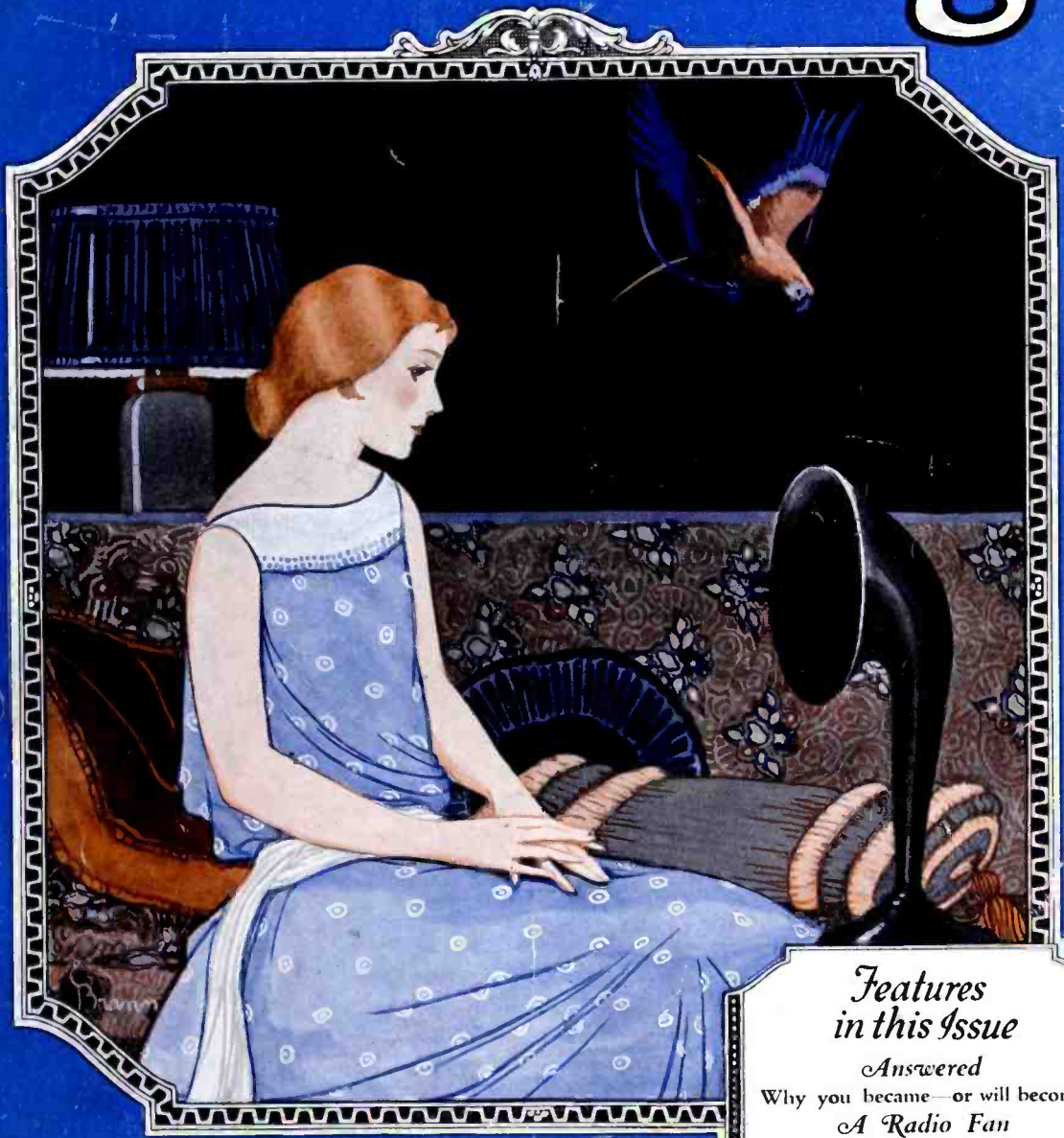
FEBRUARY 1924 25 CENTS

The Wireless Age



"America's Foremost Radiophone Review"

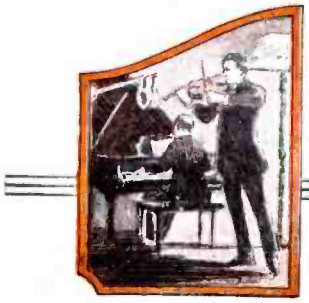
Features in this Issue

Answered
Why you became—or will become
A Radio Fan

How To Sell Radio

A New Wireless Age Set
The Reflex Receiver
Simple, Easy, Effective

I. W. A. J. Broadcasting
A Radio Story



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C-301A—5 Volts 1-4 Ampere filament..$6.50
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The Wireless Age

America's Foremost Radiophone Review

Vol. XI — No. 5

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Your Authors

MR. ARTHUR R. BURROWS (Broadcasting in the British Isles) is just about the most competent authority from whom such an article could come. And to us here in America in process of working out our broadcasting problem the British experiment should be very illuminating. Mr. Burrows is Director of Programs (or "Programmes" as the English have it) and just returned from a long vacation cruise in the South Seas or some such quarter in time to do this article for THE WIRELESS AGE.

MR. M. B. SLEEPER (How to Be a Radio Salesman) has gained his ability to handle such a subject through a considerable practical experience in radio. He is well known in New York as a radio manufacturer, and through his publication, *Radio and Model Engineering* is known widely as a radio designer and technical publisher.

MR. CARL DREHER (Little Journeys Into Radio Computations) confesses that he used to be a tennis player but that now-a-days he has to attend so closely to his job as technical sponsor for the programs that go out from WJZ and WJY where he watches like a hawk the oscillograph which gives a moving picture of the sound that he is transmitting—that he doesn't get time to follow the game. The bane of his existence, he says, are the sopranos who screech and the basses who bellow.

MR. RALPH R. BATCHER (Design of Loop Antenna) organized the first radio club in Iowa—"The Hawkeye Radio Association," in 1913. He has served as Radio Instructor in Iowa State College, Marconi Institute and Signal Corps School. Graduate Electrical Engineer of Iowa State College and grade member of the Institute of Radio Engineers, he is the author of "Prepared Radio Measurements" and numerous technical articles on radio.

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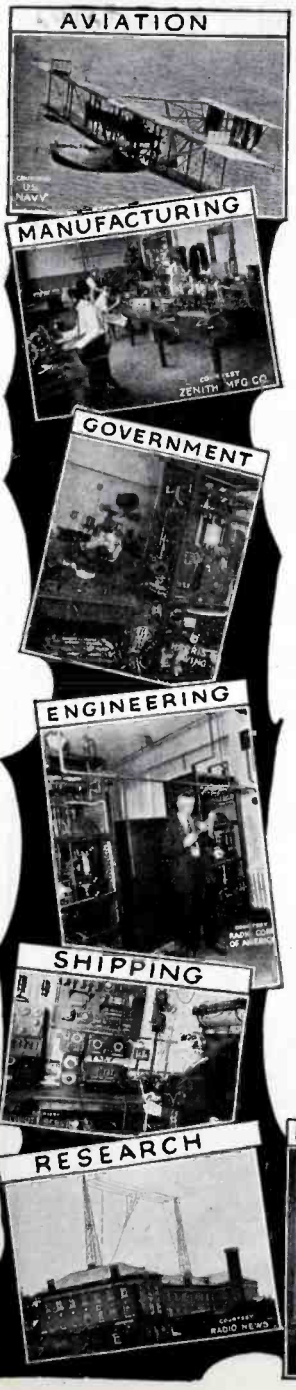
National Radio Institute Graduates Are "Cashing In" On These Wonderful Opportunities!



Austin Riu, one of our graduates, is now an operator of broadcasting station PWX of Havana, Cuba, and earns $250 a month. Merle Wetzel, of Chicago Heights, Ill., another graduate, advanced from lineman to Radio Engineer, increasing his salary about 100 per cent. *even while taking his training!* Emmett Welch of Peculiar, Mo., right after graduating started in Radio, earning $300 a month and expenses.

Every day some new use for Radio is being discovered. Every day new opportunities for earning big money are being created in this new, romantic field. Never in the history of industry has any field offered such astounding opportunities for live wires. *Hundreds, earning small salaries now, will soon make fortunes in Radio!*

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Are you "cashing in" on your Radio Knowledge? If you're not, you are passing up the best bet that has ever come your way. It's entirely up to you. There's nothing impossible in Radio for the man who has the ambition to try. In a few months at home, you can easily become a *recognized radio expert*—and to these radio specialists, Radio offers remarkable salaries, easy fascinating work, short hours—and a wonderful future!

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You can earn bigger pay than you probably ever dreamed possible. Only don't let yourself stay in a rut. Sit up—look up—make up your mind that if others can make big money and big successes in Radio, so can you. The National Radio Institute has a sound practical radio course that defies comparison. It has a record of successful graduates that is unquestionable evidence of its ability to qualify you quickly for a big money position in Radio.

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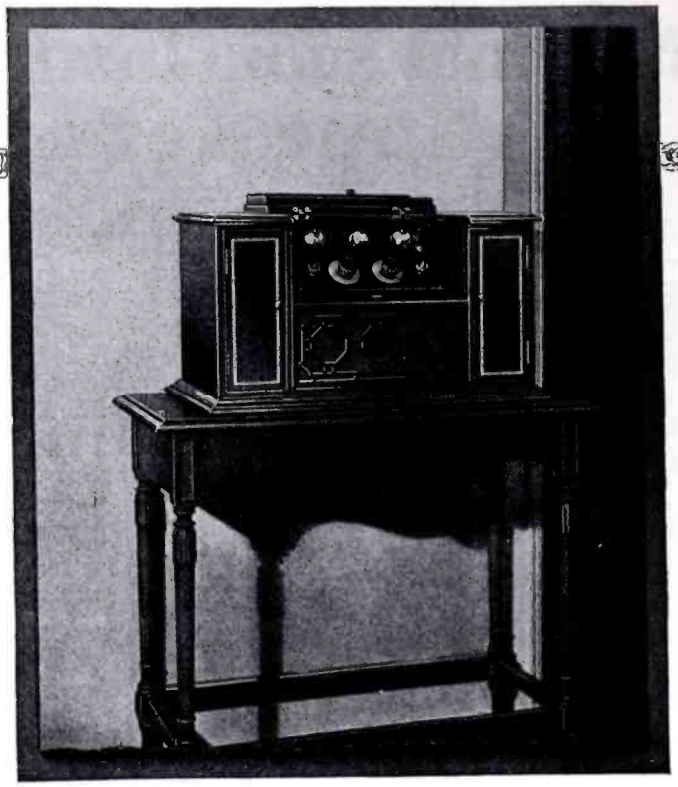

Model X

$285, Fully Equipped With Built-in Loud Speaker

This radio receiving unit is a newly perfected development of the Kennedy Engineering Staff. It is unusual in that it combines extreme simplicity of operation with the same scientific accuracy and selectivity that characterized the earlier Kennedy models. After an initial setting is made only one dial is required for all tuning. And, when a dial setting of a station is once determined, that station will always "come in" at its own setting regardless of where the receiver is used.

It is stable in operation, reproduces music and voice with remarkable faithfulness and has established some unusual distance records. Responds to all broadcast wave-lengths—operates on any antennae, outside type preferred. "Re-radiation" has been practically eliminated.

Beautiful Radio Furniture—*the* New Kennedy Receiver, Model X

As a graceful piece of furniture, the Kennedy Radio Receiver, Model X, makes a charming addition to any home. The cabinet is of mahogany, hand rubbed to a beautiful finish—with its delicate inlay of satinwood and ebony and the grill at the front, it is truly typical of the Sheraton design. A loud speaker of superior quality is built into the cabinet—by this means faithful reproduction of music and voice is available to an entire family or assembly of guests.

The control panel is symmetrically balanced and immediately indicates the remarkable ease with which the receiver may be operated—the angle at which it is set is the result of much study to provide greater comfort while tuning.

The receiving unit in Model X is everywhere recognized as one of the most noteworthy achievements in radio development—particularly since it sets a new standard of operating simplicity in combination with the precision and selectivity that have always been a feature of Kennedy radio receivers.

The price of Model X, completely equipped with all tubes, dry batteries, built-in loud speaker and individual Kennedy 3,000-ohm phones, with plug, is $285.00. Other models range from $125.00 to $825.00, completely equipped.

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THE COLIN B. KENNEDY COMPANY
St. Louis San Francisco

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KENNEDY

The Royalty K *of Radio*

If you take radio seriously

YOU want to tune in distant stations, but there is another thing you want just as keenly—to get what you get *clearly*.

No matter how far or how near the station is, for greatest clearness and for all-round satisfaction, you must use storage batteries. Once you hook up to Exide Radio Batteries you will never be satisfied with anything less. They give uniform current, smoothly, quietly, over a long period of discharge. Like good little boys, they are seen and not heard.

For low-voltage tubes

The two newest members of the Exide family are midgets in size but giants in power. These sturdy little A batteries weigh only five and six pounds each. They furnish in full measure that uniform and unfailing power so essential to clarity and distant reception.

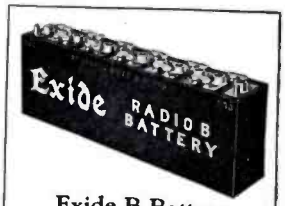
They were specially designed for WD-11 and UV-199 vacuum tubes, but can be used with any low-voltage tube. The two-volt Exide A Battery consists of a single cell. It will heat the filament of a WD-11 or other quarter-ampere tube for approximately 96 hours. The four-volt A battery, having two cells, will light the filament of a UV-199 tube for 200 hours.

For six-volt tubes

Like all Exide Storage Batteries, the Exide A Battery for six-volt tubes is dependable and long-lasting. It is made in four sizes—of 25, 50, 100, and 150 ampere-hour capacities.

On land, at sea, in the air

It is the experience back of Exide Batteries that makes the Exide give such exceptional service in radio. There is an Exide Battery for every purpose. Exides run trucks, start and light automobiles, operate drawbridges, propel under the sea a majority of the world's submarines, send your voice over the wire every time you use the telephone.



Exide B Battery

A majority of all government and commercial radio plants both on land and at sea are equipped with Exide Batteries. The Leviathan is Exide-equipped. The giant dirigible Shenandoah carries Exide Batteries for ignition, lights, and radio.

It does not pay to get any but a known-to-be-reliable storage battery for radio. Exide Radio Batteries are sold by radio dealers and Exide Service Stations everywhere. Ask your dealer for booklets describing in detail the Exide Radio Batteries, or write us direct.

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RADIO BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

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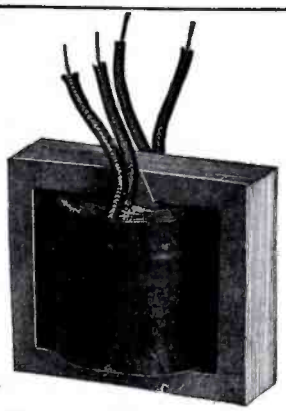
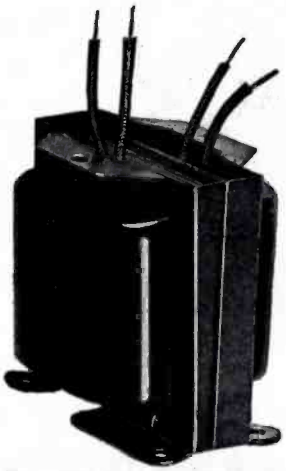
A Transformer of Real Merit

Amplification of Entire Musical Range Free from Distortion

The winding that Kellogg developed, was found to be most efficient for audio frequency transformers. Its problems involved the finding of the proper thickness of paper, the proper kind of insulated wire to provide the proper number of ampere turns, and impedance.



The one-piece laminations of silicon contain no punched holes, which in many other transformers causes eddy currents and losses. The one-piece lamination is exclusively a feature of the Kellogg transformer. It provides an exceptionally true electro-magnetic core.



To correctly shield these transformers that they may be mounted in any position desired without losses, this brass shield was designed. It is so arranged that both sides are interchangeable, locking together at the base. They are finished in a handsome maroon enamel.

The wires extend through the Bakelite top, which affords perfect insulation, and are soldered to the terminals in plain sight, where they may be inspected. This also eliminates any possibility of breakage of transformer leads.

The finished job, of which we are mighty proud. The leads are soldered to tinned terminals, which are under nickel plated nuts over which are placed knurled nuts. Each binding post is plainly marked so that it is impossible to make incorrect connections.

Amplify the pleasure of your radio set by installing Kellogg audio frequency transformers. Second to none in volume, clarity and freedom from distortion.

No. 501—Ratio 4½ to 1. No. 502—Ratio 3 to 1. Only $4.50 each

Built and Guaranteed by

Kellogg Switchboard & Supply Company

1066 West Adams Street, Chicago

Editorial Chat

AMATEURS who are versed in or are studying the code can apply their training usefully in the effort to reduce interference. It is manifestly of no practical value to make general complaints to the Department of Commerce. No investigation nor action can be based upon them. But an amateur trained in the code can report an interfering message exactly to the Department, whereby the identity of the offender can be established. Here's an opportunity to be helpful.

* * *

SAN DIEGO has the right idea—and evidently, too, the right man. An old local amateur club has joined hands with the B. C. L.'s of the vicinity in the organization of a San Diego Radio Club, which is so fortunate as to have as a guiding hand at the helm Judge Eugene Daney, leader of San Diego's legal profession and radio enthusiast. In this attempt to associate together all persons interested in radio, whatever their particular angles of interest, may be recognized the elements of a process which will one day bring the solution of many of the troublesome problems of radio as we know them today. To what extent the interests of the various shades and degrees of "ham" and listener-in blend and merge—how their common interests can best be served and their differences ironed out—is a field of inquiry which can best be approached not by individual radio enthusiasts and writers who one and all have their peculiar prejudices, so well as by closer association between radio enthusiasts of all classes.

Such association, moreover, will enable the amateur to make his knowledge of more general benefit. Some amateurs have made notable contributions to the development of radio, as is well known, but more and more we may expect the refinements and improvements to come from the investigations of highly trained technical experts rather than from the efforts of the typical amateur. However, the amateur can continue to contribute a valuable assistance in the spread of radio interest and consequently the progress of the radio science and art, if he will devote some of his attention to interesting and initiating others in the wonders and benefits of radio and lending a little aid to new "fans" with a view to making their radio installations effective and satisfying.

