8 CJV Dick D. Simpson..917 Maple St., Findlay, Ohio
8 CJW Howard Vanderwal, 325 Franklin Ave., Grand Haven, Mich.
8 CKT Lawrence Bell, 3081 Lincoln Blvd., Cleveland Heights, Ohio
8 CLU Andrew J. Lyons, 3008 Chadbourne St., Cleveland, Shaker Hts., Ohio.
8 CLX Everett Harrell, 218 Granite St., Cadillac, Mich.
8 CME Fred Brice..119 East Pine St., Washington, Pa.
8 CMF Raymond W. Andrews, 138 Sycamore St., East Aurora, N. Y.
8 CNU Paul Kaiser...212 Chatham St., Williamsport, Pa.
8 COR Patrick Dunphy....514 Walnut St., Freeland, Pa.
8 COT Albert E. DeCamp, 277 Kearney St., Cincinnati, Ohio
8 CPG Richard J. Evans, 26 Division St., Gloversville, N. Y.
8 CPH Robert Ranklin...703 Indiana, Martins Ferry, Ohio
8 CRM William Gassett, 472 East Cecil St., Springfield, Ohio
8 CSP Denver Little.....659 Alder St., Coshocton, Ohio
8 CUI J. Bernard Sponsler..837 High St., Williamsport, Pa.
8 CUZ Holland Snyder....68 Homer St., Binghamton, N. Y.
8 CVK James F. Francis....R. F. D. No. 2, Ithaca, N. Y.
8 CVR Frank Walker....Colfax Ave., Benton Harbor, Mich.
8 CYP J. Curtis Heilreigel..951 Lafayette St., Buffalo, N. Y.
8 CZV Werner K. Sauber..2906 Euclid St., Cleveland, Ohio
8 DBV Norwood High School....Sherman St., Norwood, Ohio
8 DCU T. Edwin Button....416 State St., Fulton, N. Y.
8 DDU Francis Orcutt..32 Madison St., Ashtabula, Ohio
8 DDW Lyle C. Dolfman..172 E. Main St., Salem, W. Va.
8 DGE Harold A. Tripp 1232 Portage St., Kalamazoo, Mich.
8 DIH Ralph Lawrence, 16 S. Garden St., Norwalk, Ohio
8 DIL Henry W. Gilmore, 705 Cross St., Ypsilanti, Mich.
8 DJL Edward L. Willard, 216 Atherton St., State College, Pa.
8 DJS Willard Chamberlain, 526 Eagle St., Dunkirk, N. Y.
8 DJX Frederoel W. Coath, So. Ridge St., W. Ashtabula, Ohio
8 DPD Robert Edmonds.....R. R. No. 9, Pen Yan, N. Y.
8 DSD Alfred Balling, 1625 Clinton Ave. N., Rochester, N. Y.
8 DSH Donald Ream.....Monroeville, Ohio
8 DSZ Kenneth E. Mann.....Main St., Macedon, N. Y.
8 DTG Henry Karpicke....133 Wilkins St., Saginaw, Mich.
48 DTQ Acme Apparatus Co...603 Arcade St., Cleveland, Ohio
8 DTJ Richard E. Schwartz..206 Lake St., Buchanan, Mich.
8 DTK Harold B. Jordan, 437 Patterson St., Bellefontaine, Ohio
8 DTL Joseph G. Saricks, 1038 Birkbeck St., Freeland, Pa.
8 DTM Joseph K. Thompson, 12974 Emerson St., Cleveland, Ohio
8 DTO Mrs. Marion Wesser....Charlotte St., Alpena, Mich.
8 DTP Cary C. Huffman.....Fayettsville, W. Va.
8 DTR Allen W. Henry, 1432 W. 114th St., Cleveland, Ohio
8 DTS Maxwell L. Moulin.....8 Deet St., Oil City, Pa.
8 DTT Alex Macks.....181 Lutheran St., Buffalo, N. Y.
8 DTU Wm. S. Dyeus..503 Fifth Ave., Moundsville, W. Va.
8 DTV Harry B. Baker...443 Decker Ave., Johnstown, Pa.
8 DTW J. A. S. Guy Dickey, 204 E. Central Ave., Delaware, Ohio
8 DTX Vance L. Miller....991 High St., Harrisburg, Ohio
8 DTY Edwin R. Sanders..257 Parker Ave., Buffalo, N. Y.
8 DTZ William S. Sarchet..142 N. 9th St., Cambridge, Ohio
8 DUH Russel J. Durni.....305 Oak St., Niles, Mich.
8 DTI James L. Hearn....3343 Harrison St., Cheviot, Ohio
8 EQ James C. Lisk.....902 Elizabeth St., Lima, Ohio
8 EX Henry J. Bannon, 486 E. 108th St., Cleveland, Ohio
8 FO Howard Hardesty, 396 Monterey St., Detroit, Highland Park, Mich.
8 JA College of Wooster.....Wooster, Ohio
8 KF William R. McShaffrey....36-6th St., Monessen, Pa.
8 PQ Norman H. Gimmy, 13503 Emily St., E. Cleveland, Ohio.
8 SH Leland Melvin.....1937 East St., Lansing, Mich.
8 TY Herschel V. Fitzcharles, 617 N. Main St., Hicksville, Ohio
8 UW Homer Heidt, Jr.....522 Jenison St., Lansing, Mich.
8 VM Lester Havenga.....2106 Hurdick, Kalamazoo, Mich.