* * *

BROADCAST listeners are being encouraged to enjoy the benefits of radio not only by the co-operation of amateur operators in the plans for regulating radio traffic, but also by the effort of the Department of Commerce to clear the air during broadcasting hours of ship operators' signals. Every listener-in has experienced the annoyance of hearing a code message suddenly break in upon a program which was coming over strong and clear. In many cases these messages are from ships reporting their positions as is required of them daily. And one of the wave lengths assigned to ship operators is right in the broadcasting band. It is now proposed to reduce this annoyance by requesting vessels to report their positions before seven and after eleven P. M.

GOOD idea to watch the development of news service by radio. We note particularly KYW's twenty-four-hour news bulletin service which releases the news hot from the street at half-hour intervals. This Chicago station has displayed good sense in placing the service in charge of two competent, veteran newspaper men.

There is a whiff of danger here. The right judgment and action of humans is pretty much controlled by the information about people and things and events they receive. And information, as we all know, can be variously colored by the medium through which it chances to reach us. In the newspapers we have a fairly effective check upon our news dispensers through the fact that the evidence is left in cold print for a world of contemporary writers and critics to carp at. How about the news through the ether? Once the false statements and the distorted facts are released for thousands and perhaps millions of listeners to receive, as will inevitably occur, what record will we have other than memory? And the other fellow's memory is so likely to be untrustworthy. Perhaps we'd better ask KYW to install a court stenographer and a notary public in their news service studio. And perhaps a printed and circulated "follow-up," publishing accurately the spoken news items, would be practicable and effective.

You will have to agree that there are interesting possibilities in the extension of radio news service. Furthermore, there is no need to fear that such service will curtail the demand for printed news. On the contrary, the effect is more probably going to be a stimulated demand for both newspapers and current news periodicals.

* * *

LE TEMPS, semi-official Paris journal, complains that American news gets garbled by the British in transmission. Not unlikely. Perhaps the British might as justly complain of French influence to which American news, destined to parts of the empire on which the sun never sets, may be subjected. There is only one answer. Let us hasten the extension and perfection of radio broadcasting. When all corners of the globe shall through this wonderful agency get the message from every other corner, undiluted and untainted, straight from the shoulder, a big step forward will have been made toward the better understanding between peoples. In fact, and in pursuance of this thought, what better Peace Plan could be proposed than the rapid development of radio broadcasting on an international basis? Take note, Mr. Bok.

* * *

TO all broadcast listeners: How can you expect to participate fully in the joys and benefits of radio unless you contribute some study and effort? It is surely of advantage for you to learn something about radio and the principles of radio receivers, so that you may appreciate more fully just what a wonderful apparatus you have, and may understand how to get the utmost value from it.

THE WIRELESS AGE

"America's Foremost Radiophone Review"

VOLUME XI FEBRUARY, 1924 NUMBER 5

"Why I Became a Radio Fan"

A SYMPOSIUM

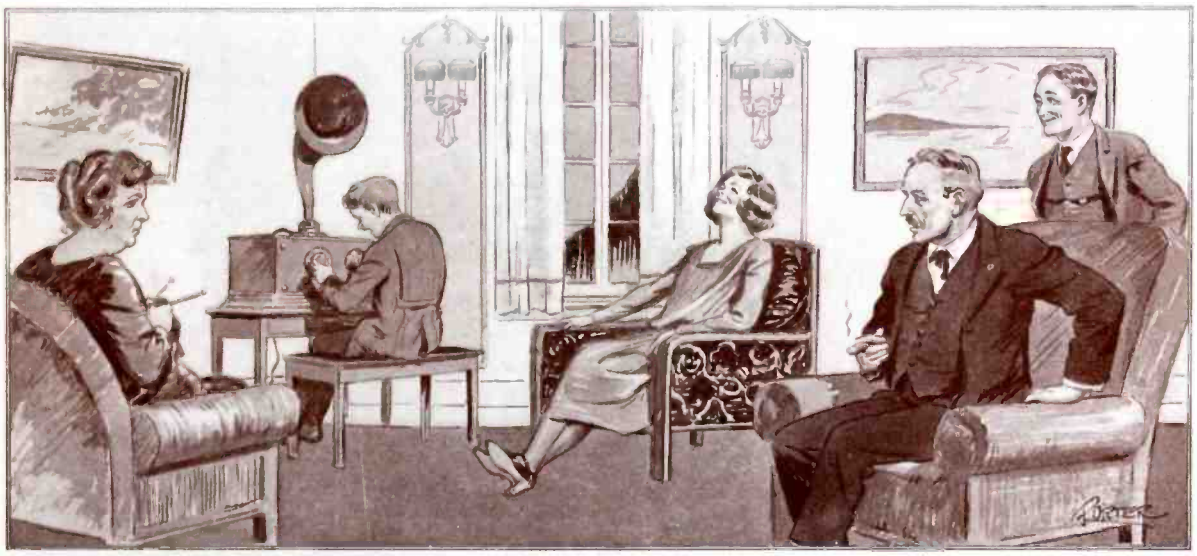
The Prize Contest Recently Conducted by THE WIRELESS AGE Was the Cause for the Receipt of a Great Number of Letters Which, Taken Together, Tell Pretty Clearly Why the World Has Become a Radio Fan

IT is a pretty general trait of human nature to want what seems to be giving a lot of other folks a good time. Sometimes we decide that the particular thing that gives some of our acquaintances pleasure may not afford that same pleasure to us. Tastes differ, and capacities differ. Not all the world likes a boxing match, and not all the world enjoys a lecture on bugs. Then, while most of us feel that we could manage to find some pleasure in a steam yacht, there aren't yachts enough to go around, so we quit thinking very much about steam yachts and trips to Europe and being president and such magnificences.

But there was one thing, back in a century that seems long ago, that everyone desired and pretty nearly everyone sooner or later managed to get—that was the bicycle. Remember? What a world of new freedom opened up with the bicycle! And along about the same era came the general extension of the telephone, so that everyone began putting telephones in the home. What a world of new possibilities and convenience opened up with the telephone—and trouble, when sister "gabs" for more than fifteen minutes with her friend, and the butcher can't make out whether it's ham or lamb you want, and Central persists in ringing you up for the "wrong party, excuse me, please!" And then, some years ago, came the automobile. Again a general fever of desire, still more keen and widespread! Still further extension of Everyman's interests and possibilities.

Today it's Radio.

Why I Became A Radio Fan Might be, but IS NOT the Title of this Picture



PRIZE CONTEST ANNOUNCEMENT—WHAT IS THE TITLE FOR THIS PICTURE?

For the best title to this picture submitted before March 31, 1924, THE WIRELESS AGE will give as a FIRST PRIZE—A WIRELESS AGE Reflex Receiver (described in this number). The next best title will receive a Second Prize of Five Dollars. The 3d, 4th and 5th prizes which will be awarded in this contest will be subscriptions to THE WIRELESS AGE. THIS IS FOR YOU! What is this picture about? And what is the snappy title that is needed to give the clue? Send in your suggestion to the Contest Editor, THE WIRELESS AGE. Don't delay.

Only in its beginning, and millions have already responded to its appeal; and because millions have shown how great a thing radio has meant and means to them, and because radio is within the compass of nearly every man, woman and child, still other millions in ever increasing numbers are going to swell the ranks of radio fans.

Why?

Because, like the bicycle, like the telephone, like the automobile and the movie, radio represents to you and to every other chap and to our wives and sweethearts and doddering grand-dads and boisterous sons and still more *boysterous* daughters—a bigger world. A bigger world! Just that.

Of course, some like their bigger world only to be fuller of tinkering and experiment, and some like their bigger world to be only fuller of lectures on bugs, and some want their bigger world to be only fuller of jazz. There's no accounting for taste. But in whatever direction you please, radio does make a bigger world. If you are specially keen about weather, as one of our contestants professes to be, you can have weather from Labrador to the Gulf and ultimately no doubt including the delicious weather that rages around Cape Horn—by the radio. Another writes that he's a radio fan principally because he can go to all the college games—by radio. Still another . . . but there's no need to refer you to the whole long list of eccentricities and hobbies and fancies. Every one of them gets a world of new interest and possibilities, via radio.

"While I listen for just one more"

Yet, withal, there are more souls still that are finding in radio, not one door and one avenue out into a bigger world of one dimension; but many doors and as many diverging avenues into a world of huge dimensions, a world of culture and science and art and pleasure, a world of interesting people and interesting ideas.

And this is why we are becoming a world of radio fans.

Now let's hear from some of our readers who have taken the pains to tell just the why of the individual case.

The First Prize Winner

Arthur N. King, of 12 Dorchester Street, Waltham, Mass., has been awarded the first prize because he wrote:

"I have a boy who wanted a bicycle. That doesn't read like radio, does it? I didn't want him to have a bicycle. The boy then proposed that if I would pay half the cost of a radio set, he would forget the bicycle. We compromised on the radio. I had never heard one! We made our receiver and have listened in from Montreal to Havana, but we want a better set.

"I read six radio magazines regularly and others when I can.

"My ears are flat and my feet get cold while I listen for just one more."

Louise Lorraine Is a Sure 'Nuf Fan

There is something that rings very true in this little 100-word letter of Arthur's. And there's a lot between the lines.

Arthur got his bug like a lot of others—from the boy. But it doesn't always come that way. Here's fan-making that comes out of an earlier year and strikes a true note. Its writer, Nelson Nichols, Jr., of Greenlawn, Long Island, has been awarded the second prize:

The Second Prize Winner

"One night in 1916 while copying press from NAA for my brother-in-law, who is not an operator, a peculiar note was heard, and in tuning down the loose-coupler to around 500 meters, we heard "Nearer My God to Thee" being played. At that time broadcasting was unknown, and so uncanny was this music that cold chills ran up and down our backbones, and we sat spellbound and speechless, looking at each other.

"I became a radio fan then and there in earnest, and probably will continue to be one until my time comes to leave this earth of ours."

Blind Fan Wins Prize

The Third Prize has been awarded to Le Roy Drake, of Chicago, Ill., the author of the following:

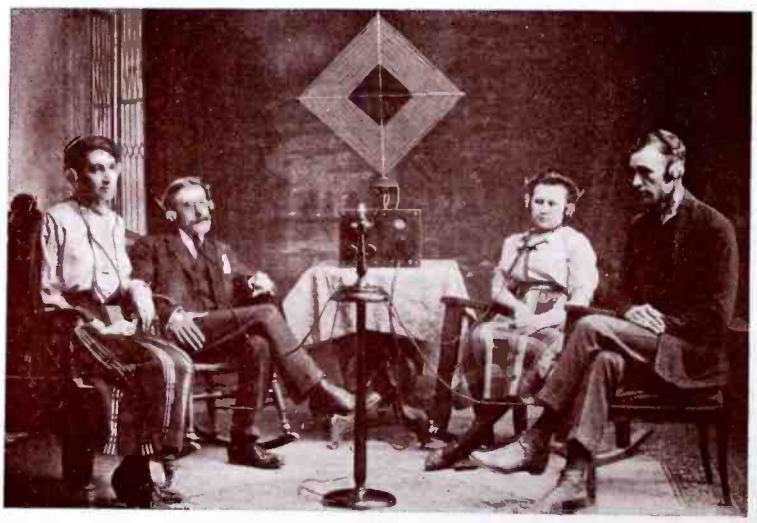
"I have been blind since infancy. I obtained my graded education from the Illinois School for the Blind at Jacksonville, Ill. I received an advanced musical training; and later I studied and graduated in electrical engineering; and the work of Nikola Tesla led me to the field of radio engineering. I design, construct and operate devices but follow no dogmatic directions. Light is needed in radio work, but much can be done without it.

"Music and radio are inseparable companions; and I try, constantly, to keep posted on both subjects. A good theoretical knowledge of radio is a valuable asset."

Crystal Set Gives First Concert

A genuine and very typical response won the Fourth Prize, for Mary

(*Continued on page* 61)



Mr. Felix Cadou, on the left, has provided radio for the whole family. They have all become fans

Outstanding Broadcast Features

Rear Admiral Shoemaker, U. S. N., one of the speakers during the Navy Night Programs which are a regular feature of WJZ

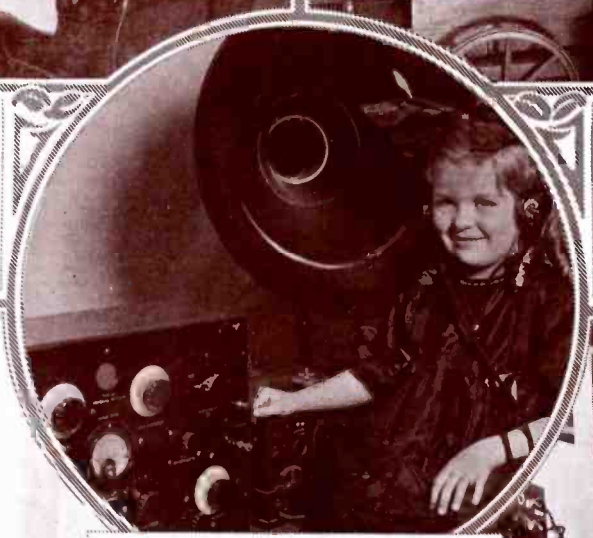
Senator Paul Dupuy, publisher of Le Petit Parisien, who broadcast his first spoken message to reach France from America as told on page 27

Just before Mr. Tom Terris gave his second talk on King Tutankhamen's tomb from WOR, Mr. Alfred McCosker showed him a map of the WOR broadcast territory

The Making of B. C. L.'s

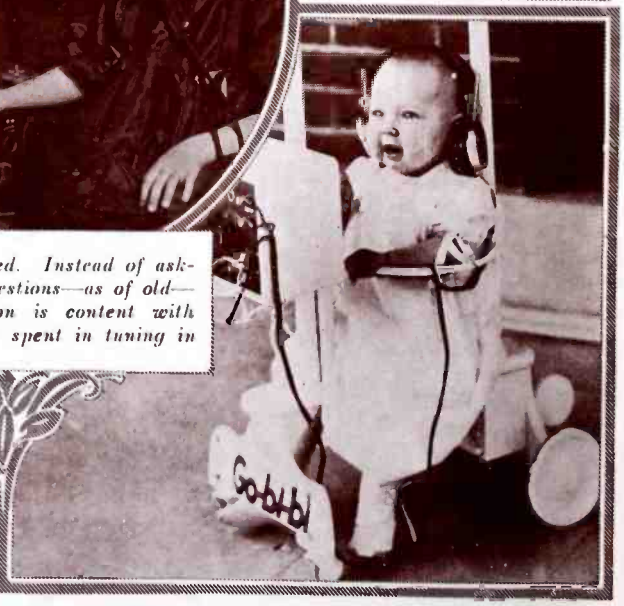
"Eve" again—still doubtful—but still convincing. She is telling her daddy that according to the talk just broadcast he did not use sound judgment in his last investments

Mozart's "Die Zauberfloete" is responsible for the expression of utter concentration on this youngster's face. He is somewhat relieved, too, that the "sandman" had the decency to stay off the air



Youth will be served. Instead of asking innumerable questions—as of old—the new generation is content with the elders' evening spent in tuning in

If it's a bed-time story, Brother Rabbit is trying to beat a split-second to cover with the Grizzly Bear rounding the last corner for the home stretch. Incidentally Brother Rabbit doesn't know that a big wolf is waiting in an ambuscade



The little fellow has just stepped out to get the market reports for his mother while she makes up her list of items to be purchased when she goes shopping. Nothing like a little co-operation from all members of the family

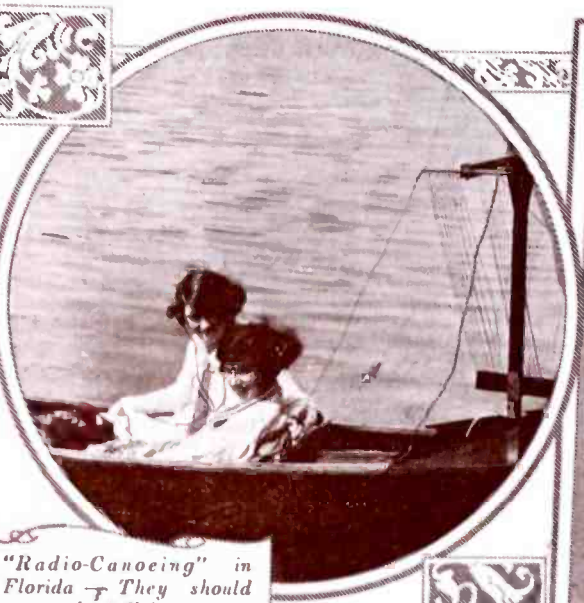
Humor, Opera and Jazz, Before the Microphone

Billy Jones and Ernest Hare, famous phonograph humorists, now a regular feature at WEAF. You see them here as they sound on the air

Mabel Corlew, Lyric Soprano, who sang the title rôle in the first Junior Operetta "Little Red Riding Hood," which was broadcast from WJZ

Newcomers to radio—The Brooklyn Mark Strand Little Symphonized Jazz Orchestra and Singers doing their "stuff" to the syncopated rhythm of "feet-shaking" jazz. But we "spilled the beans" on them in "Peeps Into Broadcast Stations." The manager of Station WJY said that they represent the "wildest" moments ever experienced in a broadcast studio

South of the Broadcast Station



"Radio-Canoeing" in Florida — They should worry about February, or, for that matter, about anything else

"Mermaiding" by radio is a new sport on the southern bathing beaches. All we want to know is, when does she dive? Or does she dive?

"Music While You Dine," on that southern trip—now we know the lure of the wide open spaces. The automobiles on Broadway, just now, seem to lack the romance pictured here

And this is adding insult to injury. They use OUR music to play on a Florida beach while WE shiver in New York so that it can be broadcast to them

Another powerful station you must try to tune in to your receiver

"K G O" on the Pacific

The General Electric Company's Pacific Broadcasting Unit

By Earl Ennis

BEDDED in concrete, its giant antennas pointing toward the Orient. and the American continent at its back, the General Electric Company's first permanent broadcasting unit has reared its sentinel towers beside the portals of the Golden Gate on San Francisco Bay—the most recent of the world's great radiophone units.

A sister station to WGY, famous unit at Schenectady, N. Y., it has stepped out of the development class, which was WGY's initial status, into the field of permanency. In Oakland, Cal., chosen for advantageous location and important purpose, all that has been worked out at Schenectady has been installed to ingenious effect. In its final analysis, the new station may be said to be one of the world's best—the compacted product of many months of experimentation in research and development fields.

The establishment of the new General Electric station comes at a most advantageous period in Pacific Coast radio development. The Pacific has long been one of the world's greatest radio fields. Perfect climatic conditions, astounding magnetic beneficence, and an absence of the terrific static so familiar to Eastern states, have made broadcasting on the West coast a thing of beauty and a joy forever.