Ninth District

9 AW Elvin E. Hahacek.....R. R. No. 1, Crete, Nebr.
9 FP Leo Kller.....3609 W. 26th St., Chicago, Il.
9 HR Maxwell H. Hutchinson.....Middlebury, Ind.
9 TT Donald C. Wallace, 54 N. Penn. Ave., Minneapolis, Minn.
9 VG Culver Woodcraft School.....Culver, Ind.
9 ZK Carl W. Klenk..3148 Halliday Ave., St. Louis, Mo.
9 ZT Donald C. Wallace, 54 N. Penn. Ave., Minneapolis, Minn.
9 ABD Gordon Verhulst, 2201 N. 8th St., Sheboygan, Wisc.
9 ABP Guy C. Long.....1139 Center St., Elkhart, Ind.
9 ABS Norman Enault.....904 Roscoe St., Chicago, Ill.
9 ABZ Herbert L. Baker, 520 49th St., Milwaukee, Wisc.
9 ACD Lester W. Guin, 219 S. Belger St., Mishawaka, Ind.
9 ADR Robert H. Knapp, 2006 Garrard St., Covington, Ky.
9 AGV Mervin J. Samuelson.....Wakefield, Nebr.
9 AIP Carroll L. Long.....New Richmond, Ind.
9 AIT Electric Service Shop, 115 S. Third St., Greenville, Ill.
9 AIW Charles E. McGraw.....Bailey, Colo.
9 AJC Raymond T. Johnson, 159 S. Harrison St., Batavia, Ill.
9 AKL Morgan G. Howard.....Appleton, Minn.
9 AQU Lawrence R. Goetz, 4200 Arthington Blvd., Indianapolis, Ind.
9 ARL Phil Davis, 6033 Surburban Ave., St. Louis, Mo.
9 AUH Joe J. Stosick, 729 Montana Ave., S. Milwaukee, Wisc.
9 AUR John H. Boos, Jr., 921 N. Main St., Alton, Ill.
9 AXJ Lane Pickett Jackson, 300 N. Pleasant St., Independence, Mo.
9 AZS Leslie D. Claybaugh, Franklin and Main Sts., Toulon, Ill.
9 AZV Chester J. Corrigan, 1446 Terrace Ave., Indianapolis, Ind.
9 BAB Carl W. Teten, 3031 Fourth St., Des Moines, Iowa
9 BBD Grant W. Bishop.....Grant City, Mo.
9 BBW Harry E. McCorkle, 1701 Chestnut St., Terre Haute, Ind.
9 BBX Fred W. Luecker, Jr., 598 17th St., Milwaukee, Wisc.
9 BCU Laurel V. Gladville, 348 S. Washington St., Bloomfield, Ind.
9 BCZ Fred'k J. Gabler, 702 W. Eighth St., Coffeyville, Kans.
9 BDQ Charles H. Krueger.....Menominee, Wisc.
9 BGU James B. French, 407 E. Seventh St., Caruthersville, Mo.
9 BHH Leo Jungs, 224½ E. Third St., Davenport, Iowa
9 BOB Earle Hanson, 1006 Reabey St., St. Paul, Minn.
9 BSM Charles B. Kramer, Sr., 1412 Maple Row, Elkhart, Ind.
9 BVJ Royer R. Blair, 461 S. 20th St., Terre Haute, Ind.
9 BWX Lewis Lamar, 2922 Seneca St., St. Joseph, Mo.
9 BXU Calvin F. Cloud.....Grant City, Mo.
9 BYL Vaughn I. Parry.....44 Warren St., Hammond, Ind.
9 BZK Paul V. Tierney....1803 Clark Ave., Parsons, Kans.
9 CAB Clere Pratt.....Farmington, Mo.
9 CAF Wm. E. McCord & DeRoyce Swinford, 2127 Brown St., Anderson, Ind.
9 CBE Paul E. Krochnert, 2635 N. Russell Ave., Minneapolis, Minn.
9 CBO Paul M. Schmitz.....Perham, Minn.
9 CBZ Philip W. Nieman, 928 Lombard Ave., Oak Park, Ill.
9 CCI Donnell W. Power, 119 E. Seventh St., Rushville, Ind.
9 CDP Charles P. Lee.....409 Second St., Frankfort, Ky.
9 CEC Delbert R. Bartsch, 228 N. Main St., Galena, Ill.
9 CEW William Doughman, 1331 Main St., Parsons, Kans.
9 CIP Fred'k Weyerhaeuser, 480 Grand Ave., St. Paul, Minn.
9 CJI Arthur L. Duvlin, 1000 Summer St., Berlin, Wisc.
9 DO Henry F. Frick, 219 N. 11th St., Belleville, Ill.
9 ACL W. E. Warner & E. M. Davis, 1228 Mississippi Ave., Davenport, Iowa
9 ADK John M. Maxwell, 5558 Central Ave., Indianapolis, Ind.
9 AEL William H. Poncot.....R. F. D. No. 2, Reeds, Mo.
9 CMP Charles S. Polacheck, 531 Lake Drive, Milwaukee, Wisc.
9 CMX Evelyn B. Kampa.....Verndale, Minn.
9 CNA Burton Robertson, 214 W. Clifton St., Tomah, Wisc.
9 CKN Daniel D. Lewis, 27 Market St., Emporia, Kans.
9 CRP George Meyers, 602 Highland Ave., Oak Park, Ill.
9 CSA John Bajalis, 863 E. 87th Place, Chicago, Ill.
0 CUF Elton F. Hess, 3035 Chicago Ave., Minneapolis, Minn.
9 CUG John M. Taylor, 3021 N. Arsenal Ave., Indianapolis, Ind.
9 CVB George S. Turner, 914 S. Lamine St., Sedalia, Mo.
9 CWH Leorman J. Bradke, 344 Washington Ave., Neenah, Wisc.
9 DAR Charles A. Kelso, 4769 Labadie Ave., St. Louis, Mo.
9 DBC Harold A. Jackson, 307 N. Prairie Ave., Yates Center, Kans.
9 DCZ Wallace N. Shinn, 901 Sycamore St., Creston, Iowa
9 DDV Arthur C. Anderson, 3518 S. 22d Ave., Minneapolis, Minn.
9 DIZ Fred Timmerman, Radio Station WVC, Signal Corps, U. S. A., Ft. Levenworth, Kans.
9 DNA Oswald Rasmussen, 476 54th Ave., West Allis, Wisc.
9 DNE Edwin F. Ottman, 108 Abbey Ave., Menasha, Wisc.
9 DOC B. R. Grawburg.....
9 DOQ Thomas B. Gibbs, 520 Adelaide Ave., Pierson, Iowa
9 DPI Elden W. May.....University City, Mo.
9 DPY Robert R. Ralston.....812 Pine St., Tarkio, Mo.
9 DTL Horace Robbins..3230 Capitol Ave., Indianapolis, Ind.
9 DTX John W. Christensen, 2003 Adams St., Two Rivers, Wisc.
9 DWH Edward W. Ohrenstein, 3238 N. Leavitt St., Chicago, Ill.
9 DYO Walter T. Mills, Jr., 451 W. 43d St., Chicago, Ill.
9 DYP Keith Jones....1510 Franklin Sts. Danville, Ill.
9 DYX Burt Moritz, Jr...1664 Steele St., Denver, Colo.
9 EGJ Oscar A. Kilbourn.....Belden, Nebr.
9 QT J. Earl Goodwin 429 Garfield Ave., Indianapolis, Ind.
9 AFU Robbins C. Foster....909 Hayes Ave., Racine, Wisc.
9 AGX Lehman Hardware and Impl. Co., 606-8 Main St., Newton, Kans.
9 AJJ Fenwick A. Fetvedt, 324 Mill St., Fargus Falls, Minn.
9 AKB Frank J. Romadka, 1021 N. Monticello Ave., Chicago, Ill.
9 AKR Otto C. Austin, 1316 Drake St., Madison, Wisc.
9 ALP Lorenzo D. Smith, 5116 S. Harriet Ave., Minneapolis, Minn.
9 AOC Archie J. Arber, 1511 Maple Ave., Independence, Mo.
9 AOF Earl R. Bell, 214 N. Murray St., Madison, Wisc.
9 AOH John Knudsen, 2315 S. 19th Ave., Minneapolis, Minn.
9 ART Otho G. Everist.....Euston, Ill.
9 ATJ Ralph H. Gullett.....R. F. D., Macuon, Ill.
9 BOX Roy C. Mullen..500 Twelfth St., Osawatomie, Kans.

Changes

9 DJ George H. Kenyon, 4555 Ellis Ave., Chicago, Ill.
9 GY Ross T. Hatton.....2220 58 St., Omaha, Nebr.
9 HR Maxwell W. Hutchinson.....Middlebury, Ind.
9 HY Jesse Huber Jay, 1341 Wisconsin St., Racine, Wisc.
9 PB Harold D. Barton, 1742 Ingraham St., Indianapolis, Ind.
9 ABV Clifford H. Rogers, 404 E. Fifth St., Hutchinson, Kans.
9 AHE Harry Gruszka, 1041 Columbia Ave., Hammond, Ind.
9 AIB Joe E. Smay, 12th and "R" Sts., Lincoln, Nebr.
9 AKD Frank Libbe, 1014 N. Adams St. South Bend, Ind.
9 ALB French H. Willis, Box 34, Cherry St., Carlisle, Ind.
9 AMR Harvey D. Matteson, 334 W. Roosevelt St., DeKalb, Ill.
9 AUR John H. Boos, Jr., 921 N. Main St., Alton, Ill.
9 AYB John O. Weaver, 922 Mulberry St., Mt. Carmel, Ill.
9 BAJ Emmer E. Herring, 509 N. Second St., Marshalltown, Iowa
9 BAZ John B. Wathen, Box 97, R. F. D. No. 1, (Mocking Bird Valley), Louisville, Ky.
9 BLN Edgar A. Triplette, P. O. Box No. 5, Hoisington, Kans.
9 BMX Leonard W. Still, 1359 Pacific St., St. Paul, Minn.
9 BNQ Ivan Boyd, 624 New York Ave., Creston, Iowa
9 CFY Clarence O. Ford, 609 S. Hancock St., Colorado Springs, Colo.
9 CKA Charles H. Guillaume, Pearl and Pleasant Sts., Elk Point, S. Dak.
9 CLG Capital City Radio Club, 717 Fourth St., Des Moines, Iowa
9 CLN Arthur E. Thompson, 812 Spencer Ave., Marion, Ind.
9 CMG Eugene C. Volz, 414 N. Front St., Winamac, Ind.
9 CSS Henry H. Guthman, 2919 Cottage Grove Ave., Chicago, Ill.
9 CST Lynne B. Greene, 3619 Walnut St., Kansas City, Mo.
9 DFZ Almon W. Sprague, 861 Palace St., St. Paul, Minn.
9 DGA Eric B. Hjerpe, 725 N. Prairie St., Galesburg, Ill.
9 DHL Harold L. Beeson, 6224 St. Winchester Ave., Chicago, Ill.
9 DIP Fred'k C. Crowell, Jr., 717 Fourth St., Des Moines, Iowa
9 DQE Raymond McCormick, 1450 "Q" St., Lincoln, Nebr.
9 DRW Frank J. Whalen, 17th and Duncan Sts., St. Joseph, Mo.
9 DWS Fred R. Wiley, 505 W. Springfield St., Champaign, Ill.
9 CTO Sylvan H. Frase, 3220 Pleasant Ave., Minneapolis, Minn.
9 DPV Roy W. Ide, Jr., 826 S. Fourth St., Springfield, Ill.
9 GT Randall Wright, Michigan Ave., Highland Park, Ill.
9 WI Lewis C. Meek, 521 S. Downing St., Denver, Colo.
9 AVA Griffith M. Morgan, 326 S. Ridgeland Ave., Oak Park, Ill.
9 CWX Jesse H. Lofton, 414 E. Liberty St., Mexico, Mo.

Eighth District

8 AAM Wm. A. Sarchet, 142 N. Ninth St., Cambridge, Ohio
8 AAZ Wm. J. Oldham, 2041 West 93d St., Cleveland, Ohio
8 ACX Floyd O. Atchley, 907 S. Webb St., Alliance, Ohio
8 ADH Paul Cary Winters, 1497 West First Ave., Columbus, Ohio
8 ADZ Frederick O. Hisington, 110 Oak St., Syracuse, Ohio
8 AEE Raymond C. Wise, 1835 Booth St., Toledo, Ohio
8 AEW Paul E. Snyder.....Boyne Falls, Mich.
8 AFP E. H. Poad (Boy Scouts of America) Cleveland, Chagrin Falls, Ohio
8 AHV Charles Nicholsk....Elm St., Webster, New York
8 AJB Robt. S. Brown, 521 Paris Ave., S. E. Grand Rapids, Mich.
8 AJO Walter Kabacinski, 908 S. Keeper Ave., Scranton, Pa.
8 AJP Raymond L. Henning, 110 Bausman St., Knoxville, Pittsburgh, Pa.
8 AJQ Lawson Johnston, 89 E. College St., Westerville, Ohio
8 AKB E. D. Shepley, 141 Eleventh St., Cambridge, Ohio
8 AKF John Hessel 744 Lafayette Ave., Grand Rapids, Mich.
8 AKF Robt. J. Daugherty, 628 Main St., Hamilton, Ohio
8 AKS Edward B. Castor 9 Wilson Ave., Amsterdam, N. Y.
8 ALB L. Selye Whitmore, 110 Dartmouth St., Rochester, N. Y. (Portable)
8 ALI Max Bauer, 11407 Scottwood St., Cleveland, Ohio
8 ALY Alfred W. Balling, 1625 Clinton Ave. N., Rochester, N. Y.
8 ANO Rhea Johnson, Grace & Woodlawn St., Bay View, Mich.
8 ANR Michael Fiehl, West Mountain St., Scranton, Pa.
8 AOW David J. Gaede, 9314 Clifton Blvd., Cleveland, Ohio
8 APB Wm. C. George, 3178 Scranton Rd., Cleveland, Ohio
8 APL Howard L. Roe, 7241 Finance St., Pittsburgh, Pa.
8 APQ W. Harvey Brown, 29 Letchworth St., Auburn, N. Y.
8 APS Victor S. Barnes.....Comstock, Mich.
8 ARW Carl B. Snyder, 410 Cypress St., Greenville, Ohio
8 ATT John Marshall VanCott, 2946 Heldeberg St., Detroit, Mich.
8 ATV Joseph M. Bogucki, R. F. D. No. 3, Hammondsport, N. Y.
8 ATY Charles W. Howard, R.F.D. No. 4, DeGraff, Ohio
8 AUI Charles Moore, 322 Prospect St., South Haven, Mich.
8 AWF Wm. C. Lynch, 159 Broad St., Auburn, N. Y.
8 AWG John M. Thompson, 108 Chapin Dr., Canandaigua, N. Y.