Nightly listeners, who sit at their lamps and knobs, reach out to untold distances with ease and surety. They span the Rocky Mountains to Chicago, New York, Atlanta and other far points much easier than do the Eastern listeners working westward. One reason lies in the fact that the West has been lacking in stations highly enough powered to span the 3,000 miles from coast to coast.

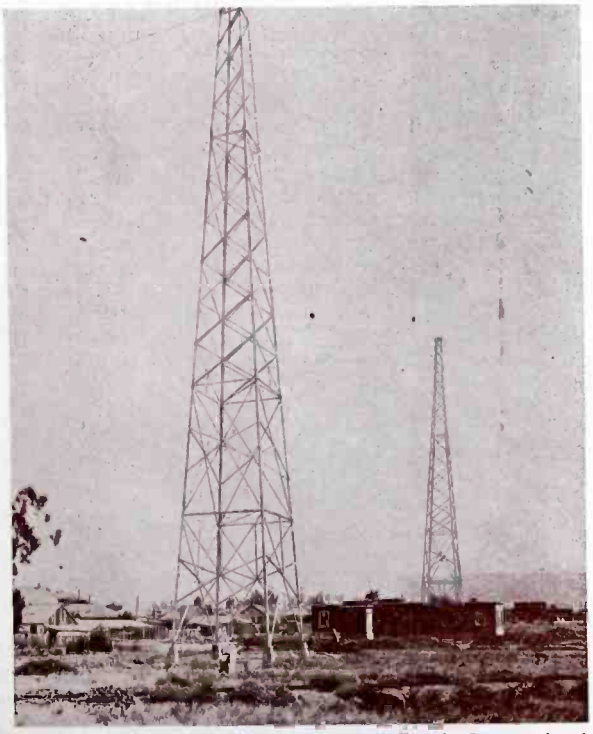
But the past year has seen the coming of standardized equipments. These have carried the fame of California stations to the East. Fragments of weather reports, the singing of canaries in the dead of winter, heard over thousands of miles of intervening space, have turned the ears and attention of the listening Eastern world toward the West. There has grown up out of these nightly pilgrimages through the ether, the hope and expectation that the West would do something for the broadcasting development commensurate with its possibilities.

Martin P. Rice, Director of Broadcasting for the General Electric Company

The new Pacific Coast broadcasting station of the General Electric Company is an answer to this national expectation. Where Oriental trade flows through the western doors of the United States, this new station, one of the most powerful of its kind and type on the globe, will reach out with its invisible fingers, tangent to six nations with its mystic touch. There will be wrought the West's great epic of aerial entertainment and service in strains of music, in tones of the human voice, knocking on a million doors to bring a message of commercial confidence and industrial faith.

The new General Electric station

(*Continued on page* 56)



Antenna, 150 feet high, for the new General Electric Company broadcasting station at Oakland, California. The operating house is shown between the towers.

The studio of the new broadcasting station of the General Electric Company at Oakland, California, which is here shown nearing completion. The first G. E. station, WGY, at Schenectady, has been broadcasting since February, 1922. A third station will probably be built at Denver, Colorado

In England the Struggle to Promote Broadcasting Is on in Full Blast. It is Worth While for America to Watch the Problem Work Out Across the Ocean

By Arthur R. Burrows

Director of Programs, British Broadcasting Company

The Editor of THE WIRELESS AGE has invited me to tell you the story of Broadcasting in the British Isles.

This story, I feel, would have come more appropriately from Mr. J. C. W. Reith, the General Manager of the British Broadcasting Company, for whatever I may say, it is he who has been engaged for over nine months, on a Government Committee and outside it, in fighting battles for radio against odds that would freeze the blood of an ordinary individual. Mr. Reith has fought, and has won, as I am sure his many American friends anticipated. He may not admit what I now suggest, but I imagine his success all along the line in breaking down prejudices and coming straight to the point may be traced in some measure to American influences when during the latter stages of the great war he was engaged in your country upon important work associated with armaments.

Having made this reservation I accept a long-sought opportunity for paying personal tribute to the wonderful pioneer work accomplished for radio by the United States.

While the writer was privileged to conduct long distance broadcasting demonstrations in the North Atlantic, from the C.P.O.S. *"Victorian"* as far back as the summer of 1920, the application of wireless telephony to public uses was not possible in Great Britain until practically the end of last year. British wireless telephones were being sent to all parts of the world, even in hundreds to China, but no practical application was permitted in Britain itself outside the Government Services. This we believe was due to the fact that our country lying on the fringe of an unsettled Europe could not afford to take risks that did not exist in the Western world. So for nearly three years it was our galling experience to have to sit helplessly and watch the striking developments taking place in your country.

Arthurs R. Burrows, Director of Programs, British Broadcasting Company

The time thus spent was not, we believe, altogether lost. There is an old adage over here, that the watchers see most of the game. Rightly or wrongly it was decided that the promiscuous granting of broadcasting licenses practiced in America would lead to disastrous results in the more limited territory of our islands and that however irksome it might be in the first instance to a freedom-loving race it would be good policy when the broadcasting veto was removed to have all stations of any serious power under one central control. Accordingly a British broadcasting company was formed at the end of 1922 which was given a license by the British Postmaster General to establish and operate eight broadcasting stations for a period of two years. The agreement was actually signed in January of this year, but operations on a limited scale under the auspices of a Provisional Committee commenced on November 14th of 1922, three stations then being thrown into service, London 2LO on 369 meters, Manchester 2ZY on 385 meters and Birmingham 5IT on 425 meters. Certain restrictions were imposed regarding the operation and the programs of these stations. No transmission was permitted before 5 P. M. except on Sundays and no news could be broadcast before 7 P. M. By an agreement between the Postmaster General and the representatives of the press all news had to pass through Reuters (who work with the Associated Press of America), who were made a collecting center for news supplied by them and three other recognized agencies.

BRITISH BROADCASTING COMPANY FORMED

The British Broadcasting Company had as its nucleus six big firms intimately associated with the wireless and general electrical industry, the British Thomson Houston Company, General Electric Company, Marconi Wireless Telegraph Company, Metropolitan Vickers, Ltd., Radio Communication Company and the Western Electric Company, all British companies. These

guaranteed the bulk of the capital. All other British firms interested in the radio business were invited to join the company by taking one or more shares and by paying a deposit of fifty pounds ($250.00).

The revenue for the broadcasting programs was to come from two sources. Every possessor of a receiving set was required to pay ten shillings ($2.50) per annum to the Postmaster General for an official permit; of each ten shillings, five were to be handed to the British Broadcasting Company. It was further arranged that except in the case of a limited number of bona fide experimenters, who having proved their purely scientific intent were granted the privilege of making their own apparatus, every would-be listener should buy sets manufactured by members of the British Broadcasting Company and that these sets should carry special royalties (varying according to the number of tubes etc.) which should also be assigned to development and program expenses.

Soon, however, it became apparent that the arrangement was a mistaken one, for as the programs developed and the stations increased in number aerials began to spring up everywhere which obviously were unlicensed, and a run was made upon the retail stocks of component parts originally intended for the pure experimenter. The innate constructive tendency of most healthy British boys asserted itself and passed for the time out of control.

The question of revenue became an acute one and the need for a revision of conditions was soon apparent. A Government Advisory Committee was therefore appointed to deal not only with the peculiar situation of the moment, but to look ahead and examine broadcasting in all its aspects. This committee held numerous sittings throughout the Spring and Summer, sifted a mass of evidence and reported last Fall. Upon this report the Postmaster General has taken action. New conditions have been made for the issue of licenses and a supplementary agreement made between the Post Office and the Broadcasting Company extending the term for which the Company enjoys the license until the last day of 1926. The new agreement permits transmissions at any hour of the day and night subject to Government sanction. It also permits an extension of the original waveband. The new limits are from 300 meters to 439 meters and from 461 meters to 500 meters. The B.B.C. royalties are also revised under this agreement; one shilling (roughly 25 cents) for a crystal set and ten shillings (say two dollars) on a one-tube set, with an extra five shillings for each additional tube.

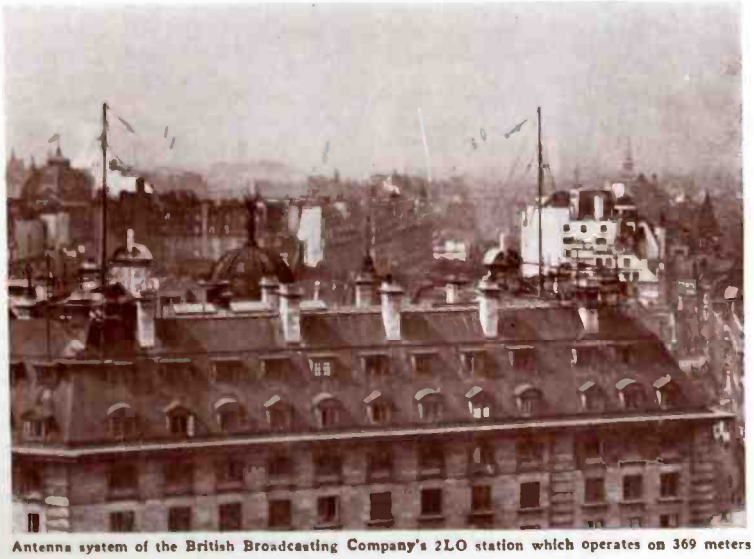
Miss Ellen Terry broadcasting from the London studio on behalf of the blind.
(Barratts Photo, London)

THE BRITISH LICENSE SYSTEMS

There are now three forms of licenses for listeners. Firstly a Broadcast license which can only be used in conjunction with a set manufactured by members of the B.B.C. This costs ten shillings annually. Secondly an Experimenter's license, issued to those having a thorough knowledge of wireless, in the hope that they will assist in advancing scientific knowledge. This permits the use of components of any origin, and costs fifteen shillings annually. Thirdly there is a Constructor's license, issued for persons wishing to build apparatus at home. Apparatus constructed under this license must employ British-made components. It may be used for the reception of broadcast telephony, and costs, like the experimenter's license, fifteen shillings annually.

There was a fourth license until the end of October known as the Interim license, intended for those who had constructed sets while the whole broadcasting position was under revision. Over a quarter of a million of these were issued in a few days following the issue of the committee's report.

The Broadcasting Company will receive from the British Post Office seven shillings and sixpence annually from each ten shilling license and twelve shillings and sixpence from each fifteen shilling license.



Antenna system of the British Broadcasting Company's 2LO station which operates on 369 meters

The immediate result of this change has been such a demand upon the postal organization for new licenses that the period set apart for "roping-in" old defaulters has had to be extended. It is impossible to give actual figures, but the latest returns indicate that the number of licensed listeners in the British Isles is rapidly approaching half a million.

The British Broadcast Stations

The British Broadcasting Company has as its chairman, Lord Gainford an Ex-Postmaster General. Its General Manager, Mr. Reith, to whom I have already referred is by training an engineer, and a man of great versatility. The company's chief engineer is Capt. P. P. Eckersley, one of a devoted band who played a great part in the development of aircraft telephony during the war. Capt. Eckersley is also known throughout the Islands as a fount of spontaneous humor.

The headquarters of the company are in London on the Thames Embankment. This is also the site of the London studio. There are now in Great Britain eight primary transmitting stations, London (2LO) 363 meters; Birmingham (5IT) 423 meters; Manchester (2ZY) 370 meters; Newcastle (5NO) 400 meters; Glasgow (5SC) 415 meters; Aberdeen (6BD) 495 meters; Cardiff (5WA) 353 meters, and Bournemouth (6BM) 385 meters. A relay station on a wavelength of about 300 meters will have been opened at Sheffield by the time this article appears in print.

The transmitting stations have an input of 1½ kilowatts, the relay station being of much smaller rating, roughly 100 watts input. Six of the stations have been designed and erected by Marconi's Wireless Telegraph Company, one by the Radio Communication Company and one by the Western Electric Company. In some of the studios Western Electric microphones are employed. In others, including London, a special transmitter developed by Capt. Round of the Marconi Company is used, employing an exceedingly flat coil of wire suspended to move freely in an intense magnetic field. In only one instance are the studio and transmitting station in close proximity, namely at Manchester. As no station is equipped with duplicate transmitting gear special attention has been given in design to the problem of rapidly interchangeable parts.

The principle of working is to draft at headquarters general rules for the conduct of stations and to leave the provincial station directors to build around these rules special programs of a character known by experience to meet local requirements. It will be obvious to anybody with a knowledge of the British Isles that a program finding favor in Aberdeen for instance, would not give unalloyed pleasure to Bournemouth and district.

Simultaneous Broadcasting

The feature of our system which is likely to create the liveliest interest in America is the simultaneous broadcasting of special events. At six o'clock each evening the British Post Office hands to the British Broadcasting Company direct trunk telephone lines running from the London station to each provincial station. At the London studio there is a distributing board with an array of speech amplifiers and through this board it becomes possible

J. C. W. Reith, General Manager of the British Broadcasting Company. (The Studio photo Sheringham, Norfolk, England)

to connect the London microphone at the same moment to every one of the eight transmitters, or to exchange programs between stations. Manchester for instance, may produce a symphony concert which specially appeals to the listeners in the Newcastle area while at the same moment Cardiff in Wales may be entertaining Aberdeen in the North of Scotland. The two main nightly news bulletins are always radiated simultaneously under control from London and so are also the big London speeches. During the opera season at the Royal Opera House, Covent Garden, London, the simultaneous broadcasting of grand opera as actually performed on the Covent Garden stage will take place on an average two nights a week. Some thousand miles of wire, mostly overhead, are involved in these simultaneous transmissions and some wonderful results have been obtained. Generally speaking there is singularly little distortion in this long distance working, though naturally there are occasional lapses from perfection, due to one of the many risks accompanying the use of long exposed lines of communication.

Experiments have been made in the use of "wired wireless" over the Post Office lines and in the relaying of wireless telephony from one station to another, and it is pretty certain that the latter practice will be employed from time to time for giving to our listeners "pictures in sound" of London by night, the nightingale singing in its natural haunts and one-thousand-and-one other innovations such as will come readily to imaginative minds.

Our programs contain, beyond the usual features, evenings set apart for distinct types of musical programs. A feature of recent programs has been special "Composer" nights when well-known British composers conduct their own compositions. At some stations we have developed programs of particular interest to rural communities. Each station has an advisory committee including representatives of the orthodox religious sects for the selection of Sunday speakers, and at most of the stations there are also advisory committees dealing with special educational features. A very considerable development on the educational side of British broadcasting may be expected.

Opposition to Broadcasting

The development of broadcasting in Great Britain as already indicated, has not been plain sailing. The moment it became apparent that broadcasting had something more than the elements of a passing craze, and that we were taking our task seriously, the entertainment industry began to mobilize its various forces. It naturally was to be expected that detailed attention would have to be paid to the matter of certain "rights," both musical and literary, but the attacks from the theatrical managers and other allied associations were not expected, particularly as we had been approached by several managements with the suggestion that we should broadcast their productions. This we actually did. Following the radiation from London alone of excerpts of three West End plays we had letters from listeners giving the names and addresses of the purchasers of nearly three thousand seats in the more expensive parts of the theaters so broadcast. In the case of one play a listener wrote to state that as the result of the wireless performance he had actually booked twenty-one stalls for himself and friends. The box office of the theater in question confirmed this. Our argument is that the broadcasting of an excerpt from a good play provides for that play the finest possible advertisement. While play bills and the usual paraphernalia of the publicity agent may leave one feeling that in

(*Continued on page* 41)

When Radio Reaches Half a Billion

High Lights of an Impromptu Address Given Recently by David Sarnoff Before the Semi-Annual Convention of the Electrical Supply Jobbers' Association at Buffalo, N.Y.

IT is estimated that, measured in consumer's list price, the American public spent in 1922 between $75,000,000 and $100,000,000 on radio.

On the same basis it is estimated that the American public spent during 1923 at least $150,000,000 on radio, although this figure is probably conservative.

The industry will undoubtedly go on for the next few years virtually doubling in volume each year.

It is a very conservative estimate that 2,000,000 sets are in use in the United States. Multiplying this figure by the size of the average American family, you have a radio audience totaling approximately eight million, and if this business is to double itself each year for the next few years, we may expect 50,000,000 people in the United States using radio.

There are today in operation approximately 450 broadcasting stations in the United States. Of this number, about fifty stations may be regarded as quality stations—that is, those capable of doing a fairly satisfactory job within the present limitations of the art. The other 400 are local stations made up of composite equipment and operated more or less for experimentation, without regular operating schedules.

The present number of stations, 450, merely represents a transient phenomenon in the march of events. Most of these stations will probably go out of business in time. More and more it is evident that the purpose of the broadcast station is to do those things which other agencies cannot do as well or at all. No other agency can speak with a single voice to 10,000,000 people. It is an instrumentality for national events, for high-grade talent, for good music, for good lectures, and the like, and therefore it means that there will be erected in time a number, possibly half a dozen, possibly three, high-powered broadcast stations, suitably located, that may constitute a chain of national broadcasting stations or a national broadcast service, each of these stations simultaneously radiating the same program, whatever it may be, with a power sufficient to reach every city, every town, every village, every hamlet, every home in the United States.

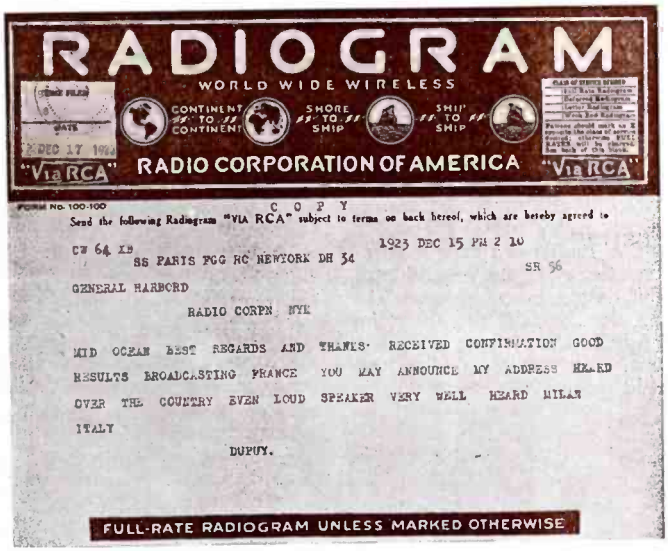
Fortunately for this country, America leads, and has led in radio development, not only in broadcasting, but alike in the matter of trans-oceanic and long-distance communication, and since it is possible to take a high-power station in New York and re-radiate its output in California by radio, it is likewise possible to take a high-power station in London and re-radiate its output in New York.