BROADCASTING STATION DIRECTORY

KDKA Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. 309
KDLR Radio Elec. Co. Devils Lake, N. Dak. 231
KDPM Westinghouse Electric & Mfg. Co., Cleveland, O. 250
KDYL Newhouse Hotel. Salt Lake City, Utah 250
KDZB Frank E. Seifert. Bakersfield, Cal. 209
KEPT Cope & Johnson. Salt Lake City, Utah 268
KFAB Nebraska Buick Auto Co. Lincoln, Nebr. 248
KFAD McArthur Bros. Co., 134 S. Central St., Phoenix, Arizona 273
KFAE State College of Washington. Pullman, Wash. 330
KFAF Western Radio Corporation. Denver, Colo. 278
KFAJ University of Colorado. Boulder, Colo. 360
KFAN The Electric Shop. Moscow, Idaho 360
KFAU Independent School District of Boise City, Boise High School, Boise, Idaho 500
KFAW The Radio Den. Santa Ana, Cal. 280
KFBB F. A. Buttrey & Co. Havre, Mont. 360
KFBC W. K. Azbill. San Diego, Cal. 223
KFBE Horn & Wilson's. San Luis Obispo, Cal. 215
KFBG First Presbyterian Church. Tacoma, Wash. 360
KFBK Kimball-Upson Co. Sacramento, Cal. 283
KFBL Leese Bros. Everett, Wash. 224
KFBU The Cathedral. Laramie, Wyo. 270
KFCB Nielsen Radio Supply Co. Phoenix, Ariz. 238
KFCC First Congregational Church. Helena, Mont. 248
KFCF Frank A. Moore. Walla Walla, Wash. 256
KFCL Leslie E. Rice, Los Angeles Union Stock Yards, Los Angeles, Cal. 236
KFCY Western Union College, Le Mars, Iowa., address 711 Dayton Ave. 252
KFCZ Omaha Central High School. Omaha, Neb. 258
KFDD St. Michael's Cathedral. Boise, Idaho 252
KFDH University of Arizona. Tucson, Ariz. 258
KFDJ Oregon Agricultural College. Corvallis, Ore. 360
KFDM Magnolia Petroleum Co. Beaumont, Texas 306
KFDX First Baptist Church. Shreveport, La. 350
KFDY South Dakota State College. Brookins, S. D. 560
KFDZ Harry O. Iverson. Minneapolis, Minn. 231
KFEC Meier & Frank Co. Portland, Ore. 248
KFEL Wilmer Radio Corp. Denver, Colo. 254
KFEQ Scroggin & Co. Bank, Oak, Neb. 268
KFER Auto Electric Service Co. Fort Dodge, Iowa 231
KFEY Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho 360
KFFB Jenkins Furniture Co. Boise, Idaho 240
KFFE Eastern Oregon Radio Co. Pendleton, Ore. 360
KFFP First Baptist Church. Moberly, Mo. 266
KFFR Nevada State Journal. Sparks, Nev. 226
KFFV Graceland College. Lamoni, Iowa 250
KFFY Louisiana College for Women. Baton Rouge, La. 275
KFGC Louisiana State University. Baton Rouge, La. 268
KFGD Oklahoma College for Women. Chickasha, Okla. 252
KFGH Leland Stanford University, Stanford Univ., Cal. 270
KFGQ Cleary Hardware Co. Boone, Iowa 226
KFGX First Presbyterian Church. Orange, Texas 250
KFHA Western State College of Colorado. Gunnison, Colo. 252
KFHJ State Teachers College. Warrensburg, Mo. 234
KFHL Penn College. Oskaloosa, Iowa 240
KFI Earle C. Anthony, Inc. Los Angeles, Cal. 469
KFIF Benson Polytechnic Institute. Portland, Ore. 248
KFIO North Central High School. Spokane, Wash. 252
KFIQ First Methodist Church. Yakima, Wash. 242
KFIU Alaska Elec. Light & Power Co., Juneau, Alaska 226
KFIZ Daily Commonwealth and Oscar A. Huelsman, Fond du Lac, Wis. 273
KFJB Marshall Electric Co. Marshalltown, Iowa 248
KFJF National Radio Mfg. Co. Oklahoma City, Okla. 261
KFJI Liberty Theatre, Astoria, Oregon. 395
KFJM University of North Dakota, Grand Forks, N. D. 280
KFJR Ashley C. Dixon & Son. Stevensville, Mont. 258
KFJX Iowa State Teachers College. Cedar Falls, Iowa 280
KFJY Tunwall Radio Co. Fort Dodge, Iowa 246
KFJZ W. E. Branch, 400 Seventh Street, Fort Worth, Texas 254
KFKA Colorado State Teachers College. Greeley, Colo. 273
KFKB Brinkley-Jones Hospital Association, Milford, Kan. 286
KFKQ Conway Radio Laboratories. Conway, Ark. 250
KFKU University of Kansas. Lawrence, Kan. ...
KFKX Westinghouse Electric & Mfg. Co., Hastings, Neb. 341
KFKZ Nassour Bros. Radio Co. Colorado Springs, Colo. 234
KFLB Signal Electric Mfg. Co. Menominee, Mich. 248
KFLP Everette M. Foster, 1242 South Sixth St., Cedar Rapids, Iowa 256
KFLR University of New Mexico. Albuquerque, N. M. 254
KFLU Rio Grande Radio Supply House, San Benito, Texas 236
KFLV Swedish Evangelical Mission Church, Rockford, Ill. 229
KFLX George R. Clough, 1214 40th St., Galveston, Tex. 240
KFLZ Atlantic Automobile Co. Atlantic, Iowa 271
KFMB Christian Churches of Little Rock, Little Rock, Ark. 254
KFMQ University of Arkansas. Fayetteville, Ark. 248
KFMR Morningside College. Sioux City, Iowa 261
KFMT George W. Young, 2219 W. Bryant Ave., Minneapolis, Minn. 231
KFMW M. G. Sateren, 127 Blanche St., Houghton, Mich. 266
KFMX Carleton College. Northfield, Minn. 283
KFNF Henry Field Seed Co. Shenandoah, Iowa 266
KFNG Wooten's Radio Shop. Coldwater, Miss. 254
KFNJ Central Mo. State Teachers College, Warrensburg, Mo. 234
KFNL Radio Broadcast Association. Paso Robles, Cal. 212
KFNV L. A. Drake, 505 Third St. Santa Rosa, Cal. 228
KFNY Montana Phonograph Co. Helena, Mont. 248
KFOA Rhodes Dept. Store. Seattle, Wash. 455
KFOC First Christian Church. Whittier, Cal. 230
KFOJ Moberly High School Radio Club. Moberly, Mo. 246
KFOL Leslie M. Schafbuch, 502 W. Marion St., Marengo, Iowa 234
KFON Echophone Radio Shop. Long Beach, Cal. 230
KFOO Latter Day Saints University, Salt Lake City, Utah 242
KFOR David City Tire & Electric Co., David City, Neb. 226
KFOT College Hill Radio Club. Wichita, Kan. 231
KFOX Technical High School. Omaha, Neb. 248
KFOY Beacon Radio Service. St. Paul, Minn. 252
KFPG Garretson & Dennis. Los Angeles, Cal. 238
KFPL C. C. Baxter, 205 Grafton St. Dublin, Tex. 242
KFPM New Furniture Co. Greenville, Texas 242
KFPN Missouri National Guard, 70th Infantry Brigade, Jefferson City, Mo. 242
KFPR Los Angeles County Forestry Department, Los Angeles, Cal. 236
KFPV Heintz & Kohlmoos. San Francisco, Cal. 236
KFPW St. John's Church. Carterville, Mo. 268
KFPX First Presbyterian Church. Pine Bluff, Ark. 242
KFPY Symons Investment Co. Spokane, Wash. 283
KFPY The Principia, 5539 Page Ave., St. Louis, Mo. 261
KFQA Searchlight Publishing Co., Fort Worth, Texas 254
KFQB Kidd Brothers Radio Shop. Taft, Cal. 232
KFQC Southern California Radio Association, Armory Exposition Park, Los Angeles, Cal. 228
KFQH Albert Sherman, Hillsborough Box 51, Burlingame, Cal. 220
KFQI Thomas H. Ince Corp. Culver City, Cal. 234
KFQJ Harbour-Longmire Co. Oklahoma City, Okla. 236
KFQK Democrat Leader. Fayette, Mo. 236
KFQM Texas Highway Bulletin. Austin, Texas 268
KFQR Walter L. Ellis, 625 East 6th St., Oklahoma City, Okla. 250
KFQT Texas National Guard, Thirty-sixth Signal Co., Denison, Texas 252
KFQU W. Riker. Holy City, Cal. 222
KFQW C. F. Knierim Photo, Radio & Electric Shop, North Bend, Wash. 248
KFQY Farmers State Bank. Belden, Neb. 273
KFQZ Taft Radio Co., 5653 De Longpre Ave., Hollywood, Cal. 239
KFRB Hall Brothers. Beeville, Texas 248
KFRC City of Paris Dry Goods Co., Gear and Stockton Streets, San Francisco, Cal. 268
KFRF W. R. Brown. Alexandria, La. 242
KFRH The Radio Shop. Gratton, N. D. 268
KFRL Men's Club of First Presbyterian Church, Grand Forks, N. Dak. 240
KFRM Lieut. James P. Boland, U. S. A., Fort Sill, Okla. 263
KFRN M. Laurence Short. Hanford, Cal. 224
KFRP Trinity Church. Redlands, Cal. 206
KFRQ Radio Market Service Co. Portland, Ore. 213
KFRU Bristow, Oaklahoma (Etherical Studios). 394
KFRW United Churches of Olympia. Olympia, Wash. 220
KFRX J. Gordon Kleinguard. Pullman, Wash. ...
KFRY New Mexico College of Agriculture & Mechanic Arts, State College of N. M. 266
KFRZ The Electric Shop. Harrington, Neb. ...
KFSG Echo Park Evangelistic Association, Los Angeles, Cal. 277
KFSY Van Blaricom Co., 20 So. Main St., Helena, Mont. 261
KFUM W. D. Corley, 114 W. Del Norte St., Colorado Springs, Col. ...
KFUJ Hopper Plumbing & Heating Co., Breckenridge, Minn. 242
KFUL Thomas Goggen & Bros. Galveston, Texas 256
KFUO Concordia Seminary. St. Louis, Mo. 549
KFUP Fitzsimmons General Hospital. Denver, Colo. 234
KFUR Perry & Redfield. Ogden, Utah 223
KFUS L. L. Sherman & Church. Oakland, Cal. 234
KFUT University of Utah. Salt Lake City, Utah 360
KFUU Colburn Radio Laboratories. San Leandro, Cal. 224
KFUV G. Pearson Ward. Springfield, Mo. 252
KFUY Irvine H. Bonchard. Butte, Mont. 254
KFUW Carl W. Lewis. Moberly, Mo. 233
KFVE Film Corporation of America, 6800 Delmar Boulevard, St. Louis, Mo. 240
KFVG First Methodist Episcopal Church, 204 South Elm Ave., Independence, Kan. 236
KFVH Whan Radio Shop. Manhattan, Kansas 218
KFVI Headquarters Troop, 56th Cavalry Brigade, 305 Sabine Street, Houston, Tex. 248
KFWA Browning Brothers. Ogden, Utah 261
KFWD Arkansas Light and Power Co., Arkadelphia, Ark. 266
KFWF St. Louis Truth Center, 4030 Lindell St., St. Louis, Mo. ...
KGB Tacoma Daily Ledger. Tacoma, Wash. 252
KGO General Electric Co. Oakland, Cal. 312
KGU Marion A. Mulrony. Honolulu, Hawaii 360
KGW Portland Morning Oregonian. Portland, Ore. 492
KGY St. Martin's College. Lacey, Wash. 258
KHJ Times Mirror Co. Los Angeles, Cal. 395
KHQ Louis Wasmer. Seattle, Wash. 360
KJBS Julius Brunton. San Francisco, Cal. 238
KJR Northwest Radio Service. Seattle, Wash. 283
KJS Bible Institute of Los Angeles, Los Angeles Cal. 293
KLDS Reorganized Church of Jesus Christ of Latter Days Saints 268
KJQ C. O. Gould. Stockton, Cal. 273
KLS Warner Brothers Radio Supplies Co., Oakland, Cal. 242
KLX Tribune Publishing Co. Oakland, Cal. 509
KLZ Reynolds Radio Co. Denver, Colo. 283
KMJ San Joaquin Lt. & Power Corp. Fresno, Cal. 234
KMO Love Electric Co. Tacoma, Wash. 360
KNX "Hollywood," Los Angeles Evening Express. 337
KOA Rocky Mts. Broadcasting Station, General Elec. Co., Denver, Colo. 323
KOB New Mexico College of Agriculture and Mechanic Arts, State College, N. M. 348
KOP Detroit Police Dept. Detroit, Mich. 277
KPO Hale Bros. San Francisco, Cal. 423
KPPC First Presbyterian Church. Pasadena, Cal. 228
KQV Doubleday Hill Electric Co. Pittsburgh, Pa. 275
KQW Charles D. Herrold. San Jose, Cal. 226
KRE Berkeley Daily Gazette. Berkeley, Cal. 258
KSAC Manhattan. Kans. 340
KSD Post Dispatch (Pulitzer Pub. Co.), St. Louis, Mo. 546
KSL The Radio Service Corp. of Utah, Salt Lake City, Utah 299
KTHS Hot Springs, Ark. 374
KTW First Presbyterian Church, Seattle, Washington 454
KUO Examiner Printing Co. San Francisco, Cal. 245
KUOM State University of Montana. Missoula, Mont. 244
KWG Portable Wireless Telephone Co., Stockton, Cal. 247
KYQ Electric Shop. Honolulu, Hawaii 270
KYW Westinghouse Elec. & Mfg. Co., Chicago, Ill. 536
KZKZ Electrical Supply Co, 109 Plaza Maraga, Manila, P. I. 270
KZM Preston D. Allen, 13th and Harrison Sts., Hotel Oakland, Oakland, Cal. 242
KZRQ Far Eastern Radio Co., Manila Hotel, Manila, P. I. 222
WAAB Valdemar Jensen, 137 S. St. Patrick St., New Orleans, La. 268
WAAC Tulane University. New Orleans, La. 360
WAAD Ohio Mechanics Institute. Cincinnati, Ohio 258
WAAF Chicago Daily Drover's Journal. Chicago, Ill. 286
WAAM I. R. Nelson Co. Newark, N. J. 263
WAAW Omaha Grain Exchange. Omaha, Neb. 278
WABA Lake Forest University. Lake Forest, Ill. 227
WABB Harrisburg Sporting Goods Co., Harrisburg, Pa. 266
WABI Bangor Railway & Electric Co., Bangor, Me. 240
WABL Connecticut Agricultural College. Storrs, Conn. 283
WABM F. E. Doherty Automotive & Radio Equipment Co., Saginaw, Mich. 206
WABN Ott Radio, Inc., 1627 State St., La Crosse, Wis. 244
WABO Hickson Electric Co. Rochester, N. Y. 277
WABQ Haverford College Radio Club. Haverford, Pa. 261
WABR Scott High School. Toledo, Ohio 263
WABU Victor Talking Machine Co. Camden, N. J. 226
WABW College of Wooster. Wooster, Ohio 207
WABX Henry B. Joy. Mount Clemens, Mich. 246
WABY John Magaldi, Jr., 815 Kimball St., Phila., Pa. 242
WABZ Coliseum Place Baptist Church, New Orleans, La. 263
WADC Allen T. Simmons. Akron, Ohio 258
WAFD Albert P. Parfet Co., 1432 Military Ave., Port Huron, Mich. 256
WAHG A. H. Grebe Co. Brooklyn, N. Y. 316
WAIT A. H. Waite Co., 32 Weir St. Taunton, Mass. 220
WBAA Purdue University. West Lafayette, Ind. 283
WBAK Pennsylvania State Police, 18th and Herr Sts., Harrisburg, Pa. 275
WBAN Wireless Phone Corporation. Paterson, N. J. 244
WBAO James Milliken University. Decatur, Ill. 275
WBAP Wortham-Carter Publishing Co. (Star-Telegram), Fort Worth, Texas 476
WBAV Erner & Hopkins Co. Columbus, Ohio 294
WBAX John H. Stenger, Jr., 66 Glidersleeve St., Wilkesbarre, Pa. 253
WBBA Plymouth Congregational Church, Newark, Ohio 225
WBBG Irving Vermilya. Mattapoisett, Mass. 248
WBBL Grace Covenant Church. Richmond, Va. 283
WBBM H. Leslie Atlas, 7421 Sheridan Road, Chicago, Ill. 226
WBBP Petoskey High School. Petoskey, Michigan 238
WBBR Peoples Pulpit Association. Rossville, N. Y. 273
WBBS First Baptist Church. New Orleans, La. 252
WBBU Jenks Motor Sales Co. Monmouth, Ill. 224
WBBV Johnstown Radio Co. Johnstown, Pa. 248
WBBW Ruffner Junior High School. Norfolk, Va. 222
WBBY Washington Light Infantry, Charleston, S. C. 268
WBBZ Noble B. Watson, 233 Iowa St., Indianapolis, Ind. 227
WBCN Southtown Economist Station. Chicago, Ill. 266
WBDC The Baxter Laundry Co., 747 Fountain St., N. E., Grand Rapids, Mich. 256
WBES Bliss Elec. Co. Takoma Park, Md. 222
WBOQ A. H. Grebe & Co., Inc., 70 Van Wyck Blvd., Richmond Hill, N. Y. 236
WBRE Baltimore Radio Exchange. Wilkesbarre, Pa. 231
WBS D. W. May (Inc.) Newark, N. J. 252
WBT Southern Radio Corp. Charlotte, N. C. 360
WBZ Westinghouse Elec. & Mfg. Co., Springfield, Mass. 337
WCAD St. Lawrence University. Canton, N. Y. 263
WCAE Kaufman & Baer Co. Pittsburgh, Pa. 462
WCAG Clyde R. Randall, 2813 Calhoun St., New Orleans, La. 268
WCAH Entrekin Electric Co. Columbus, Ohio 265
WCAJ Nebraska Wesleyan University, University Place, Neb. 280
WCAL St. Olaf College. Northfield, Minn. 360
WCAO The Sanders and Stayman Co., Baltimore, Md. 275
WCAP Chesapeake & Potomac Telephone Co., Washington, D. C. 469
WCAR Southern Radio Corp. of Texas, San Antonio, Texas 263
WCAT South Dakota State School of Mines, Rapid City, S. D. 240
WCAU Durham & Co. Philadelphia, Pa. 278
WCAX University of Vermont. Burlington, Vt. 360
WCAY Milwaukee Civic Broadcasting Station, Hotel Antlers, Milwaukee, Wis. 266
WCAZ Carthage College. Carthage, Ill. 246
WCBA Charles W. Heimbach, 1015 Allen St., Allentown, Pa. 280
WCBC University of Michigan. Ann Arbor, Mich. 229
WCBD Wilbur G. Voliva. Zion, Ill. 356
WCBE Uhalt Radio Co. New Orleans, La. 263
WCBG Howard S. Williams. Pascagoula, Mass. 268
WCBH University of Mississippi. Oxford, Miss. 242
WCBI Nicoll, Duncan & Rush. Bemis, Tenn. 240
WCBJ J. C. Mans. Jennings, La. 244
WCBL Northern Radio Mfg. Co. Houlton, Me. 280
WCBM Charles Schwarz, Charles and North Aves., Baltimore, Md. 229
WCBQ First Baptist Church. Nashville, Tenn. 236
WCBR Charles H. Messter. Providence, R. I. 245
WCBT Clark University. Worcester, Mass. 238
WCBU Arnold Wireless Supply Co. Arnold, Pa. 220
WCBW George P. Rankin, Jr., and Maitland Solomon, Macon, Ga. 225
WCBY Forks Electrical Shop. Buck Hill Falls, Pa. 230
WCBZ Neutrowound Radio Mfg. Co., Chicago Hgts., Ill. 217
WCCO Washburn Crosby Co., 200 Chamber of Commerce, Minneapolis, Minn. 417
WCEE Charles E. Erbstein, R. F. D. 6, Box 75, (Near) Elgin, Ill. 275
WCK Stix Baer & Fuller Dry Goods Co., St. Louis, Mo. 360
WCM Texas Markets & Warehouse Department, Austin, Texas 268
WCTS C. T. Sherer Co. Worcester, Mass. 268
WCUW Clark University. Worcester, Mass. 238
WCX The Detroit Free Press. Detroit, Mich. 517
WDAE Tampa Daily Times. Tampa, Fla. 360
WDAF Kansas City Star. Kansas City, Mo. 411
WDAG J. Laurence Martin. Amarillo, Tex. 263
WDAH Trinity Methodist Church (South), El Paso, Tex. 268
WDAY Radio Equipment Corp. Fargo, N. D. 244
WDBC Kirk Johnson & Co. Lancaster, Pa. 258
WDBD Herman E. Burns. Martinsburg, W. Va. 254
WDBE Gilham School Elec. Co., 22 Luckie St., Atlanta, Ga. 278
WDBF Robert G. Phillips. Youngstown, Ohio. 222
WDBJ Richardson-Wayland Electrical Corp., Roanoke, Va. 229
WDBK M. F. Broz Furniture Hdw. and Radio Store, 13918 Union and Kinsman Sts., Cleveland, Ohio 227
WDBO Rollins College. Winter Park, Fla. 240
WDBP Superior State Normal School. Superior, Wisc. 242
WDBQ Morton Radio Supply Co. Salem, N. J. 234
WDBR Tremont Temple Baptist Church. Boston, Mass. 261
WDBS S. M. K. Radio Corp. Dayton, Ohio 275
WDBT Taylor's Book Store. Hattlesburg, Miss. 236
WDBV Strand Theatre. Fort Wayne, Ind. 258
WDBW The Radio Den. Columbia, Tenn. 268
WDBX Otto Baur, 138 Dyckman St., New York, N. Y. 233
WDBY North Shore Congregational Church, Chicago, Ill. 258
WDBZ Boy Scouts of America, Ulster County Council, Kingston, N. Y. 233
WDM The Church of the Covenant, Washington, D. C. 234
WDOD Chattanooga Radio Co., Inc., 540 McCallie St., Chattanooga, Tenn. 256
WDWF Dutee Wilcox. Flint Cranston, R. I. 440
WDZ J. L. Bush. Tuscola, Ill. 275
WEAA Frank D. Fallain, Police Building. Flint, Mich. 234
WEAF American Telephone & Telegraph Co., New York, N. Y. 492
WEAH Wichita Board of Trade. Wichita, Kan. 268
WEAI Cornell University. Ithaca, N. Y. 254
WEAJ University of South Dakota. Vermillion, S. D. 278
WEAM Borough of North Plainfield, North Plainfield, N. J. 261
WEAN Shepard Co. Providence, R. I. 273
WEAO The Ohio State University. Columbus, Ohio 360
WEAP Mobile Radio Co. Mobile, Ala. 360
WEAR Goodyear Tire & Rubber Co. Cleveland, Ohio 384
WEAU Davidson Bros. Company. Sioux City, Iowa 275
WEAY Iris Theatre. Houston, Texas 270