Broadcasting can surely be made commercially practicable without any means being found for collecting from the consumer. Just as soon as the freedom and universality of radio is destroyed and confined to only those who pay for it—those who pay for the service—just so soon as broadcasting becomes "narrowcasting" the fundamental of the whole situation is destroyed. And, therefore, broadcasting as constituted today is commercially sound, and will remain so in the future, although there may be selective methods and narrowcast methods which will do no harm.

The General Electric Company, the Westinghouse Electric and Manufacturing Company and the Radio Corporation of America have spent and will spend during the present year approximately $1,500,000 on radio research and equipment.

The Radio Corporation of America alone spent in the neighborhood of a quarter of a million dollars for Station WJZ, on the roof of the Aeolian Hall in New York City. It is costing them many thousand dollars a month to run. They have another one in Washington, D. C., and the General Electric Company will shortly open a station in California and another one somewhere in the Middle West.

Senator Dupuy's Homecoming Delivered to His People in French


RADIOGRAM

WORLD WIDE WIRELESS

CONTINENT TO CONTINENT · SHORE TO SHIP · SHIP TO SHIP

"Via RCA" RADIO CORPORATION OF AMERICA "Via RCA"

DEC 17 1923

FORM No. 100-100

COPY

Send the following Radiogram "VIA RCA" subject to terms on back hereof, which are hereby agreed to

CW 64 KB 1923 DEC 15 PM 2 10

SS PARIS FGG RC NEWYORK DH 54 SR 56

GENERAL HARBORD

RADIO CORPN NYK

MID OCEAN BEST REGARDS AND THANKS. RECEIVED CONFIRMATION GOOD RESULTS BROADCASTING FRANCE YOU MAY ANNOUNCE MY ADDRESS HEARD OVER THE COUNTRY EVEN LOUD SPEAKER VERY WELL HEARD MILAN ITALY

DUPUY.

FULL-RATE RADIOGRAM UNLESS MARKED OTHERWISE

ON the night of December 11, 1923, a voice in New York bridged the Atlantic for eager ears in France. It was Senator Dupuy talking.

Paul Dupuy, a great man in France, a strong figure internationally, stood before the microphone in the studio of WJZ to broadcast a message to the French amateurs. In his native tongue he told them that his investigation of American journalism had been completed, and that he was ready to return home.

Senator Dupuy is the owner of Le Petit Parisien, one of the most influential publications of France. He had come here to study American journals and journalism. His observation of radio development in this country was one of his primary interests and largely formed the text of his message to the French amateurs.

His voice was recognized in Paris, but the words were not distinct. In the rural districts, however, his complete message was received. A report from Milan, Italy, claimed good reception on a loud speaker.

As an expression of his delight with the result, M. Dupuy sent a radiogram to General Harbord from mid-ocean.

IWAJ Broadcasting

A Radio Drama of Extensive Action and Interest

By Eric H. Palmer

"What I have to say is intended for only three men on this continent within reach of this broadcast station"

LOOKING puzzled and yet manifestly much interested, the manager of the broadcasting station arose and addressed the visitor.

"I am very sorry," he informed the tall young man who faced him, "but your request is decidedly out of the ordinary. As I have told you, you are right in the assumption that the privileges of our broadcasting facilities are available under mutually advantageous or otherwise desirable conditions when there is something of interest to the public. In fact, as you know, we have made a number of tests along this line. But your proposition is different. I must submit it higher up. Suppose, then, you let me have a copy of what you intend to say in the ten minutes' time you desire to purchase. You might also let me take the check for one hundred dollars which you have shown me. This will expedite matters. Will you phone me tomorrow morning about 10 o'clock? I hope to have an answer for you."

MYSTERIOUS MESSAGES

Judson Gayne, capitalist with international connections, director of a score of corporations, and philanthropist, was sitting on the porch of his mansion on the North Shore of Long Island, Friday evening, when the butler came forward with a telegram.

"The boy just brought this up from the village, sir," the butler announced.

"Who's wiring me here? Somebody dead?" Gayne exclaimed, hastily tearing the envelope.

A glance through the contents of the message evoked another ejaculation of surprise.

"This is queer; some foolishness, most likely—but I'll do it," he thought aloud. "Thank you, Stevens. Tell the boy there is no answer."

Up in his lodge in the Adirondacks, Harold Dodgworth, millionaire manufacturer and patron of the arts, was summoned to the telephone.

"Telegram for you, sir," spoke the operator at the railroad station ten miles away.

"Wonder what's up! Some crazy idea, maybe, but I'll do it," muttered Dodgworth as he hung up the receiver.

The wireless expert on the yacht bearing Richard Harmstrong, banker and sportsman, saluted and remarked:

"Kind of an unusual message I've picked up for you, sir, if you'll pardon my saying so. They've been trying to get us for some time. Here it is."

Harmstrong read and then laughed.

"Unusual, indeed," he remarked. "But, of course, I'll do it. How the dickens did he know I'd be sailing off Newport today? Here, Anna, look at this, and tell me what's up!"

AN UNUSUAL PROGRAM

It was Saturday night. In all parts of America, in the cities, on the farms, and out on the lakes—and even out on the oceans—thousands upon thousands of people, hundreds of thousands, were listening to the voices and the music in the ether.

Programs of song, talk, and laughter were being given from the studios of a hundred or more broadcasting stations.

Radio fans, everywhere, were manipulating the dials on their sets, thrilling themselves and their associates with the results which carrier waves from far-away cities were bringing to them as if by magic. It was a clear and cool evening. Reception was excellent. Even at an early hour sensitive apparatus in the East was picking up music from Chicago.

But on the North Shore of Long Island, in the Adirondacks, and on the Atlantic off Asbury Park, three men, with their guests, were keeping tuned in with WFFA, one of the newest and most powerful stations in the metropolitan district.

At 9:45 o'clock came the announcement they were waiting to hear.

"This is Station W-F-F-A," a bass voice resounded through the receivers. "The number you have just listened to was 'My Hero,' from 'The Chocolate Soldier,' sung by Miss Ellen Baysden, contralto, of Yonkers. This number concludes her first group of songs. We are delighted to inform you that later on in the program Miss Baysden will be heard again. Station W-F-F-A. One moment, please. . . . This is Station W-F-F-A, New York. Ladies and gentlemen of our radio audience, we now have a special announcement to make. By oral persuasion, more than by any other consideration, a young man has been granted the privilege of addressing the radio audience for a period not exceeding ten minutes, on a subject distinctly personal and hardly in keeping with our regular series of educational lectures. He has especially requested this opportunity tonight. It is not our custom to give permission for a request of this kind, but there are what might be called special circumstances, which I cannot reveal, and we trust you will bear with us, in this one instance, and be interested in what he has to say. The speaker chooses not to permit his name to become publicly known; the reason will become apparent to you in just a moment. He wishes to be designated just by the initials I. W. A. J. We have seen the outline of his message and believe you will be interested. Mr. I. W. A. J."

A strong and appealing voice floated through the air.

"Ladies and gentlemen, I wish that I could do something in which you are probably most interested, sing or tell jokes to you good people, wherever you are," the speaker began, "but I must inform you at the outset that what I have to say tonight is really intended for only three men on this continent, each of whom is within easy reaching distance of this station."

"Now aren't you interested?" the announcer broke in.

"To each of these three men," the speaker continued, "I have dispatched a telegram asking him to listen in. My message in each case was the same, and read as follows: 'You will be rendering a genuine service in encouraging ambition, and perhaps as great a service to yourself, in the final analysis, and to many, many others, if you will listen in to WFFA, Saturday night, shortly after 9.30 o'clock, to hear a message which is intended for you. When you have listened will you kindly send your impressions and reaction to I. W. A. J., care of WFFA.

Signed I. W. A. J.' I trust, therefore, that the distinguished gentlemen in question—for they are distinguished in ability and achievement—(you'll forgive me, won't you, for this allusion—I hope, as I said, that these gentlemen, whom I do not know personally, but whom I admire, are now listening to these remarks.

"Probably the rest of you may be wondering what I am going to tell them. It will be very brief; it will not take all of the ten minutes.

"Now, what does I. W. A. J. stand for 'I want a job.' That is all there is to it. I am advertising through the air for that job. And the men to whom I have telegraphed are the men who have the filling of the kind of position I can occupy in best justice to myself. This job is an exceptional one, calling for certain particular qualifications. I have found it impossible, within the past month, to approach these gentlemen in any other way than through the air—as I would like to approach them. I know that each could use, in this particular and exceptional way, an executive who has a vision for larger accomplishments—if you will not think it amiss for saying this about myself. But I must not let modesty deter me in this—what you might call—this adventure. Your secretaries know all about me, gentlemen. They know my name, and I have taken the liberty of informing them that on Monday or Tuesday they may be asked about I. W. A. J. I have sent each a notice under my name as to what is meant by I. W. A. J. Good evening, gentlemen, and you, ladies and gentlemen of the radio audience, I hope that I have not bored you with this, undoubtedly the first radio application for a position."

"APPLAUSE" MESSAGES

"Well, that chap has some nerve," Judson Gayne said to a party of friends who were listening to the loud speaker. "Do you know, I got one of those telegrams. And that fellow is undoubtedly a live wire. Who else did he send to, I wonder. I think I'll just look him over. Here, you, Billy, call up WFFA on the telephone, and leave a note for I WANT A JOB to be at my office ten o'clock Monday morning."

Harold Dodgworth was talking.

"Operator, I want Radio Station WFFA, New York. How long will it take you?"

Richard Harmstrong turned to his guests and said:

"That fellow had the gall to send one of those telegrams to me, right on the boat. Howard must have told him I was out here. Bates, can you get through a message to WFFA, asking I. W. A. J. to meet me at the bank about three Monday afternoon?"

* * *

The director of the broadcasting at WFFA, at 11 o'clock, beckoned to the visitor who had been sitting quietly in the reception room and stated:

"Here's a telegram."

"From the *Starling;* that's Harmstrong's yacht," exclaimed I. W. A. J. "Just the very word I wanted. Thank you very much."

"No thanks," was the response. "Maybe we'll get the dickens for this. Radio advertising has to be soft-pedaled, you know. But I wish you luck. And, by the way, let me know, won't you?"

THE RADIO ARTIST INTERVIEWED

Harmstrong greeted the newcomer with a smile, and indicated a seat.

"So, Mr. I. W. A. J., you are Donald Russell; or, rather, Mr. Russell, you are I. W. A. J. The name is familiar. Did you ever play football?"

I. W. A. J. nodded.

"Then I remember you," Harmstrong went on genially. "You ran 80 yards to a touchdown on Franklin Field?"

"Were you there, sir?"

"I was—and so was my nephew, whom you bowled over!"

Both laughed.

"Now," the financier declared, "Mr. Howard, my secretary, has been saying a lot of nice things about you."

"You will recall, perhaps, Mr. Harmstrong, that he has mentioned my name to you once or twice, and said it was 'quite special.'"

"Yes, but I have been out of town so persistently that I have made no appointments except for pressing affairs. You know, I can't see a fifth of the people who want to talk with me. How could I be expected to do so? But I am very glad to see you and to have met you—over the radio. You know, I am quite a radio fan. The other night I heard Omaha, but I can't get Frisco yet—can't sit up that late, anyway. But to get down to the matter at hand: I do have an opening for a man of your type—"

Russell interjected:

"Pardon me, Mr. Harmstrong, and thank you again, but I do not want to misrepresent further. That is not the kind of a job I am after, or suited for."

The millionaire looked surprised, and then responded a little sharply:

"Oh, if you don't want—"

"No, offense, sir," said his visitor, with a broad smile. "May I explain?"

Russell's cheery manner smoothed the ruffled feelings of the elder man, who then lit a cigarette, after offering one, leaned back in his chair and advised: "Go ahead."

"Well, you see, Mr. Harmstrong," Russell started. "I have just come from most pleasant meetings with Mr. Gayne and with Mr. Dodgworth, whom you know—intimately. Mr. Dodgworth just returned to town this morning, to see you this evening, too, as he happened to inform me. By the way, I addressed telegrams to them—they are the other two—and they listened in and were courteous to communicate with me."

(*Continued on page* 61)

"Well, that chap has some nerve," Judson Gayne exclaimed to a party of friends listening to the loud speaker

There are Periods in Radio Furniture as in any other kind — Chippendale, Sheraton, Georgian, Jacobean, Gothic and Early American Colonial

Radio Cabinets Through a Lorgnette

Aunt Phoebe's Tour of Radio Furniture

By William A. Hurd

AUNT PHOEBE had written that she was coming East to buy a radio set.

All my fault—I admit it—but I had persuaded her that radio was essential to her elderly, maiden existence only because I needed something to talk about in my letters. Heaven knows I hadn't expected to convert her, to say nothing of prying her loose from the old homestead in Missouri. But that's Aunt Phoebe. When she makes up her mind to do something she does it thoroughly. And coming to New York? Well, when she starts to spend money like that someone might as well prepare for the worst.

This time I knew there was no escape. I had to escort her on one of those dreadful shopping tours.

Having done with the customary display of emotion, so sacred to Aunt Phoebe in all family reunions, we set out to look for an appropriate radio cabinet.

"Something in Early American Colonial," she explained, "would be suitable for the reception room but Hepplewhite would do better for the library. I've been thinking that we might as well have the thing in the library where Martha could play it with less trouble. Martha is getting so old now. Anyway, I think it should go in the library."

Martha is a distant cousin as maidenly, and more prosaic, than Aunt Phoebe, besides having a strong antipathy for new contrivances from which any form of entertainment may be procured.

An enlarged copy of an old Italian Jewel Casket done in dark brown mahogany with Grecian dancing figures in bold relief. It represents the early Italian Renaissance Period

Suspecting that Martha had opposed any such radical notion as buying a radio set, I ventured, "Could it be that you and Martha finally agree on one subject?"

Aunt Phoebe visibly stiffened.

Well, we drifted about the Madison Avenue antique shops, but found nothing appropriate for radio in Hepplewhite cabinets.

At Slum's furniture store on Fifth Avenue, Aunt Phoebe discovered an Italian Renaissance cabinet that stood about four feet high and would just accommodate a good set with loud speaker. It was done in black walnut with hand carved figures in bold relief and a conventional motif.

"It is quite satisfactory," Aunt Phoebe acknowledged, "but I've hardly had enough time to decide."

Understanding perfectly that she meant to see all the cabinets in New York I resigned myself to the inevitable.

In Happyway's, just off the Avenue, the salesman told us that they had discontinued their line of cabinets built specially for radio as everybody preferred period pieces in which they could install the wireless equipment.

We looked at a large assortment of beautiful cabinets, or rather, I should say that Aunt Phoebe examined them. She always seemed to be on the point of scrutinizing an object through a lorgnette.

She discovered Chinese Chippendale, Georgian, Sheraton, William and Mary, and of all things, a Hepplewhite. She's always discovering things.

"The William and Mary cabinet," the salesman insisted, "was the final lot in that period and by all means should be purchased."

"But you appear to concern yourself very little about the periods in which my rooms have been furnished," Aunt Phoebe suggested, "and even though I do say so myself, the best decorator from Chicago arranged the appointments."

This cabinet set is a conventional design done in American walnut. It has an appropriate place with the finest furniture

The inflection of her voice carried a note of finality. I knew she had her mind set on the Hepplewhite cabinet.

"True enough," the salesman explained as he smiled pleasantly. "You see, periods are mixed now. A Georgian piece will be in perfect accord with Early American Colonial or a Chinese Chippendale fits in with Italian Renaissance. Cabinets are especially desirable in any room, including the hall, because they break the line that marks the usual height of most furniture. The only precaution is that bright mahogany doesn't stand next to dull oak. Such contrasts might well be avoided."

Copy of an old Elizabethan cabinet from the days of Sir Walter Raleigh and the Spanish Armada. It is done in oak, weathered finish, and the figures hand carved in bold relief. A conventional motif governs the design of the frieze and drawer-fronts

No use talking, Aunt Phoebe had finally degenerated to martyrdom. Copperweight's, Splint's, and Buckle-Newhat, each of the best houses, as were the others we had visited, confirmed the fact that a cabinet of any period would be suitable for her library.

However, there was no argument against the selection of a radio set built in the cabinet providing, of course, one could be found in good taste.

In Lard and Tallow's, one of New York's finest department stores, Aunt Phoebe was hardly impressed with the offering of sets designed after the conventional upright phonograph. The manager of the radio department courteously explained that the demand for this style had decreased considerably, but that they sold quite a number of the smaller cabinets, splendidly adapted for placing on a table or stand.

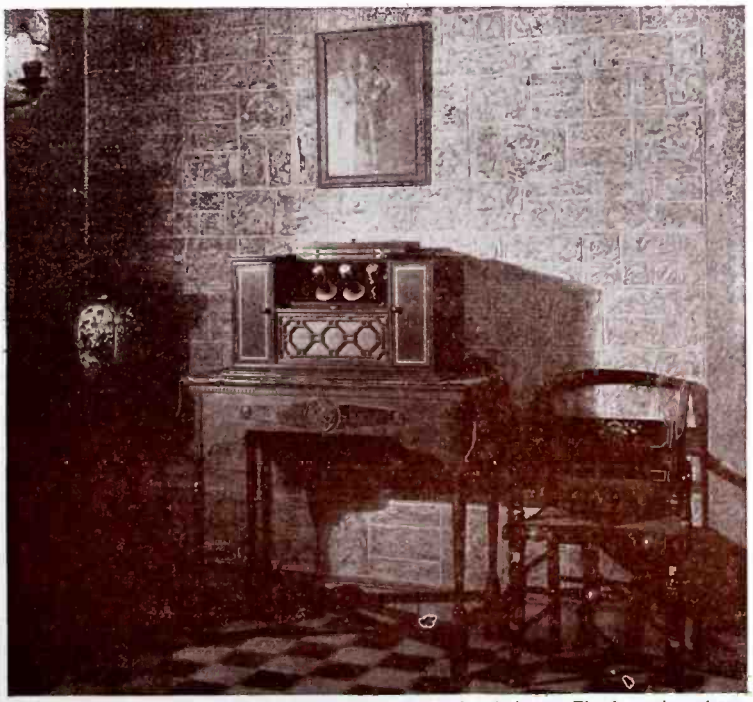
From there we took the Fifth Avenue bus uptown and dropped in at Herbs and Brewing. I was astonished to find them bitterly opposed to cabinet sets. The salesman plunged into super-heterodyne and reflex circuits, arguing that people wanted their radio to look like workshop devices. That might do for regular fans, but he made a fatal error when he talked "technical" to Aunt Phoebe.