WEBA The Electric Shop.....Highland Park, N. J. 233
WEBC Walter C. Bridges.....Superior, Wis. 242
WEBD Electrical Equipment Service Co., Anderson, Ind. 246
WEBE Roy W. Waller.....Cambridge, Ohio 234
WEBH Edgewater Beach Hotel Co.....Chicago, Ill. 370
WEBJ Third Ave. Ry. Co.....New York City 273
WEBK Grand Rapids Radio Co...Grand Rapids, Mich. 242
WEBL R. C. A. United States (portable)..... 226
WEBQ Tate Radio Co.....Harrisburg, Ill. 226
WEBR H. B. Howell.....Buffalo, N. Y. 244
WEBT Dayton Cooperative Industrial High School, Dayton, Ohio 270
WEBW Beloit College.....Beloit, Wis. 283
WEBY Hubart Radio Co.....Rolindale, Mass. 226
WEBZ Savannah Radio Corp.....Savannah, Ga. 234
WEEI Edison Co.....Boston, Mass. 303
WEMC Emmanuel Missionary College, Berrien Springs
WENR Atl American Radio Corporation, 2650 Coyne St., Chicago, Ill. 266
WEW St. Louis University.....St. Louis, Mo. 280
WFAA The Dallas News, The Dallas Journal, Dallas, Texas 476
WFAM Times Publishing Co.....St. Cloud, Minn. 273
WFAV University of Nebraska.....Lincoln, Neb. 273
WFBB Eureka College.....Eureka, Ill. 240
WFBC First Baptist Church.....Knoxville, Tenn. 250
WFBU Gethsemane Baptist Church...Philadelphia, Pa 234
WFBE John Van De Walle, P. O. Box 41, Seymour, Ind.
WFBG William F. Gable Co.....Altoona, Pa. 277
WFBH Concourse Radio Corp.....N. Y. C. 273
WFBI Galvin Radio Supply Co.....Camden, N. J. 236
WFBJ St. John's University.....Collegeville, Minn. 236
WFBK Dartmouth College.....Hanover, N. H. 256
WFBL Onondaga Hotel.....Syracuse, N. Y. 252
WFBM Merchants Heat & Light Co., 519 Guaranty Building, Indianapolis, Ind. 268
WFBN Radio Sales & Service Co., 1 Broad St., Bridgewater, Mass. 226
WFBQ Wynne Radio Co., 226 Fayetteville St., Raleigh, N. C. 252
WFBR Fifth Infantry, Maryland N. G., Fifth Regiment Armory, Baltimore, Md. 254
WFBT Gloucester County Civic League, Pitman, N. J. 231
WFBY Signal Officer, Fifth Corp Area, Ft. Hayes, Columbus, Ohio ...
WFBZ Knox College.....Galesburg, Ill. ...
WFI Strawbridge & Clothier.....Philadelphia, Pa. 395
WFKB Francis K. Bridgman, 4536 Woodlawn Ave., Chicago, Ill. 217
KFVH Wilan Radio Shop.....Manhattan, Kansas 218
WGAL Lancaster Elec. Supply & Const. Co., Lancaster, Pa. 248
WGAQ Youree Hotel.....Shreveport, La. 252
WGAZ The South Bend Tribune.....South Bend, Ind. 275
WGBA Jones Elec. & Radio Mfg. Co., Baltimore, Md. 254
WGBB Harry H. Carman.....Freeport, N. Y. 244
WGBC First Baptist Church.....Memphis, Tenn. 266
WGBF Finke Furniture Co., 307 Upper 7th St., Evansville, Ind. 217
WGBG Brettenbach's Radio Shop.....Thrifton, Va. 226
WGBH Fall River Herald Publishing Co., Fall River, Mass. 209
WGBI Frank S. Megarge.....Scranton, Pa. 240
WGBK Lawrence Campbell.....Johnstown, Pa. 248
WGBM Theodore N. Saaty.....Providence, R. I. 234
WGBN Hub Radio Shop, 728 First St., La Salle, Ill. 256
WGBO Dr. Roses Artan, 197 Ponce Leon Ave., San Juan, P. R. 275
WGBQ Stout Institute.....Menomonie, Wis. 234
WGBS Gimbel Brothers.....New York City 316
WGBT Furman University.....Greenville, S. C. 236
WGBX University of Maine.....Orono, Maine 252
WGBY The Progress Sales Co., R. R. No. 2, New Lebanon, Ohio 250
WGI American Radio & Research Corp., Medford Hillside, Mass. 360
WGN Drake Hotel.....Chicago, Ill. 370
WGR Federal Telephone Mfg. Co.....Buffalo, N. Y. 319
WGST Georgia School of Technology.....Atlanta, Ga. 270
WGY General Electric Co.....Schenectady, N. Y. 380
WHA University of Wisconsin.....Madison, Wis. 283
WHAD Marquette University.....Milwaukee, Wis. 275
WHAG University of Cincinnati.....Cincinnati, Ohio 232
WHAM Eastman School of Music, Rochester, N. Y. 277
WHAR Seaside Hotel.....Atlantic City, N. J. 275
WHAS Courier Journal and Louisville Times, Louisville, Ky. 400
WHAV Wilmington Electrical Specialty Co., Inc., Wilmington, Del. 360
WHAZ Rensselaer Polytechnic Institute.....Troy, N. Y. 380
WHB Sweeney School Co.....Kansas City, Mo. 411
WHBA Shaffer Music House.....Oil City, Pa. 250
WHBB Hebal's Store.....Stevens Point, Wis. 240
WHBC Henry L. Ley.....Canton, Ohio 254
WHBD Charles W. Howard.....Bellefontaine, Ohio 222
WHBF Beardsley Specialty Co.....Rock Island, Ill. 222
WHBG John S. Skane.....Harrisburg, Pa. 231
WHBH Culver Military Academy.....Culver, Indiana 222
WHBI Chesaning Elec. Co.....Chesaning, Mich. 227
WHBJ Lauer Auto Co.....Ft. Wayne, Ind. 234
WHBK Franklin St. Garage, Inc.....Ellsworth, Maine 231
WHBL James H. Slusser.....Logansport, Ind. 220
WHBM C. L. Carroll.....Chicago, Ill. 233
WHBN First Ave. Methodist Church, St. Petersburg, Fla. 258
WHBO Y. M. C. A.....Sumner St., Pawtucket, R. I. 231
WHBP Johnstown Automobile Co.....Johnstown, Pa. 256
WHBT Thomas W. Tizzard, Jr....Downers Grove, Ill. 206
WHBU B. L. Bing's Sons.....Anderson, Ind. 218
WHBV Fred Ray's Radio Shop, 2014 Talbot Ave., Columbus, Ga. 244
WHBW D. R. Klenzle.....Philadelphia, Pa. 215
WHBX J. W. Bowser, 206 Grenwood Ave., Punxsutawney, Pa. 212
WHBY St. Norbert's College, College Ave., West De Pere, Wis. 250
WHDI William Hood Dunwoody Ind. Ins., Minneapolis, Minn. 278
WHEC Hickson Electric Co.....Rochester, N. Y. 258
WHK Radiovox Co.....Cleveland, Ohio 283
WHN George Schubel, Loew's State Theatre Bldg., New York City 360
WHO Bankers Life Co.....Des Moines, Iowa 526
WIAD Howard R. Miller, 6318 N. Park Ave., Philadelphia, Pa. 254
WIAK Journal-Stockman Co.....Omaha, Neb. 278
WIAS Home Electric Co.....Burlington, Iowa 283
WIBA The Capital Times.....Madison, Wisc. 236
WIBC L. M. Tate Post No. 39, Veterans of Foreign Wars, 434 2nd Ave., N. St. Petersburg, Florida 222
WIBD X-L Radio Service, 223 Van Buren St., Joliet, Illinois 200
WIBE Martinsburg Radio Broadcasting Co., 145 S. Queen St., Martinsburg, W. Va. 209
WIBF S. P. Miller Dance Activities, Wheatland, Wisconsin 231
WIBG St. Paul's Protestant Episcopal Church, Elkins Park, Pa. 222
WIBO Nelson Brothers, 6310 Broadway, Chicago, Ill. 226
WIL Benson Radio Co.....St. Louis, Mo. 273
WIP Gimbel Brothers.....Philadelphia, Pa. 509
WJAD Jackson's Radio Engineering Laboratories, Waco, Texas 353
WJAG The Norfolk Daily News.....Norfolk, Neb. 270
WJAK Clifford L. White.....Greentown, Ind. 254