Working our way through the crowds we stepped into the Manton Electric Company where we were shown the small cabinet sets and a console design which was too low for convenient operating.

A Queen Anne Period done in wax-finished hand rubbed mahogany. The tone chamber is carved from half-inch laminations, kiln dried maple, to eliminate the natural period of vibration in the horn. This cabinet is well adapted to modern furnishings

Finally arriving at Hand-Gripping further on we were ushered upstairs to the showroom. An excellent display of cabinet sets confronted us and the salesman brought out photographs of those not in stock.

Aunt Phoebe was particularly impressed with the artistic manner in which period pieces were unusually arranged to enhance their individuality.



A hand rubbed mahogany cabinet with inlay of satin wood and ebony. The decorative scheme is a blending of modern and period. It is also built as a console cabinet of American walnut with artificially matched panelling. It exemplifies the late Jacobean design

The day over, and Aunt Phoebe perched uncompromisingly on the one really comfortable chair in the living room, the conversation naturally centered on the photographs she had collected during our joyous adventures.

"Well, Aunt Phoebe, since the photographs represent the choice of sets from which you will probably make your selection, what one are you particularly inclined toward?" I asked with a vast amount of dignity well calculated to impress her with the important rôle I had played in this, the big event of her life.

"Dear boy," was her disconcerting reply, "I wish you would put that horrible pipe away. You smoke too much to have a clear mind in performing your duties."

It seemed to me that that was altogether irrelevant. Besides, my effort toward adult patronage had been utterly ruined.

But being something of a stoic, or whatever it is that distinguishes a man of courage, I insisted, "Aunt Phoebe, you have the right idea when you say that radio should be a part of the furnishings rather than a misplaced workshop, but which one of those cabinet sets do you like best?"

She turned the question over in her mind for a long while and then said, "Each one is desirable."

"But which one do you like best?" I still insisted.

"Well," she answered slowly, "the young gentlemen who showed them to us were so obliging I don't wish to be unfair in my choice."

"Yes?" I encouraged.

"So," she finished, "I believe we had better look at all the cabinets again tomorrow."

How To Be A Radio Salesman

By

M. B. Sleeper

Radio Designer and
Technical Publisher

If YOU will
practice the rules of the selling game as given in this story of two young radio salesmen, you, too, can sell radio and sell big

Of all the branches of the radio industry, radio salesmanship offers the widest opportunity for the application of originality and personality. He has the wide world from which to draw his "selling" points of interest

ARE you one of those keen experimenters who has become so interested in radio work that you want to take it up as a means of earning your living, and of carving out a future, or the sort who is looking for more interesting work in which there may be a wider opportunity than appears to be ahead in what you are now doing? Have you been thinking about making a salesman's start in the radio business?

If so, you can get a fairly good angle on this kind of work and what it will require of from what follows. I won't attempt to sell you on the idea of putting yourself across as a radio salesman, or discourage you from it. I'll just try to tell you, in a general way, what you'll find it necessary to be, what you'll have to know and do, and what you may get out of it.

This isn't a how-to-succeed-as-a-salesman story, but an account of two young fellows who started at this work, and what happened to them. I'm going to assume that you want to go into this work for all there is in it, either as a stepping-off place to owning a store yourself or as a start toward bigger things which might be in an altogether different kind of business.

After the two big years that the radio industry has had, we find the four sections drawing utterly different development curves. Scientific research has made a steady line upward, manufacturing jumped up, dropped more suddenly, rose waveringly, and is now turning up at a fast rate. The establishment of sound merchandising methods hardly showed above zero until Spring of 1923, when it started slowly up in bumpy fashion, steadying itself slightly this past Fall. The record of radio retailing, however, is a most dismal failure, for practically no progress in developing the art of retail radio selling has been recorded. In fact, the introduction of price cutting as a means of increasing sales should appear negatively, below the zero line.

What does all this mean to you? If you can read between the lines, it means that retail selling, done, after all, by the man behind the counter, owes its increase almost entirely to the demand of the public, created by the appeal of radio itself to the public mind. It means that of all the branches of the radio industry, radio salesmanship offers the widest opportunity for the application of originality and personality.

But let's get back to you and your part in the system of things. Rather than give you a series of do's and dont's, I'm going to tell you about two young chaps who, three years ago, were eighteen years old. They both started out to earn their living at radio when they graduated from high school. They aren't imaginary fellows, invented for your benefit, but real boys whom I know intimately because they came to work for me when they finished school. Before we start with them, however, let me remind you that it isn't necessary to get into a large store in a big city. You may be in the radio department of a hardware store in a town of 25,000 people. There may be other stores there which sell radio, and half a dozen men who build cheap sets to order in their cellar shops. Your opportunity is there just the same, and perhaps a greater chance to develop it.

In the December, 1923, issue of THE WIRELESS AGE, Mr. Pierre Boucheron contributed "Opportunities in Radio Today," in which he told about the six different ways of breaking into the radio game. As there are many thousands of people who are today considering the possibilities of a successful career in the radio field, it is natural that this article by Mr. Boucheron should have received widespread attention. Our readers were promised that THE WIRELESS AGE would publish a series of special articles by well qualified leaders in the radio industry which would develop this subject in detail and inform any reader just how to make a start in any branch of radio. In this month's article Mr. Sleeper, a well-known radio designer, manufacturer and publisher, tells the secrets of RADIO SELLING. His instructions, given in the delightful form of the true experience story, will help everyone who is engaged in radio merchandizing, and will be of invaluable assistance to every person who is new to the business.

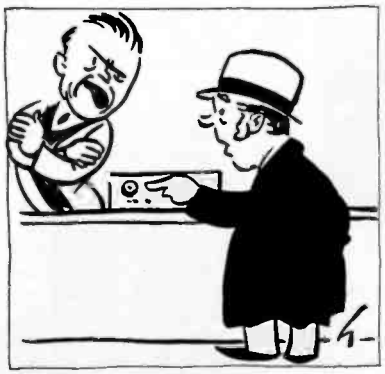
If you are interested in this rapidly developing business of radio and want to learn all you can about it from those who have helped to build it up—if you are one of those already in the industry who want to better themselves—still more, if you are one of those thousands who want to find a way to get into radio and contribute to its development—then you must not fail to read these articles on the "Opportunities in Radio Today."

WHY ONE YOUNGSTER FAILED

Larry Thayer, when he started in behind the counter on the first morning, immediately tore off a piece of wrapping paper, spread himself over the showcase, and, supporting his chin on one hand, apparently continued to dope out a circuit he had been thinking about on the way from home. The first customer, in a hurry to get something as he passed the store on his way to work, had to wait until Larry finished what he was doing before he could get any attention. Meanwhile, he couldn't see the top row of trays in the showcase because Larry was in the way. Then—"Well, old top, what do you want?" It happened that the customer was too much older than Larry to relish such a salutation.

But he patiently explained that he was making a loose coupler, and wanted sliders and rods. Back came Larry, "Oh, that's old stuff. Everyone's using variocouplers nowadays for getting short wave transmitters. Let me show you," and he tore off another piece of wrapping paper on which to draw a sketch of it. Now it happened that the man was employed in a jewelry store, and wanted a tuner for Arlington time signals. There were sliders and rods in the case under Larry's nose.

When the customer said, "No, never mind," and walked out provoked, Larry was offended. He remarked to another clerk that the poor nut didn't have sense enough to take the advice of a fellow who knew the game. Why, he made himself a variocoupler way back in the old days when they only had carborundum detectors! In "those days" he was about nine years old, but



"Well—what do YOU want!" The customer was too much older than Larry to relish such a salutation

that was a matter of detail that didn't count.

Two weeks later, shipments of new stock came piling in, in preparation for the Fall trade, growing rapidly with the establishment of broadcasting. Larry studied each new item until he must have known it inside out. In fact, he didn't have much time to wait on customers. When a man went right up to Larry and said he'd been standing around ten minutes just to get a couple of binding posts, Larry, with a far-away look in his eyes, and an air of being imposed upon would get out the parts, ask rather insolently, "Is that all you want?" make two or three mistakes in the cash slip, and go back to his studies again.

He didn't seem to think that he was employed to sell apparatus and not to look at it. Probably he didn't realize that his customer was offended, that a courteous clerk in another store would sell that man five or ten dollars' worth of the same new parts that we had just put in, or that untidy sales slips are the bane of a bookkeeper's life.

HOW PETTY THEFT DEVELOPS

Before long, Larry's friends started to turn the store into a smoking room. They hung around for hours, it seemed, telling lies about their sets at as much length and with as much noise as some golfers we know whose main topic is their shots and scores. Pretty soon a few tubes disappeared, followed by meters and other parts. Of course, Larry didn't take them, but he was careless about leaving things out on the counter.

Finally, someone who knew him made a remark about the wonderful radio set that he had, an outfit so elaborate that he couldn't have bought the parts from his weekly wages. One of our boys stopped at his house the next evening, and, sure enough, there were all kinds of things which, as Larry explained, he had taken home to try out. No one wants to have an employee arrested for stealing, but in the radio business, where "borrowing" is so easy and so expensive to the company it is necessary, as an example to the others to secure for the offender the maximum sentence. Because Larry was not of age he went to a reformatory until he was twenty-one.

I shall never forget the words of the policeman who came for him. He said, "If you had had any common sense you'd have known that, no matter how clever you are at doing wrong, there is always some one just a little more clever to find you out."

Most concerns allow employees to take things out on memorandum, or sell them at actual cost, to make stealing unnecessary. Why Larry wasn't satisfied with that I don't know.

HOW CHARLIE MADE GOOD

The other boy was Charles Farris. He came up from Fort Worth, Texas, to learn the radio business. He didn't make any pretense of knowing radio. In fact, he had never heard a spark signal, but he thought there were big things ahead in radio and wanted to be in on them. Consequently he started in the packing room where he learned the names of the instruments and picked up a little general knowledge about them.

Quick, willing, cheerful, working rapidly but carefully, he soon graduated to the shop where he assembled sockets, transformers, variometers and what not. He was so interested in learning everything about his work that it was a pleasure to move him around so that he could get the widest experience. At the same time, he kept his

He didn't seem to think that he was employed to sell apparatus

questions for lunch time or after hours at night. He did less talking during the day than any other boy in the shop yet he learned more. The next step was the assembly of sets and wiring, followed by trouble-shooting at the test bench.

In three months' time he was ready for the store. No customer had to wait for Charlie. He was ready with a pleasant "Good morning," and the last customer of the day was greeted with an equally cheerful "Good evening." Charlie's system was simple, though it took mighty good judgment to carry it out. When he first talked with a customer he decided about how much money he had with him. Then he set out to make him spend all of it. That method had to be carried out with discrimination. If a man stopped in to buy a spool of wire and produced a ten-dollar bill it wasn't practicable to sell him ten dollars' worth of goods, as a rule. However, there was always a new magazine or book, a new lot of plugs, a special on variable condensers, or something else which, oftentimes, cost more than the thing that had brought the man into the store. On the other hand I have watched him sell a customer a list of parts so carefully that I wondered why he left him twenty-five cents. And when I asked him, he told me it was a man who lived outside the city, and it cost a quarter for him to get home!

Did those little extra sales—a magazine, some screws, or a package of soldering lugs pay? Charlie's sales

(*Continued on page 74*)

Oberammergau Comes to America Through the Microphone

Age Old Traditions Seek Refuge in Radio

As Told by W. A. H.

ROMANCE in Radio? Well, rather!

Seated comfortably in the parlor of Anton Lang's suite at the Hotel Waldorf-Astoria, our little party exchanged reminiscences of studio lore while we waited to go on the air. Anton Lang was in the next room rehearsing the talk that he would deliver over the microphone to an audience of one million people, an audience remote from Bavaria, the land of privation and suffering. The bits of gossip, long familiar to me, mingling with the muffled roar of the great city below, lulled my thoughts to a passive state of reflection. The microphone, idly engaging my attention, seemed like a crystal globe; fancy shaped into pictures.

A winding road leading over the Bavarian Alps, past the old Monastery of Ettal, drops down to the valley of the Ammer River where Oberammergau nestles in the hollow of picturesque mountains.

A TYPICAL SCENE IN OBERAMMERGAU
The church in the background originally housed the Passion Play

During the reign of Charlemagne the Passion Play was introduced into Germany, gaining a renewed popularity when the Crusades caused a great religious revival. While the Christian World dreamed of retrieving the Holy Land from the Moslems, Oberammergau was founded. And later, following the Thirty Year's War, a pestilence raging through Bavaria reached this little village and claimed so many victims that the entire population was threatened.

On the vigil of the feasts of Saints Simon and Jude, October 27, 1633, the remaining villagers assembled in the churchyard and over the graves of the departed pledged themselves to enact the Passion-tragedy in honor of the bitter sufferings and death of the Lord every tenth year for all time to come.

In the following year the pious promise was fulfilled for the first time. And from father to son down through the generations these people of Oberammergau have kept their faith.

First in the church, later in the churchyard, and finally in an open theater, the Passion Play has been performed on a magnificent scale, the text having been revised in the nineteenth century by the parish priest of the village, the Rev. Father Daisenberger, who devoted his life to the welfare of the Oberammergauers.

The music for the chorus, which explains and connects the various scenes and tableaux, was composed by the village schoolmaster, Rochus Dedler, in 1810.

While our party, consisting of the announcer and operator for WJZ, Dr. Ruederer, a Munich correspondent and member of Herr Lang's party, and a young American of the publicity staff, were waiting for the moment when Herr Lang should give his message over the ether, Dr. Ruederer told us somewhat of the home life of these folk.

Scattered about the church and theater, the houses of Oberammergau, low, substantial structures of stone with the outer walls covered with lime, have painted upon them the various scenes from the life of Christ or the Virgin Mary or some favorite patron saint. Each home contains the workshop of the owner.

The villagers, themselves, are a quiet, simple folk, artisans in the woodcarving craft and painting and pottery, living devout lives to better prepare themselves for their rôles in the Passion Play. Each child hopes for the highest honor known to the Oberammergauers, the part of Christus, accorded to that one who has led the most exemplary life.

Woodcarving is the principal occupation of these villagers, but pottery and painting are an important and highly developed part of their activities. A rigid custom rules that son be

apprenticed to his father, thus maintaining the traditions and excellency of their art.

Early it was conceded that Anton Lang would be chosen for the Christus. He ployed that rôle in 1900 and again in 1910, and probably for the last time, because of his age, in 1922. The latest performance of the Passion Play was delayed two years on account of the great World War.

The war; the suffering following the ravages of that war! My thoughts abruptly came back to the hotel room and the mission that brought the fourteen players from Oberammergau to America.

Anton Lang entered, smiling, a little confused.

Shaking his head slowly, he said, "It doesn't seem possible that a million people can hear me when I talk into that instrument. They have told me that your people will hear me and know of my mission in all parts of the country if I tell them over the radio."

Into the microphone, slowly, passionately, he delivered his plea for the preservation of Oberammergau traditions which his people have so courageously maintained for three hundred years.

He described the work of their hands, their woodcarving and pottery and painting, the schools that were founded for the teaching of these arts, and their plight now that their products are a luxury in Germany and their world markets gone.

They do not raise their own food and it is food they lack. His people face starvation.

Simply, earnestly, he declared their real concern to be for the children who must carry on the traditions of Oberammergau. The older folk, having resigned themselves to the inevitable, look to the future generation for the fulfillment of their ideals.

Anton Lang, the Christus of the Passion Play delivering his first address to America through the microphone which was connected by direct wire to station WJZ. The announcer and operator, at the right, found it difficult to convince Herr Lang that he could actually talk "through the air"

The profits of the Passion Play are used to increase their educational facilities, and the general improvement of the town, but the 1922 performance was a financial failure, adding to the burdens of an already devastated land.

And now the delegation of Oberammergau players have come to America, not for charity, but to sell the products of their labor at the exhibitions to be given over the country.

Having concluded, Anton Lang looked up with the curious twist of his head so characteristic of him.

"I can hardly believe your people have heard me—so many of them," he said, rather plaintively.

Seemingly in answer to his doubt, telephone messages began to come in, and a few moments later, a telegram was rushed to the room. His audience had been there! They had heard!

"Radio is truly a great marvel," Herr Lang replied to my query, "and much more marvelous than in Germany. In my country we don't know so much about these things. I could never talk to such a vast audience there."

Asked if he had been nervous, he answered, "I made some mistakes and it made me feel that perhaps I was not the one to be chosen for a task of such great—" (he referred to his translation dictionary and found the word)—"responsibility."

The American publicity staff member laughed and said to Anton Lang, "Had your talk been any better they'd have thought it was one of us."

"But," protested Anton Lang, "the fate of a stricken people hidden away in the Bavarian Alps might be decided by the message to the Americans through that microphone."

Years of tradition, the fulfillment of an ideal and the faith of a sacred vow hanging in the balance—the weight of a microphone tipping the scales! I wondered if listeners-in realized the dramatic power of broadcasting. Centuries were here spun into a single strand to be woven into a span of a million threads reaching out into American homes.

"Why don't you broadcast the Passion Play?" I asked.

"Never, never," Herr Lang exclaimed, "it is too sacred. We can never commercialize that!"

On the left, Andreas Lang, Sr., in the middle, Anton Lang, and Guido Mayr on the right, putting the finishing touches on some of their carvings and pottery

Little Journeys Into Radio Computations

Some Short Cuts and Interesting Relations in Radio Calculations Told in Practical Illustrations

By Carl Dreher

SOME broadcast listeners are satisfied to hear the music and give no heed to the insides of the receiver. But many of them build their own apparatus and must have some knowledge, at least, of circuits and their functioning. A certain percentage of very hard-boiled BCL's go in for designing sets and working out problems, and for these hardy souls the following article is written. Only the elements of radio computation are taken up, but even so a good many telegraph amateurs, if they will read the article, may discover something new, for many a man who can copy his twenty words per minute does not know why, if he doubles the number of plates in his variable condenser, it will tune to only 1.41 times the former maximum wavelength, while if he doubles the number of turns in the inductance it will tune to twice the wavelength. However, no attempt is made to cover the whole field of radio calculations; instead, attention is called particularly to short cuts and interesting relations through practical illustrations.

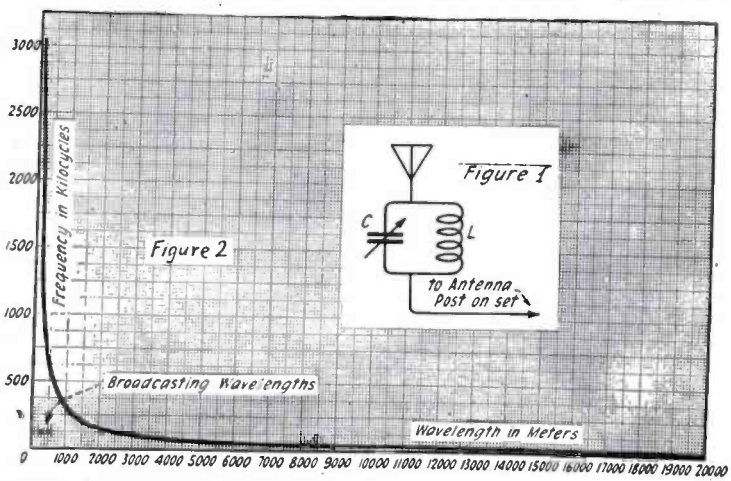


Figure 1—Frequency trap. Figure 2—Chart showing relation of wavelength in meters to frequency in kilo-cycles

Radio is a matter of waves—wavelength and frequency—so the first equation we must consider is the fundamental formula of wave motion. If we have any object—not necessarily an aerial—emitting waves—not necessarily electric waves—we may write

$$\lambda = \frac{v}{n} \qquad (1)$$

where λ is the wavelength, v the velocity or speed of the wave in whatever medium it travels, and in the frequency of vibration of the radiating object.

One should always try to understand a mathematical relation physically and concretely if possible. In the case of an antenna, for example, we have an alternating current of very high frequency. For every oscillation of this current a disturbance or wave starts out from the antenna with a speed of 300 million meters, or 186,000 miles, per second. If the antenna belongs to a broadcasting station, there may be one million such oscillations, and the same number of waves, every second. A wave starts out into space, and a millionth of a second later the next wave sets out in pursuit. The first wave by this time has traveled 300 meters. Hence we see that the wavelength corresponding to a frequency—n in the above equation—of 1,000,000 oscillations per second, is 300 meters. This is a good constant to remember for mental computations. By means of the formula we can readily calculate the wavelength corresponding to any frequency, or the frequency corresponding to any wavelength. The two have an inverse relationship. As one grows, the other diminishes. Thus, while 300 meters corresponds to one million oscillations or cycles per second, the ship communication wavelength, 600 meters, has only half a million oscillations per second; 6,000 meters, which is used for medium high power communication over considerable distances, rates only 50,000 cycles per second; and if we now double the wavelength and get into the band of high power transoceanic communication, we find that 12,000 meters corresponds to 25,000 cycles per second.

As we have seen, 600 meters is the wavelength of a 500,000-cycle oscillation. Or we may speak of 500 kilocycles, a kilocycle being 1,000 cycles. Turning the figures upside down, 500 meters is the wavelength corresponding to 600 kilocycles per second. Halfway between the lines cross; 550 meters have the same number of kilocycles.*

The constant v in the wavelength-frequency equation is, as stated, 300 million meters, or 186,000 miles, per second, for light or electric waves. That seems fast, but it is really none too fast, for as H. S. Osborne points out in his paper "Telephone Transmission over Long Distances" in the Journal of the A.I.E.E., October, 1923, if electricity traveled with only the speed of sound, that is, if v were only 1,100 feet per second—it would take seven hours for a word to travel from California to Cuba, as in the recent 5,500-mile demonstration between Catalina Island and Havana. Actually it takes less than one-tenth of a second, even though the voice currents on a telephone line travel a little slower than radio waves, so that there is nothing to worry about. However, as Mr. Osborne says, "This emphasizes the necessity for using electrical means for the transmission of speech over great distances." It would hardly do to make some sweet remark to a girl on the other side of the continent, and have the answer come back fourteen hours later; she would be too old by the end of the conversation.

At present the tendency is to classify stations not by wavelength, but by frequency, and to speak of kilocycles instead of meters. This is because tuning depends on kilocycles, and while a separation of two kilocycles between two stations corresponds to only a few meters at the higher frequencies, at the lower frequencies it amounts to several thousand meters. Thus if one talks in meters the effect is confusing, for it is hard to understand why a station on 597 meters is no harder to tune out on 600 meters, than a 25,000 meter station on 30,000 meters. The fact is that in dealing in kilocycles we remain in the field of electrical circuits, wher-

*The precise figure is 547.6 based on the true value of v which is 299,820,000 instead of 300,000,000 as generally used.

as when we speak in terms of wavelength the constant v is introduced, so that the move to allocate stations to certain frequency bands is in the direction of purely electrical calculation and discussion, in place of the foreign though connected element of linear measurement. However, as we are now used to thinking in terms of the old arrangement, it will take some time to swing over to the more logical treatment proposed by the Second National Radio Conference.

Having now seen the relationship between wavelength and frequency, we may discuss the factors which determine the frequency in electrical circuits. These are inductance and capacity, provided by the familiar coils and condensers of radio apparatus. In such an oscillating circuit the energy changes rapidly from the electrostatic to the electromagnetic state, being stored up first in the condenser, then in the coil, and alternating continually from one to the other. The number of times per second that this change occurs is the frequency—the quantity n in the fundamental equation. If we call the inductance L and the capacity C, we can readily see that as these quantities grow larger, the energy will necessarily take longer to move from its capacity residence to its inductive residence, just as it would take longer to move the furnishings out of a large house rather than a small one. The frequency, therefore, varies in some inverse ratio to the inductance and capacity. The actual relationship is

$$n = \frac{1}{2\pi\sqrt{LC}} \qquad (2)$$

If this value of n is substituted in the equation (1) in order to get the wavelength in terms of the inductance and capacity, we obtain

$$\lambda = 2\pi v\sqrt{LC} \qquad (3)$$

But this is not in a form suitable for computation. For this purpose the equation may be resolved into the form

$$L = 0.281\,\frac{\lambda^2}{C} \qquad (4)$$

In (4) λ is in meters, L in microhenries, C in micro-microfarads, these being practical quantities used in radio designing. L and C may thus be chosen for any desired wavelength. In practice, the wavelength is known, some value of either L or C is chosen, and the other quantity is then calculated.

Suppose, for example, that we are designing a frequency trap, in the form of a simple resonant circuit, as shown in figure 1, placed in the antenna lead. It is desired to trap out amateur signals only, so that the upper limit need not be over 300 meters. A 23-plate variable condenser is available. Of course 23 plates as a rating of capacity does not mean much, but the usual capacity of such a condenser is 500 mmfd. Substituting 300 meters and 500 mmfd. in their proper places in equation (4), we find that the necessary inductance is a little over 50 microhenries. A spiderweb coil with an inside diameter of 1¾ inches, wound with 25 turns of No. 22 S.C.C. wire, will serve the purpose.

The calculation of inductance is not within the scope of this article, which is intended only as an introduction to the subject of radio computations. It may be mentioned, however, that the best formula for cases where ordinary accuracy is sufficient, is that of Lorenz, given on page 41 of "Formulae and Tables for the Calculation of Mutual and Self-Inductance," by Edward B. Rosa and Louis Cohen, Reprint No. 93 of the Bureau of Standards. This formula applies to single layer cylindrical coils of any practical length, and is given in the simple form

$$L = a\,n^2\,Q \qquad (5)$$

where a is the radius of the solenoid in centimeters, n the total number of turns in the coil, and Q is a factor depending on the ratio of the diameter of the winding to its length; the value of Q for various values of this ratio is given in an accompanying table.

For formulas dealing with special forms of inductance, such as spirals and multi-layer coils, the reader is referred to Circular No. 74 of the Bureau of Standards, "Radio Instruments and Measurements," now out of print as a government publication, but obtainable in book form from the Wireless Press. While these equations are more complicated than (5) above, they are all simple algebraic expressions and no special skill is required to use them, although familiarity with the slide rule certainly reduces the labor involved.

One important rule should be noted in regard to the characteristics of inductances. With any given shape or form of coil the inductance varies, in general, with the square of the number of turns. Doubling the number of turns, that is, gives four times the inductance; tripling the number of turns multiplies the inductance by nine; and so on. Now, equation (4) involving wavelength, inductance, and capacity, may be re-written in the form

$$\lambda^2 = \frac{L\,C}{0.281} \qquad (6)$$

or

$$\lambda = \frac{\sqrt{L\,C}}{0.53} \qquad (7)$$

or, roughly,

$$\lambda = 2\sqrt{L\,C} \qquad (8)$$

(Continued on page 76)

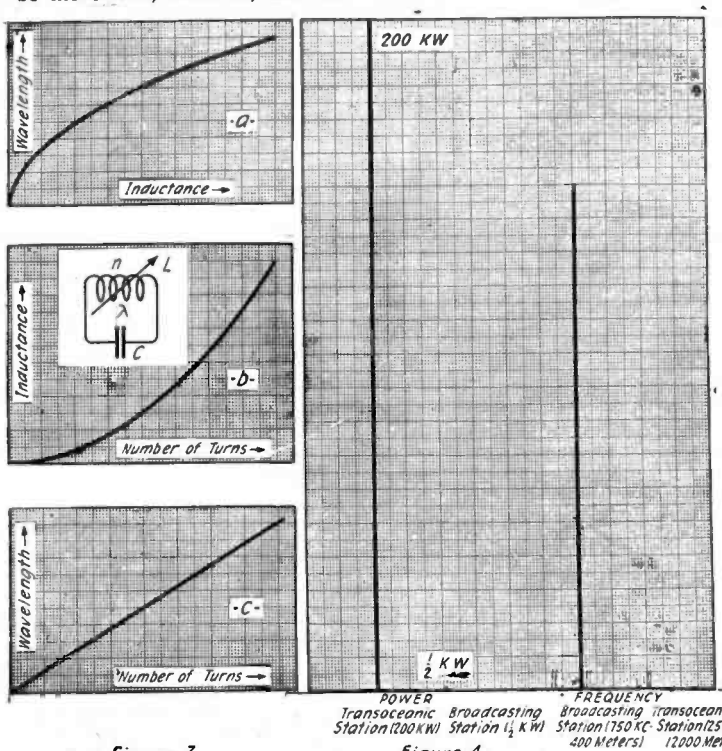
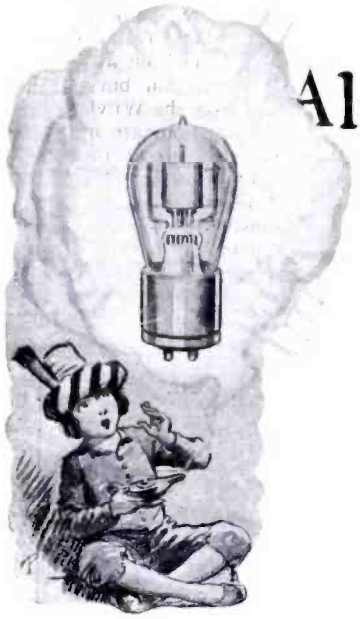


Figure 3 Figure 4

Figure 3—(a) Shows variation of wavelength with inductance, capacity being fixed. The curve is first steep and then flattens out. In (b) the concavity of the curve is opposite, the steepness increasing with the number of turns. These two forms neutralize each other so that, as shown in (c) wavelength increases linearly with the turns if C is constant. Figure 4—Comparison of transoceanic and broadcasting stations' power and frequency



Aladdin's Magic Lamp

There Is No Magic in Any Lamp as in the Radio Bulb

By Jerome W. Howe

THE Arabian Nights! How we have thrilled at these strange Oriental tales that, more than any other stories in the world, have satisfied youth's boundless capacity for imagination and belief! And of the whole collection of fanciful romances which has been aptly called a great three-decker to carry tired people—tired big people no less than tired little people—to Islands of the Blest, what is more often retold and more clearly remembered than the story of Aladdin and his wonderful magic lamp?

With but the mention of the tale it all comes back to us—how the wicked but potent magician came out of Africa to China and used a poor, shiftless, good-for-nothing orphan tailor's son, Aladdin, as a means to get into his possession a wonderful magic lamp which was to be found in a remarkable cave without an entrance deep under the ground; how the magician caused the earth to break away and disclose the cavern into which he dispatched Aladdin after the lamp; and how Aladdin suffered the magician's anger at nearly the price of his life.

But Aladdin came through the ordeal as do most of the heroes of the stories we love, and remained the lucky possessor of the magic lamp.

That magic lamp and its gigantic genie who appeared whenever Aladdin rubbed its surface—what indescribable wonders it worked! You remember, of course, how it provided Aladdin with rich feasts, and brought him a glorious, lovely princess, and how it provided troops of slaves with costly gifts, and, finally, how it transported a whole palace from China to the middle of far-away Africa and brought it back again. Wonderful magic lamp!

But no more space can be spared here for such pleasant reminiscence, for the purpose here is to tell about another magic lamp, discovered centuries and centuries after this old brass oil-burner of Aladdin's, and not in ancient China, but in twentieth-century England and America. And this modern magic lamp, too, can provide feasts and undreamed-of pleasures, and transports on an instant the wonders of far-away places to our very hearths.

Yet there is a great thing about this modern magic lamp that cannot be said of its ancient prototype. There was only one Aladdin recorded by the "Arabian Nights." Today we may all of us be Aladdins and possess a magic lamp, not the least bit less potent and mysterious and wonderful than the old hand-rubbed article of mythological ages ago.

Aladdin's lamp was not found in a day. The African Magician spent forty years in experimenting with enchantments, so the story runs, and after a successful operation of geomancy, whatever that may be, he learned of the existence and location of the marvelous lamp. Then ensued the long difficult travel from Africa to Aladdin's home, and finally the thrilling adventure of the subterranean cavern.

The modern magic lamp was, likewise, the product of long years of patient investigation which led to the development of a two-element tube from which the air was evacuated. An English scientist, Dr. H. A. Fleming, was the first to apply this "valve," as it was termed, to the reception of radio waves. This was in 1904. This tube acted like a valve because it permitted the currents of electricity to flow only in one direction. It thus rectified them into a pulsating direct current, which was then effective in actuating the diaphragms of the telephone receiver.

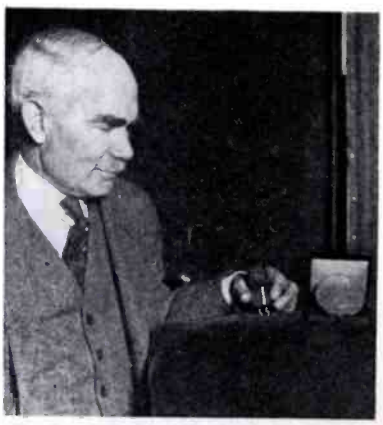
Soon after Fleming's application of this "valve," as the English still call it, to radio, Lee DeForest, in the United States, developing Fleming's discovery, added a very important feature, the grid, which gave us a three-electrode "audion" in which the grid served to control the current passing between the plate and the filament. This was an important step in the development of the new "magic lamp," but still the "genie" was not the sort of chap who, like Aladdin's, could be always depended upon.

This early tube was rather erratic, and sometimes it worked and sometimes it didn't. But it afforded sufficient proof of the possibilities of the vacuum tube to cause the great electrical companies of America to take up its exhaustive and extensive study. And so was perfected in course of time the wonderful vacuum tube as we know it today.

It was found that the vacuum tube was effective not only as a detector in the reception of radio waves, but also as an oscillator to produce radio waves in the transmitting apparatus; so it has come about that the vacuum tube is the primary element upon which radio depends, and when we consider all the wonderful results today that came from radio communication and radio broadcasting, it is apparent that the little vacuum tube is a veritable Aladdin's magic lamp.

The ancient Aladdin had only to rub his lamp; the present-day Aladdin must have a little knowledge about his lamp in order to get the best service from its "genie," and so I am presenting here a brief description of the different kinds of vacuum tubes, their various characteristics and some notes regarding the proper use of them.

The chart on the opposite page contains data on the proper plate, grid and filament voltages for the "UV" and



Dr. Lee DeForest with the medal and the tube that won it

"C" and "WD" tubes commonly used in receiving sets.

As there is very little current flowing in the grid circuit, the "C" battery will last about as long as it would normally last when not in use.

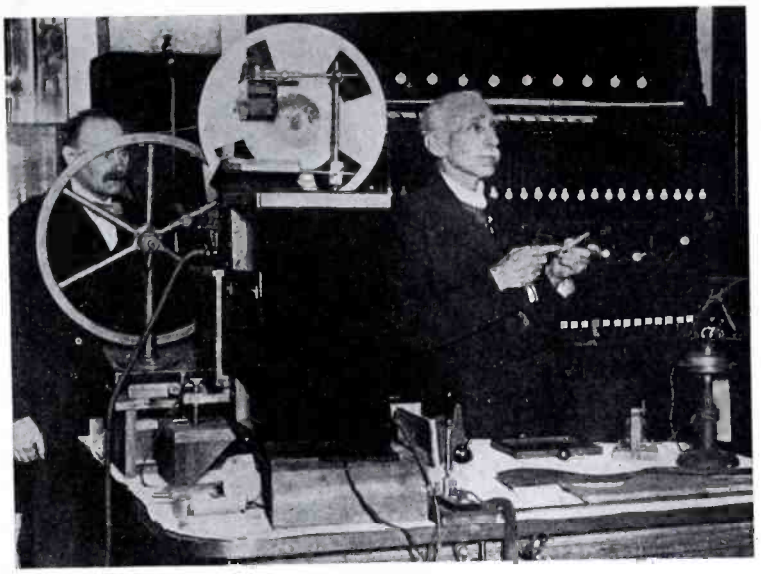
In using vacuum tubes, one should always closely adhere to the manufacturer's specifications as to the proper voltages best suited for that particular tube. One should be very careful not to apply excessive voltage to the filament terminals, as this is quite disastrous, as the filament will either burn out or be so injured that the operating life of the tube will be shortened considerably.

In general, the selection of vacuum tubes depends upon the type of battery available for filament heating. If only dry cells are to be used, our choice is necessarily limited to vacuum tubes of the dry-cell type; that is, those of such construction that the filament consumes but little current; permitting use of dry cells for a comparatively long period.

Of the dry cell tubes, the UV-199 (C-199), the WD-11 and 12, there is little difference as far as actual results are concerned. However, the UV-199 is especially suited for amplification in untuned transformer, choke-coil or resistance coupled radio frequency amplifiers, as it has a low capacity between the plate, grid and filament electrodes; furthermore, the fact that the filament current is so small (.06 of an ampere) makes this tube preferable to the WD tubes.