WJAM D. M. Perham, 332 Third Ave., W. Cedar Rapids, Iowa 268
WJAR The Outlet Co.....Providence, R. I. 305
WJAS Pittsburgh Radio Supply Co.....Pittsburgh, Pa. 275
WJAZ Zenith Radio Corporation, 332 So. Michigan Ave., Chicago, Ill. 268
WJBC Hummer Furniture Co., Second & Joliet Sts., LaSalle, Ill. 234
WJBD Ashland Broadcasting Committee, Ashland, Wisc. 233
WJD Richard Howe.....Granville, Ohio 217
WJJD Mooseheart.....Mooseheart, Ill. 278
WJY R. C. A.....New York City 405
WJZ R. C. A.....New York City 455
WKAA H. F. Paar, 1444 Second Ave. E., Cedar Rapids, Iowa 278
WKAD Charles Looff (Crescent Park), East Providence, R. I. 240
WKAP Dutee W. Flint.....Cranston, R. I. 360
WKAQ Radio Corp. of Porto Rico.....San Juan, P. R. 340
WKAR Michigan Agriculture College, East Lansing, Mich. 280
WKAV Laconia Radio Club.....Laconia, N. H. 254
WKBE K. & B. Electric Co.....Wenster, Mass. 231
WKRC—Kodel Radio Corp., 120 West 3d St., Cincinnati, Ohio. 309
WKY W. K. Y. Radio Shop....Oklahoma City, Okla. 360
WLAP W. V. Jordan, 306 W. Breckenridge St., Louisville, Ky. 286
WLAX Greencastle Community Broadcasting Station, Greencastle, Ind. 231
WLB University of Minnesota at Minneapolis, Minn.
WLBL Wisconsin Department of Markets, Stephens Point, Wis. 278
WLIT Lit Brothers.....Philadelphia, Pa. 394
WLS Sears, Roebuck & Co.....Chicago, Ill. 345
WLW Crosley Radio Corp.....Cincinnati, Ohio 423
WMAC Clive B. Meredity.....Cazenovia, N. Y. 265
WMAF Round Hills Radio Corp.....Dartmouth, Mass. 360
WMAK Northern Laboratories.....Lockport, N. Y. 265
WMAN Heskett Radio Station.....Columbus, Ohio 277
WMAQ Chicago Daily News.....Chicago, Ill. 448
WMAY Kingshighway Presbyterian Church, St. Louis, Mo. 280
WMAZ Mercer University.....Macon, Ga. 261
WMBB Trianon Ball Room, 6201 Cottage Grove, Chicago, Ill. 250
WMBF .....Miami Beach, Fla. ...
WMC Commercial Appeal.....Memphis, Tenn. 500
WMCA Hotel McAlpin, Broadway & 34th St., N. Y. C. 341
WMU Doubleday-Hill Electric Co...Washington, D. C. 261
WNAB The Shepard Stores, 30 Winter St., Boston, Mass. 250
WNAD University of Oklahoma.....Norman, Okla. 254
WNAL Omaha Central High School.....Omaha, Neb. 258
WNAP Wittenberg College.....Springfield, Ohio 248
WNAR First Christian Church.....Butler, Mo. 231
WNAT Lennig Bros. Co.....Philadelphia, Pa. 250
WNAX Dakota Radio Apparatus Co.....Yankton, S. D. 244
WNJ Radio Shop of Newark.....Newark, N. J. 233
WNYC City of New York.....New York, N. J. 526
WOAC Page Organ Co.....Lima, Ohio 261
WOAF Tyler Commercial College.....Tyler, Texas 360
WOAI Southern Equipment Co.....San Antonio, Texas 394
WOAN Vaughn Conservatory of Music, Lawrenceburg, Tenn. 360
WOAW Woodmen of the World.....Omaha, Neb. 526
WOAX Franklyn J. Wolff, 600 Ingham Ave., Trenton, N. J. 240
WOC The Palmer School of Chiropractic, Davenport, Iowa 498
WOCL Hotel Jamestown.....Jamestown, N. Y. 275
WODA James K. O'Dea Radio & Victrola Shop, Paterson, N. J. 202
WOI Iowa State College.....Ames, Iowa 360
WOO John Wanamaker.....Philadelphia, Pa. 509
WOQ Western Radio Co.....Kansas City, Mo. 360
WOR L. Bamburger & Co.....Newark, N. J. 405
WORD Peoples Pulpit Association.....Batavia, Ill. 275
WOS Missouri State Marketing Bureau, Jefferson City, Mo. 441
WOWL Owl Battery Company, H. M. Holmes, Pres., 901 Carondelet St., New Orleans, La. 270
WPAJ Doolittle Radio Corp.....New Haven, Conn. 268
WPAK North Dakota Agricultural College, Agricultural College, N. D. 275
WPAZ Dr. John R. Koch.....Charleston, W. Va. 267
WPG Municipal Radio Station.....Atlantic City, N. J. 296
WPSC Penna State College.....State College, Pa. 261
WQAA Horace Beale, Jr.....Parkersburg, Va. 360
WQAC Glah Radio Service.....Amarillo, Texas 234
WQAE Moore Radio News Station.....Springfield, Vt. 275
WQAM Electrical Equipment Co.....Miami, Fla. 273
WQAN Scranton Times.....Scranton, Pa. 250
WQAQ Calvary Baptist Church.....New York, N. Y. 360
WQAS Prince-Walter Co.....Lowell, Mass. 252
WQJ Calumet Rainbo Broadcasting Co..Chicago, Ill. 448
WRAA Rice Institute.....Houston, Texas 256
WRAF The Radio Club.....Laporte, Ind. 224
WRAL Northern States Power Co., St. Croix Falls, Wis. 248
WRAM Lombard College.....Galesburg, Ill. 244
WRAN Black Hawk Electrical Co.....Waterloo, Iowa 236
WRAV Antioch College.....Yellow Springs, Ohio 263
WRAW Avenue Radio Shop.....Reading, Pa. 238
WRAX Flexons Garage.....Gloucester City, N. J. 268
WRBC Immanuel Lutheran Church....Valparaiso, Ind. 278
WREO Reo Motor Car Co.....Lansing, Mich. 288
WRC Radio Corp. of America.....Washington, D. C. 469
WRHF Washington Radio Hospital Fund, 525 11th St., Washington, D. C. 256
WRK Doron Bros. Elec. Co.....Hamilton, Ohio 270
WRL Union College.....Schenectady, N. Y. 360
WRM University of Illinois.....Urbana, Ill. 273
WRR City of Dallas Police and Fire Signal Dept., Dallas, Texas 261
WRW Tarrytown Radio Research Laboratory, Tarrytown, N. Y. 273
WSAB South East Missouri State Teachers College, Cape Girardeau, Mo. 360
WSAC Clemson Agricultural College, Clemson College, S. C. 360
WSAD J. A. Foster Co.....Providence, R. I. 261
WSAG Gospel Tabernacle.....St. Petersburgh, Fla. 266
WSAI United Playing Card Co.....Cincinnati, Ohio 326
WSAJ Grove City College.....Grove City, Pa. 229
WSAN Allentown Call Publishing Co...Allentown, Pa. 229
WSAP Seventh Day Adventist Church, N. Y. C., N. Y. 263
WSAR Doughty & Welch Elec. Co....Fall River, Mass. 254
WSAU Camp Marienfeld.....Cheshum, N. H. 229
WSAV Clifford W. Vick Radio Construction Co., Houston, Texas 360
WSAX Chicago Radio Laboratory.....Chicago, Ill. 268
WSAZ Chase Electric Shop.....Pomeroy, Ohio 244
WSB Atlanta Journal.....Atlanta, Ga. 429
WSL Hatfield Elec. Co.....Utica, N. Y. 242
WSOE School of Engineering of Milwaukee, Milwaukee, Wis. 246
WSRE Harden Sales and Service.....Broadland, Ill. 233
WSRO Radio Co. (Harry W. Fahrlander), Hamilton, Ohio 252
WSKG World's Star Knitting Co., Water St., Bay City, Mich. 261
WSMB Saenger Amusement Co. and Maison Blanche Co., Maison Blanche Bldg., New Orleans, Louisiana 319