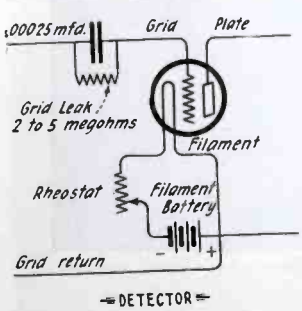
There is no necessity of critical regulation of the plate or filament

(*Continued on page 70*)



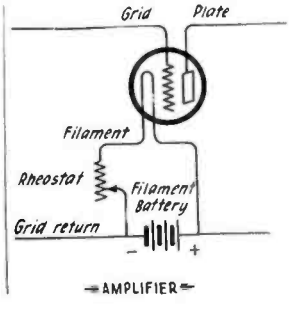
Professor J. A. Fleming holds lectures for children at the Royal Institution on electric waves and wireless telephony

Tube	Filament Battery Voltage	Max. Rheostat Resistance Ohms	Filament Terminal Voltage	Filament Current	Plate Voltage	Plate Impedance in Ohms	Amplification Constant (Approx.)	Mutual Conductance in mmhos.	OPERATION		
									As an Audio Freq. Amplifier	As a Detector	As a Radio Freq. Amplifier
WD 11 WD 12	1.5	4 to 6	1.1	0.25	40 to 100	19,000 at 40 Volts 17,000 at 80 Volts	6.5	340	Fair	Good	Good
UV–199 C –299	4.5	30	3.0	0.06	40 to 60	18,500 at 40 Volts at Zero Grid 16,000 at 80 Volts with 4.5 Negative Grid	6.25	340	Fair	Good	Splendid with either Tuned or Untuned Intertube Coupling
UV–201–A C –301–A	6.0	6 to 10	5.0	.025	40 to 120	16,500 at 40 Volts at Zero Grid 12,500 at 100 Volts with 6 Negative Grid	8	485	Exceptionally Good	Very Good Next to UV–200; Use 15 Ohm Rheostat—45 to 60V B Battery	Excellent with Tuned Intertube Coupling; Not so Good with Untuned Coupling
UV–200 C –300	6.0	4 to 6	5.0	1.00	15 to 23.5	9,000	.....	.....	Good for Code but not so Good for Telephony	Excellent	.....
UV–201 C –301	6.0	4 to 6	5.2	1.00	40 to 120	18,000	7.5	440	Very Good	Fair	.....
WE–"J" VT–1	4.0	2 to 4	2.6	1.2	40 to 100	18,000	6.5	360	Good	Very Good	.....
UV–202	10	1.5 to 3	7.5	2.35	350	5000 at 350 Volts Zero Grid	7.5	1500	Excellent	.....	.....



GRID OR "C" BATTERY VALUE

UV–201–A C–301–A		WD 11 and WD 12		UV–199 C–299	
Plate Voltage	Negative Grid Bias Voltage or "C" Battery	Plate Voltage	Negative Grid Bias Voltage or "C" Battery	Plate Voltage	Negative Grid Bias Voltage or "C" Battery
40	0.5 to 1.0	.....	.....	.....	.....
60	1.0 to 3.0	45	0	40	0.5 to 1.0
80	3.0 to 4.5	60	1.5	60	1.0 to 3.0
100	4.5 to 6.0	80 to 100	3.0	80	4.5 to 6.0
120	6.0 to 9.0	.....	.....	100	6.0 to 7.5



Design of Loop Antenna

Part I

How One Can Easily Obtain the Correct Dimensions to Use Without Mathematical Computations

By Ralph Batcher, E.E.

Author "Prepared Radio Measurements" Wireless Press

WITH the increasing use of radio frequency amplification and the desire on the part of many amateurs to avoid cumbersome outdoor aerials, loops of all sizes and shapes have gained an increasing popularity. However, there is a distinct lack of practical information on the design of this type of antenna. To fill this need a series of three articles will be published in THE WIRELESS AGE and a study of them will enable any amateur to design and construct his own loop for broadcast and amateur reception. The series of articles will treat the subject in an easy-to-understand, non-mathematical way, including the determination of the value of inductance necessary and how to make the loop to obtain this value; mechanical considerations and finally, signal strength with loops and a discussion of their directional properties.

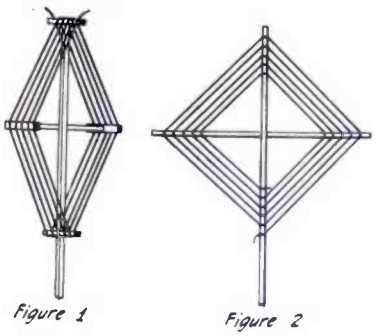


Figure 1 Figure 2

Box and plane type of loop antenna

Before the mechanical design can be taken up, the electrical design must be first considered. The common method of tuning a loop antenna is to shunt a variable condenser across its terminals. This condenser should be the best obtainable and should be selected as one having the greatest maximum-minimum capacity ratio possible. A condenser with this ratio equal to 10 will in most cases give a wavelength range not much over 2—that is, the minimum wavelength receivable will be around half the maximum. To thoroughly cover the broadcasting wavelengths a higher wavelength ratio is generally desirable, so a variable condenser with a capacity radio of around 30 should be selected.

In selecting a condenser it is also preferable to use one with a small maximum capacity. In this way more turns may be used on the loop and a greater signal strength obtained. It is to be remembered, however, that in most cases the smaller the condenser the smaller the capacity ratio. In most cases for the broadcasting range an .0005 mfd. condenser may be used.

After selecting a condenser and determining the maximum wavelength desired the following table may be used to determine the inductance value which must be supplied by the loop:

MAX. INDUCTANCE DETERMINATION

Max. λ =	300	400	500	600	1000	2000	3000	Meters
Cap. = .0004	63.2	113	175	250	700	2800	6350	
.0005	50.5	90	140	200	560	2250	5000	Micro-henries
.001	25.	45	70	100	280	1120	2530	
.0015	17.	30	47	67	187	750	1700	

Or if desired the formula

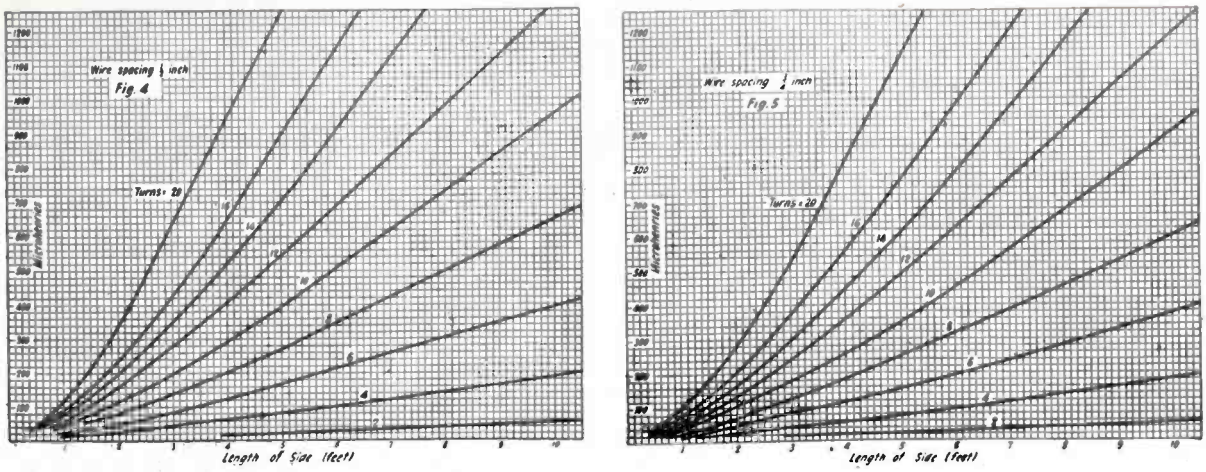
$$L = \frac{\lambda^2}{3600\,C}$$

or any other of the standard and common methods can be used.

There are two general types of loop antenna in common use: (A) the box type (figure 1) where all turns have the same dimensions, and (B) the plane type (figure 2) with all turns in the same plane and with the center turns smaller than the outer turns. Of the two types using the length of the outer turn as a basis of comparison, the former is a little more efficient in most cases although the difference is not great. This is due to the fact that it has a little less distributed capacity and has a larger inductance and a larger area per turn, while the former type has a somewhat neater appearance and is generally easier to construct.

The following charts will enable the proper size and turns to be selected for the desired inductance. The specifications in these charts are especially pre-

This novel indoor loop antenna consists of wire sewn to an ordinary window shade. Designed by W. H. Bullock



Graphs giving constructional data for design of inductance coils

pared for loops shown as type A. (But it will be shown later that the same data applies to type B if the value "a" is taken equal to the length of the average turn divided by 4.)

The data applies only to square loops with the wires spaced ¼, ½ or ¾ inch apart. It makes no difference how the loop is mounted (whether the sides are vertical or oblique), either in the matter of the resulting inductance or in the matter of the received energy. If the loop is used near metallic or plaster walls or metal pipes, both the inductance and received energy values are affected.

Three sets of curves are shown from which the inductance of any number of turns and size of loop may be read, for the ordinary range of values used in receiving loops. These curves are based on actual measurements on a series of loops, the data being hitherto unpublished. The wire used was the equivalent of No. 14 B. and S. gauge. The values have been checked and the accuracy should be within 10%, depending on the care taken in interpolation.

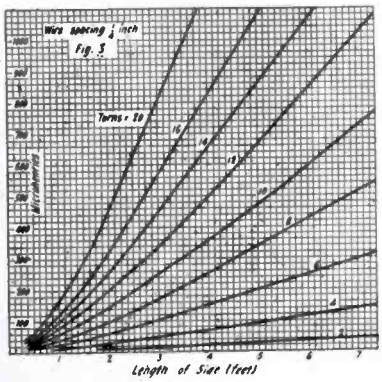
Two theoretical formulas have been published from which the inductance of a loop may be computed, but each is more or less involved for rapid computations. The first may be found in *Jarb. Drahtlose T. & T.*, page 276, in Vol. 1919, by A. Esau. Practical tables are included there for the determination of the constants. The second is shown as Formula 165 in Bulletin No. 74 of the Bureau of Standards. These publications should be referred to in case the theoretical inductance is desired.

In any loop constructed for the ordinary broadcasting wavelengths it is advisable to space the wires at least ¼ inch or more if practical. The spacing in practical cases depends upon the number of turns, since a large number of turns with large spacing gives a loop which may be cumbersome to handle. The spacing should therefore be as large as convenient consistent with practical loop dimensions.

From an inspection of the curves in figures 4, 5 and 6 it will be seen that the desired inductance can be obtained from a number of different combinations of turns, spacing and loop dimensions. All factors considered, except appearance and room space, it is desirable to build a large loop with few turns rather than a smaller loop with a greater number of turns. The reasons will be taken up in a following chapter.

From the above outline it will be seen that all the factors in loop construction can be selected to suit the builder's convenience, except one, but that one must be carefully computed. These factors are:

1. Maximum wavelength desired.



Graph for constructing inductance coil having one-quarter-inch wire spacing

2. Maximum capacity of variable condenser.
3. Spacing of wires.
4. Length of side of square of the loop.
5. Number of turns.

If the values for four of these factors are picked out, the fifth can be readily solved by use of the table and the charts.

The next instalment will deal with mechanical features of loop construction, and the final instalment will take up the theoretical considerations, directional properties, etc.

The second article of this series by Ralph Batcher will appear in an early issue of THE WIRELESS AGE.

Broadcasting in the British Isles

(*Continued from page 26*)

the purchase of tickets there is the element of a gamble, wireless gives to the individual an opportunity for sampling the play and backing his own judgment.

Certain theatrical managers searching around for further arguments against the broadcasting of plays have suggested that great damage might be done by the broadcasting of a play which, although most successful on the stage, has not the essentials for a radio triumph. This is a dubious reflection on those responsible for the broadcast programs. No play would be scheduled for broadcasting that had not been thoroughly tested out with a microphone on the stage and headphones at some remote point.

Happily every management has not taken up this hostile attitude and we are still able to broadcast from actual playhouses grand opera, Shakespeare and non-musical modern plays. We are making arrangements to perform actually in our own studios plays of the character now denied to us elsewhere, and feel confident that in having a free hand for the development of that special technique of translating action in terms of sound we shall probably produce more entertaining results than would be possible if we relied solely on the theatrical managers' assistance.

(*Continued on page 67*)

Peeps into Broadcast Stations

Voice Doesn't Work Well on Soft Carpet

"SCANDAL? . . . Scandal enough!"

Thus was Mr. Felix's reply to our request for some "peeps" behind the scenes at the studio. He happens to be the publicity manager and "trouble shooter" of WEAF.

"Listen," he continued, "why don't you write a story about the trials and tribulations of a broadcast studio personnel?

"For instance, we have artists scheduled for the air who send their photos, demanding that we get them in print, which we certainly try to do, but failing, they threaten to cancel their dates. And, mind you, after we have released our programs to the papers.

"On one occasion, a brilliant artist, due to go on the air, stepped into the studio. When she discovered that she stood on a heavily carpeted floor, there was an immediate protest. 'I cannot sing if I stand on a soft carpet. It is absolutely impossible. My voice is not the same.' (Of course the carpet was necessary to the successful broadcasting of the program but we've had previous experiences.) 'Certainly madam, you win. It is only the less experienced artists than yourself who do not realize that they cannot sing as well from a softly carpeted floor. Just one moment, this shall be remedied.'

"Recently, a new announcer handled his first program. His mother had listened-in but had failed to recognize the voice of her son—so carefully had he applied the art of correct tone and enunciation for the microphone in acquiring a 'radio voice.'

"On the other hand, not many days previous, another new announcer had been heard by a friend whom he had neither seen nor been in communication with for several years, but who, nevertheless, had not questioned for a moment the identity of the announcing voice, and telephoned a message of congratulation.

"One other little incident was a telegram from the station in Kansas City that was broadcasting President Coolidge's message to Congress by a direct wire from the Capitol. They claimed that they could hear President Coolidge turning the pages of his manuscript. An immediate check was made through the observing operator who sat in the gallery of the House. And strangely enough, the Kansas City station had actually heard the rustle of the manuscript over 3,600 miles of telephone line used in the event."

Margaret Madigan, well known young soprano who has broadcast from WJZ several times

Chicago Enters Northern Solitude

ON the stroke of twelve every Wednesday night a program is broadcast from WJAZ for a little band of men who sit huddled together in the forepart of the schooner *Bowdoin*, "frozen in," 11 degrees from the North Pole. Dr. Donald B. MacMillan and his exploration party are thus able to make a weekly visit back to the States—other than that, silence confronts them.

At a dinner given Dr. MacMillan, March 21st, 1923, he told of the true hardship of the Arctic—not the cold, not the lack of food, but the awful silence, so terrible indeed that men go mad because of it. He recalled one expedition in particular when this tragic fate befell a number of the party and the only way the remainder of the crew could get back to safety was to shoot them.

One of the guests at the dinner suggested that radio equipment should be taken on the next expedition. Two months later Dr. MacMillan arranged to take with him a dependable outfit.

So there they are—Dr. MacMillan and his crew of seven within a few miles of the North Pole, the deck of the boat covered with snow, to shut out the cold and keep within the little heat it is possible to generate. Stretched between the high masts of the *Bowdoin* is the antenna wire.

In Chicago, promptly at midnight, the announcer of WJAZ changes the call letters to 9XN and calls WNP (Wireless North Pole). Then he reads to them letters and messages from friends and relatives of weddings, births, and deaths; messages of all sorts from home.

When the personal messages have gone their way, a résumé of the week's news is given.

And such is the blessing of radio to the ice-bound adventurers, a little group of men all but crushed by the Northern silence.

A novel feature of WJAZ is the Crystal Studio. It is glass encased and sound proof. Although visitors to the station are separated from the studio by a triple plate-glass wall, they are enabled to hear the program by means of a receiving set located just outside.

Singer Meant Well But He Wore a Belt

MR. POPENOE, the winsome manager of WJY, complained that B. C. L.'s don't seem to realize that some mighty good stuff goes off the wire from that station.

Taking advantage of his permission to browse around behind the scenes we discovered that some "good stuff" does go off the wire—and a lot more that doesn't.

The Brooklyn Mark Strand Theater broadcasts a program every week that includes everything from grand opera to jazz. After a performance in the theater, the whole show, in costumes and war paint, jumps into taxis, rushes over to WJY, stages a radio "blow-out," and rushes back to the theater for another performance on the stage.

Getting the instruments into the studio, up and down the elevators, and arranging the cast entails a steady stream of people circulating through the station for well over an hour.

One night, the harps had been tuned and placed in position around the microphone ready to go on the air. Just at the moment when the operator "threw" the switch and signaled the players to start, one of the studio personnel stepped into the room, sniffed the air and immediately proceeded to open the windows! The result? Harps out of tune!

After the players had recovered, the culprit explained that he had merely wished to freshen the air in the room. He didn't know that an even temperature is absolutely essential to keep a harp in tune.

The Grand Opera tenor was scheduled next. His voice was so powerful he had to stand eight feet back from the microphone to insure perfect transmission. But he became so engrossed in the aria that he moved, step by step, toward the instrument, wringing his hands. The announcer moved the microphone, bit by bit, away from him until the wall had been reached. The singer's concentration defeated all attempts to catch his attention. There was but one recourse. He was unceremoniously jerked back by the simple expedient of grasping his belt. Incidently, he doesn't wear the belt any more—in the studio.

And by way of capping the climax, Mark Strand, the owner, can't listen-in on his own show because he lives in a suburb of New York that happens to be a "dead" area for receiving the stations located in New York.

Agnes Lenard, the only bedtime story-teller who sings the kiddies to sleep to the accompaniment of a ukelele, is a favorite with WJZ's younger audience

A new announcer recently introduced a speaker but forgot to "throw" the switch. The speaker talked to himself for several minutes before it was discovered that he wasn't on the air.

And speaking of announcers, T. H. Cowan received a letter from an unknown feminine admirer.

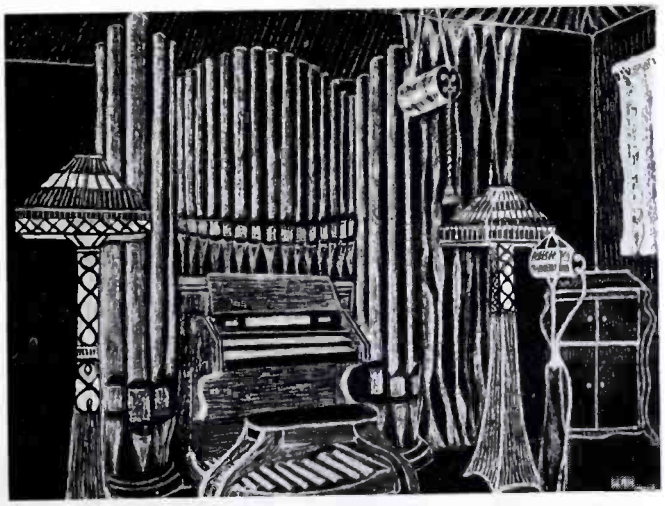
"I want to say a word for the announcer," the letter read. "I doubt if they realize how much they contribute to the enjoyment and thrill we women get from radio.