WSMK S. M. K. Radio Corp., S. W. Third & Loudon Sts., Dayton, Ohio 275
WSUI State University of Iowa, Capitol and Washington Sts., Iowa City, Ia. ...
WSY Alabama Power Co.....Birmingham, Ala. 360
WTAB Fall River Daily Herald Pub. Co., Fall River, Mass. 266
WTAC Penn. Traffic Co.....Johnstown, Pa. 209
WTAF Louis J. Gallo, 2222 Lapeyrouse St., New Orleans, La. 260
WTAL Toledo Radio & Elec. Co.....Toledo, Ohio 252
WTAM Willard Storage Battery Co.....Cleveland, Ohio 389
WTAP Cambridge Radio & Elec. Co...Cambridge, Ill. 242
WTAQ S. B. Van Gorden & Son.....Osseo, Wis. 254
WTAR Itellance Elec. Co.....Norfolk, Va. 280
WTAS Charles E. Erbstein, R. F. D. 6, Box 75, Elgin, Ill. 286
WTAT Edison Electric Illuminating Co., Boston, Mass. 244
WTAU Rueeg Battery and Electric Co., Tecumseh, Neb. 242
WTAW Agricultural & Mechanical College, College Station, Texas 280
WTAX Williams Hardware Co.....Streator, Ill. 231
WTAY Oak Leaves Broadcasting Station, Oak Park, Ill. 250
WTAZ Thomas J. McGuire.....Lambertville, N. J. 261
WTG Kansas State Agricultural College, Manhattan, Kan. 273
WTHS Flint Senior High School, Crapo St., Flint, Mich. 210
WTIC The Travelers Insurance Co....Hartford, Conn. 340
WWAD Wright & Wright, Inc.....Philadelphia, Pa. 360
WWAE Lawrence J. Crowley (Alamo Ball Room), Joliet, Ill. 242
WWAO Michigan College of Mines.....Houghton, Mich. 244
WWJ Ford Motor Co.....Dearborn, Mich. 265
WWJ Detroit News.....Detroit, Mich. 517
WWL Loyola University.....New Orleans, La. 280

ALASKA

KFIU Alaska Electric Light & Power Co.....Juneau 226
KFQD Chovin Supply Co.....Anchorage 280

CANADA

CFAC The Calgary Herald.....Calgary, Alta. 430
CFCA Star Publishing & Printing Co., 18 King St. W., Toronto, Ont. 400
CFCF Marconi Wireless Telegraph Co. of Canada, Ltd., Canada Cement Bldg., Phillips Square, Montreal, P. Q. 440
CFCH Abitibi Power & Paper Co., Ltd., Iroquois Falls, Ont. 400
CFCK Radio Supply Co., Ltd., 10229 101st St., Edmonton, Alta. 410
CFCL Centennial Methodist Church, Victoria, B. C. 400
CFCN W. W. Grant Radio, Ltd., 708 Crescent Rd. N.W., Calgary, Alta. 440
CFCQ Radio Specialties, Ltd., 791 Dunsmuir Ave., Vancouver, B. C. 450
CFCR Laurentide Air Service, Ltd., Nickie Range Hotel, Sudbury, Ont. 410
CFCT The Victoria City Temple, 1110 Douglas St., Victoria, B. C. 410
CFCU Jack V. Elliot, Ltd., 123 King St. W., Hamilton, Ont. 410
CFCW London Radio Company.....London, Ont. 430
CFDC Sparks Company, Wallace & Fitzwilliam Sts., Nanaimo, B. C. 430
CFHC Henry Birks & Sons, Ltd., 708 Crescent Road N. W., Calgary, Alta. 440
CFKC D. J. Fendell, Patricia Theatre Bldg., Thoroid, Ont. 295
CFLC Chas. Guy Hunter, 551 Adelaide St., London, Ont. 430
CFQC The Electric Shop, Ltd., 144 Second Ave. N., Saskatoon, Sask. 400
CFRC Queen's University (Dept. of Electrical Engineering), Fleming Hall, Queen's University, Kingston, Ont. 450
CFXC Westminster Trust Co., Columbia & Begbie Sts., New Westminster, B. C. 440
CFYC Victor Wentworth Odlum, Mercantile Bldg., 318 Homer St., Vancouver, B. C. 400
CHBC The Albertan Publishing Co., Ltd., 708 Crescent Road N. W., Calgary, Alta. 410
CHCE Western Canada Radio Supply, Ltd., 919 Fort St., Victoria, B. C. 400
CHCM Riley & McCormick, Ltd., 708 Crescent Road N. W., Calgary, Alta. 440
CHCS The Hamilton Spectator, Spectator Bldg., Hamilton, Ont. 410
JCHIC Northern Elec. Co.....Toronto, Ont. 350
CHNC Toronto Radio Research Society, 46 Lauder Ave., Toronto, Ont. 350
CHUC International Bible Students Association, Cor. Main and 2nd Sts., Saskatoon, Sask. 400
CHXC J. R. Booth, Jr., 28 Range Rd., Ottawa, Ont. 435
CHYC Northern Electric Co., Ltd., 121 Shearer St., Montreal, P. Q. 341
CJBC Jarvis Street Baptist Church.....Toronto, Ont. 312
CJCA The Edmonton Journal, Ltd., Journal Bldg., Edmonton, Alta. 450
CJCD The T. Eaton Co., Ltd., Queen St. W., Toronto, Ont. 410
CJCE Sprott Shaw Radio Co., Room 1604, Tower Bldg., Vancouver, B. C. 400
CJCF The News Record, 39 South Cameron St., Kitchener, Ont. 295
CJCK Radio Corporation of Calgary, Ltd., 223 Second Ave. N. E., Calgary, Alta. 316
CJCL A. Contiore.....Montreal, P. Q. 270
CJCM J. L. Philippe Laundry.....Mont Joli, P. Q. 312
CJCN Simons, Agnew & Co.....Toronto, Ont. 410
CJGC London Free Press Ptg. Co., 440 Richmond St., London, Ont. 430
CJSC The Evening Telegram, 81 Bay St., Toronto, Ont. 430
CKAC La Presse Publishing Co., Ltd., Cor. St. James St. & St. Lawrence Blvd., Montreal, P. Q. 430
CKCD Vancouver Daily Province, 142 Hastings St. W., Vancouver, B. C. 410
CKCE Canadian Independent Telephone Co., Ltd., Wallace Ave. & Ward St., Toronto, Ont. 450
CKCI Le "Soleil," Limited, C. W. Lindsay Bldg., cor. St. John & St. Eustache St., Quebec, P. Q. 295
CKCK Leader Publishing Co., Ltd.....Regina, Sask. 420
CKCO Dr. G. M. Geldert, 282 Somerset St. W., Ottawa, Ont. 400
CKCX P. Burns & Co., Ltd., 708 Crescent Rd. N. W., Calgary, Alta. 440
CKFC First Congregational Church...Vancouver, B. C 385
CKLC Wilkinson Electric Co., Ltd., 2119 Seventh Ave. 400
CKOC Wentworth Radio Supply Co., Ltd., Hamilton, Ont. 410
CKY Manitoba Telephone System, Sherbrooke St., Winnipeg, Man. 450
CNRA Canadian Nat'l Railways.....Moncton, N. B. 313
CNRC Canadian Nat'l Railways.....Calgary, Alta. 440
CNRE Canadian Nat'l Railways.....Edmonton, Alta. 450
CNRM Canadian Nat'l Railways.....Montreal, P. Q. 341
CNRO Canadian Nat'l Railways.....Ottawa, Ont. 435
CNRR Canadian Nat'l Railways.....Regina, Sask. 420
CNRS Canadian Nat'l Railways.....Saskatoon, Sask. 100
CNRT Canadian Nat'l Railways.....Toronto, Ont. 400
CNRW Canadian Nat'l Railways.....Winnipeg, Man. 450

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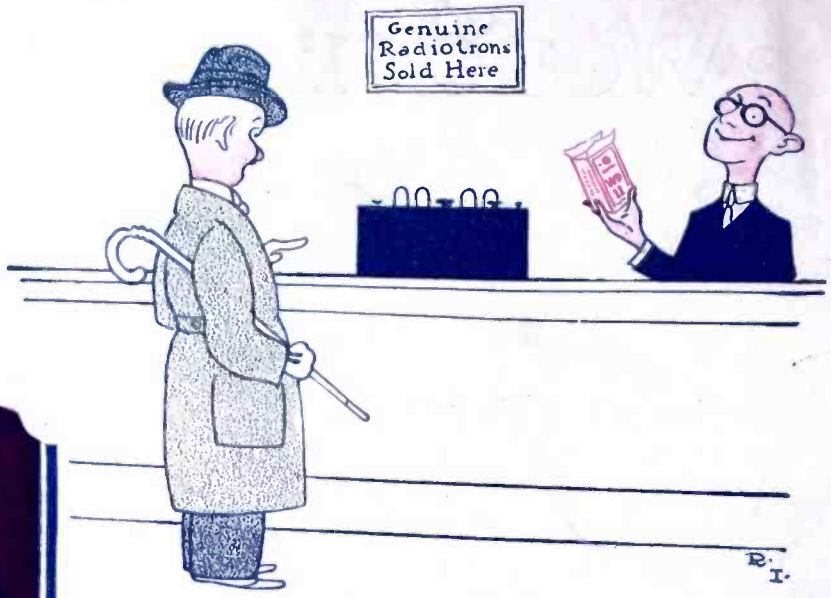

WD-11
WD-12
UV-199
UV-200
UV-201-a

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