"He should have his picture printed along with the program for he is as well liked as a movie star, especially if he is young and his voice magnetic, as every woman thrills to the way a man says 'love,' 'lover,' 'sweetheart,' 'adore' and 'longing' and a hundred other words used in connection with the love between man and woman.

"There is something about a man's voice that sets our heart strings singing, especially if he is young and virile."

In answer to this prayer a picture of Cowan, in a striking pose, has been printed for the general edification of our readers, and the correspondent in particular.

Another letter to Mr. Cowan has irrevocably established his position with the women B. C. L.'s. That one, however, remains a state secret—at least a station secret.



The "Casovant" Pipe Organ, at station CKAC, Canada, was designed and built for radio broadcasting

Microphones Don't Tell What Announcers Don't Know

A NEW wrinkle in radio broadcasting was the masked singer at WTAM recently.

The mysterious unknown was several years ago a prominent figure in vaudeville. As a comedian and singer, he had reached the top of the profession, but seeing no future in store, he retired to an obscure but successful business career in Cleveland. However, he has been besieged with requests to "do his stuff" on several occasions but has always declined. Hence his insistence that his identity remain hidden when he consented to broadcast. His former partner in vaudeville was his accompanist and likewise had to remain incog. Manifestly, we are unable to publish their pictures.

Radio Movies Shown

THE near future will see the perfection of radio movies; essentially, they are here today. Anyone, with the aid of special apparatus, contained in a box about a foot square, and a small curtain, will be able to see as well as hear over the radio, according to C. Francis Jenkins of Washington, D. C.

The making of speaking films in Berlin. Experiments utilizing the radiophone to produce the "talking movies" are being made in Germany

Professor Jenkins, who has previously demonstrated the transmission of still pictures by radio, recently showed on a screen in his laboratory the movements of his hand and other objects held in front of his radio transmitting apparatus in another room. The apparatus used in transmitting still pictures was employed in the last experiment, but a new "lens-faced prismatic ring" was introduced to show a rapid succession of pictures depicting movement.

Perfection of the moving picture radio transmitting set now awaits only the manufacture of a new and more powerful electric lamp of the "corona-glow" type. In the recent demonstration, use was made of a temporary lamp by the inventor, but it is not strong enough to transmit large pictures. The question of rapidity is solved, Jenkins says, as he has already sent pictures at twice the standard movie speed. What he needs is a better and stronger lamp which will stand up when the signal strength is increased about 3,000 times, as is necessary in sending pictures in motion.

Not only actual pictures of moving bodies can be transmitted, by pointing the machine at them, but films can be broadcasted, Jenkins claims, and shown on screens in theaters or homes where proper receiving and reproducing apparatus and a screen are available. When the power of the light is raised the size of the picture can be increased, it was explained.

Broadcasting Boon to Wall Flowers

WOR has had requests to broadcast information concerning lost dogs, cats and other members of the family.

One day a wire came in from an elderly lady saying that she has been deaf for 40 years but at the moment of sending the telegram she was hearing for the first time. And it's our conservative guess that McCosker's "dope" on the "Hollywood" news was largely responsible.

A letter with a real human appeal was received from the matron of a Home for the Blind. Prayers of 700 blind persons were offered for the success of Mr. McCosker because he forms the connecting link between them and the current motion pictures.

One of the women listeners-in wrote to WOR that having been a charter member of the Wall Flowers Association, Local 23, she now had the station to thank for the loss of her card. It seems her husband had never previously been willing to learn the terpsichorean art but had finally taken up dancing lessons through the broadcast instructions of Arthur Murray.

T. H. Cowan, erstwhile known as "A.C.N.," the announcer with the magnetic voice

And inasmuch as a well known dancing teacher once said that husband and wife could never dance together because she was generally given to candid criticism, this would appear to mark another epoch in our great social evolution. The privacy of the home hath many blessings.

Dick Barthelmess recently broadcast a talk from WOR that retrieved an old college roommate who had always been "going to write" but had always been too busy. The urge to speak to him personally came from hearing his voice by radio.

Digging Coal to Prison Tempo

WOS, the one distinctly "farmers' radiophone" is located in the dome of the State Capitol at Jefferson City, Missouri.

Broadcasting market news on farm products and live stock is the primary service rendered by this station. Through it farmers in the middle west situated miles from any source of communication with the world are provided with information of live stock, grain and other market transactions before it is scarcely an hour old.

The broadcasting of musical programs from WOS on Monday, Wednesday and Friday nights has been proven to be no mere side line of service. Little did Missouri state officials think a year ago that the leader of the State Prison Band made up of thirty-two regulars would select from that number twenty expert musicians who would build up a national reputation for Missouri. The first anniversary of the Missouri State Prison Band broadcast an especially delightful program.

So thoroughly satisfied were the "listeners-in" that two hundred and eighteen of them sent prepaid telegrams to WOS expressing appreciation. Thirty-seven states and three provinces of Canada were represented in the flood of congratulatory telegrams to WOS and the Missouri Prison Band boys. The detailed list of telegrams by states proves conclusively that WOS with its State Prison musical experts has attained remarkable success and popularity throughout the United States.

Two men deep beneath the surface of the earth in their quarters in an Illinois coal mine reported enjoying the wonderful "music of the air." A crew of trainmen in North Dakota wired that they were enjoying the Prison Band program from a Northern Pacific caboose. Frequently, ranchers in isolated sections of the far west wire or

write appreciation of the Band Concerts. Ships at sea are now and then among those reporting.

Pathos, wit, humor and irony are unstintingly used by WOS correspondents in expressing themselves regarding the broadcasting. Thus, the decidedly human side of the hundreds of thousands of American radio fans is revealed. Frequent communications express sorrow that talented artists such as compose the Missouri State Prison Band must linger behind the high, gray stone walls at "Silent City." One man wrote that if he were Governor of Missouri he would pardon the whole bunch of the band boys.

Others write: "Hold them there for life, so we radio bugs can enjoy their fine music." Still others opine that all of the "musically confined" experts in the United States must be segregated behind the big prison walls in Jefferson City, Missouri. Quite a number have inquired whether the cornet soloist could be parolled to them. Others express a preference for the talented pianist. Some want the jazzy saxophonist. Running like a golden thread throughout the entire correspondence, however, is a philosophical note which proves that the hundreds of thousands of "listeners-in" are, after all, true-type Americans interested in improving social conditions that make prisons necessary.

The thousands of letters and telegrams received from all over North America even to far away Alaska, from ships on the Atlantic, the Caribbean, and the Gulf, and from Old Mexico, Cuba, Porto Rico, Hawaii, Newfoundland, and other distant points, go far toward lifting the heavy burden from the lives of the unfortunate boys behind the big stone walls. The many letters, postals and telegrams provide hours of interesting reading and pastime for them. The tobacco supplies so liberally sent to WOS for the consumption of the Prison Band Boys is also greatly appreciated by them.

Although the State Prison Band is a frequent performer at WOS, it by no means has a monopoly on broadcasting successful and popular programs. The management of WOS has invited all of the approximately forty institutions of higher learning in Missouri to broadcast musical and educational programs. The group of twenty Junior Colleges for Girls have responded most splendidly; a number of them have broadcast delightful programs from WOS. College professors from the State University regularly broadcast lectures.

The Old-Time Missouri Fiddlers broadcast from WOS their first anniversary program. No one realized that this was such a feet-shaking nation until the congratulatory telegrams began pouring in. The operators found it necessary to notify their audience that it was too disturbing to sit at the telephone to answer the continuous string of long distance calls that were still awaiting on the line after the 17th one had been answered. These old fellows played Turkey in the Straw, Arkansas Traveler, Pop Goes the Weasel, Leather Breeches, Wild Boy, and other old time country rag selections.

The Prison Band at WOS and a scene in the mine where the band music was heard by radio. Both represent new innovations in the broadcast and B.C.L. field of radio transmission and reception.

Mme. Glukeya Campanieskaja, "Russia's Great Carmen," who has but recently arrived in this country, broadcasting from WJZ

Then follows a statement in French, afterward repeated in English, as to the selections and artists. The numbers of the program alternate for the French and English listeners-in, the announcements being made in both languages.

The novelty of this bilingual arrangement appeals to Uncle Sam's audience. The mail pouch daily has a large collection of letters from all over the continent.

The common illusion that Parisians cannot understand the dialect of the French in Quebec has been exploded by acknowledgments of enjoyed reception from gay Paree. A ship operator reported excellent reception in the Bay of Biscay.

A noteworthy feature of this station is the pipe organ that is part of the equipment, especially and compactly built for radio transmission. A brief recital on this Casovant forms part of nearly all of CKAC's concerts.

Bilingualism and Accents

J. N. CARTIER, manager and announcer at the Canadian station CKAC, begins each broadcast:

POSTE Say-Kah-Ah-Say,
La Presse, Montreal.

Laughter on the Radio Wave

Technical Giggles

By Jack Bront

We fully anticipated the fact that broadcasting would ultimately pass "into the hands of receivers."

We have failed so far to communicate with the spirits through radio. We suggest the use of phantom antennas on a dark night.

We're glad we're not a radio operator over in Holland. Try this on your microphone, after first calling in the fire department: "Tankstoombootmaatschappij;" or this little German zephyr: "Dampschiffahrtsgesellschaft."

What more could you wish than a "two-step" for radio dancing?

Willie maintains the wire on his single circuit coil is hard drawn. It took six days to extract six simoleons from Pa.

Prohibition has even affected the radio business. View the dry cell tube. Who uses a wet battery now?

The lad nowadays burns the midnight filament in preference to the midnight oil of yore.

High inductances at the broadcasting station should result in many "good turns" to listeners.

In radio at least, we know "distance" makes the heart grow fonder.

Instructive broadcasting from aircraft can be well deemed "education on a higher plane."

Japanese fishing fleets employing radio will be angling both above and below. The habit should be nothing less than catching.

Glendora inquires if the naval airship going to the pole will communicate with the south by means of polarized relays. We assume it will take some cold calculation to accomplish the result.

Glendora naively suggests that in her musical broadcasts, kind Nature supplies the "air." At least the broadcast station manager has not, so far, given her the "air."

We cannot help but admire the manner in which broadcasting does the formerly impossible. "Samples" of opera are distributed to the ticket buying public at first hand, just as if they were containers of nose powder or yard goods.

The Gift Shoppe station will broadcast as a first number the popular refrain: "Yes, We Have No Bandannas."

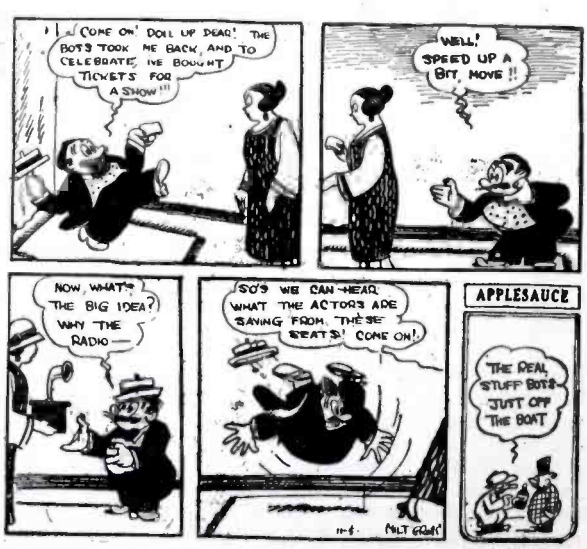
H. V. Neff, a student in the Evergreen School for the Blind, at Baltimore, Md., apologized to WGY for not earlier acknowledging the pleasure he received from the program of the Schenectady station. "Bum spelling was the cause of my not writing sooner," he wrote. "I just learned this morning how to spell the city in which you are located and I don't know now whether or not I am right."

A Schenectady woman, wife of a school teacher, asked WGY to broadcast a request for a flat. She described and specified the number of rooms she desired and the rent it was possible for her to pay and also mentioned the streets she preferred.

Mr. Mason, who is retired, informed WGY that he was camping in the wilds north of Grand Rapids, Mich., and the only interruption to the perfect transmission of WGY was the noise of a bear.

WGY, the General Electric Company broadcasting station at Schenectady, N. Y., indirectly controls the turning on and off of the street lights at Howard Beach, about 25 miles from New York. William L. Welling of that place reports that he depends on WGY for the correct time to switch off the street light in Howard Beach.

N. Y. Evening World



N. Y. Evening World

BROADCASTING STATION DIRECTORY

(Revised to January 15th, 1923)

KAO	Young Men's Christian Association, Denver, Colo.	360
KFI	E. C. Anthony.....Los Angeles, Calif.	469
KFZ	Doerr Mitchell Electric Co.....Spokane, Wash.	283
KGB	Tacoma Daily Ledger.....Tacoma, Wash.	252
KGG	Hallock & Watson Radio Service, Portland, Ore.	360
KGN	Northwestern Radio Mfg. Co.....Portland, Ore.	360
KGU	M. A. Mulrony.....Honolulu, Hawaii	360
KGW	Oregonian Pub. Co.....Portland, Ore.	492
KGY	St. Martins College.....Lacey, Wash.	258
KHJ	Times Mirror Co.....Los Angeles, Calif.	395
KHQ	Louis Wasmer.....Seattle, Wash.	360
KJQ	C. O. Gould.....Stockton, Calif.	360
KJR	Northwest Radio Service Co.....Seattle, Wash.	270
KJS	Bible Institute of Los Angeles, Inc., Los Angeles, Calif.	360
KLN	Monterey Electric Shop.....Monterey, Calif.	261
KLS	Warner Brothers.....Oakland, Calif.	360
KLX	Tribune Publishing Co.....Oakland, Calif.	360
KLZ	Reynolds Radio Co.....Denver, Colo.	360
KMC	Lindsay-Weatherill & Co.....Readley, Calif.	360
KMJ	San Joaquin Light & Power Corp., Fresno, Calif.	273
KMO	Love Electric Co.....Tacoma, Wash.	360
KNT	Grays Harbor Radio Co.....Abeideen, Wash.	263
KNV	Radio Supply Co.....Los Angeles, Calif.	256
KNX	Electric Lighting Supply Co., Los Angeles, Calif.	360
KOB	New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	360
KOP	Detroit Police Dept.....Detroit, Mich.	286
KOQ	Modesto Evening News.....Modesto, Calif.	360
KPO	Hale Bros.....San Francisco, Calif.	423
KQI	University of California.....Berkeley, Calif.	360
KQP	Apple City Radio Club.....Hood River, Ore.	360
KQV	Doubleday-Hill Electric Co.....Pittsburgh, Pa.	360
KQW	Charles D. Herreld.....San Jose, Calif.	360
KRE	Berkeley Daily Guzette.....Berkeley, Calif.	278
KSD	Post-Dispatch.....St. Louis, Mo.	546
KSS	Prest & Dean Radio Rsch. Lab., Long Beach, Calif.	360
KTW	First Presbyterian Church.....Seattle, Wash.	360
KUO	The Examiner Printing Co., San Francisco, Calif.	360
KUS	City Dye Works & Laundry Co., Los Angeles, Calif.	360
KUY	Coast Radio Co.....El Monte, Calif.	256
KWG	Portable Wireless Telephone Co., Stockton, Calif.	360
KWH	Los Angeles Examiner.....Los Angeles, Calif.	360
KXD	Herald Publishing Co.....Modesto, Calif.	252
KYQ	Electric Shop.....Honolulu, T. H.	360
KWY	Westinghouse Elec. & Mfg. Co....Chicago, Ill.	536
KZM	Preston, D. Allen.....Oakland, Calif.	360
KZN	The Desert News.....Salt Lake City, Utah	360
KZW	Wenatchee Battery & Motor Co., Wenatchee, Wash.	360
KDKA	Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.	326
KDPM	Westinghouse Elec. & Mfg. Co., Cleveland, Ohio	270
KDPT	Southern Electric Co.....San Diego, Calif.	244
KDLY	Telegram Publishing Co...Salt Lake City, Utah	360
KDYM	Savoy Theatre.....San Diego, Calif.	252
KDYQ	Oregon Institute of Technology...Portland, Ore.	360
KDYS	The Tribune, Inc.....Great Falls, Mont.	360
KDYW	Smith, Hughes & Co.....Phoenix, Ariz.	360
KDYX	Star Bulletin Publishing Co...Honolulu, T. H.	360
KDZB	Frank E. Siefert.....Bakersfield, Calif.	240
KDZE	Rhodes Company.....Seattle, Wash.	455
KDZF	Automobile Club of So. Calif., Los Angeles, Calif.	275
KDZI	Electric Supply Co.....Wenatchee, Wash.	360
KDZK	Nevada Machinery & Electric Co.....Reno, Nev.	360
KDZQ	Pyle & Nichols.....Denver, Colo.	360
KDZR	Bellingham Publishing Co...Bellingham, Wash.	261
KDZT	Seattle Radio Association.....Seattle, Wash.	360
KDZU	Western Radio Corporation.....Denver, Colo.	360
KDZV	Cope & Conwell Co.....Salt Lake City, Utah	360
KFAD	McArthur Brothers Mercantile Co., Phoenix, Ariz.	360
KFAE	State College of Washington....Pullman, Wash.	360
KFAF	Western Radio Corporation.....Denver, Colo.	360
KFAJ	University of Colorado.....Boulder, Colo.	360
KFAN	Electric Shop.....Moscow, Idaho	360
KFAP	Standard Publishing Co.....Butte, Mont.	360
KFAR	Studio Lighting Service Co.....Hollywood, Calif.	280
KFAT	Dr. J. T. Donohue.....Eugene, Ore.	275
KFAU	Independent School District of Boise City, Boise, Idaho	270
KFAV	Abbot Kinney Company.....Venice, Calif.	258
KFAY	W. J. Virgin.....Medford, Ore.	283
KFAW	The Radio Den, Ashford & White, Santa Anna, Calif.	280
KFBB	F. A. Buttrey & Co.....Havre Mont.	360
KFBC	W. K. Azbill.....San Diego, Calif.	360
KFBE	Reuben H. Horn.....San Luis Obispo, Calif.	360
KFBK	Kimball-Upson Co.....Sacramento, Calif.	283
KFBL	Leese Bros.....Everett, Wash.	224
KFBS	Chronicle News and Gas & Elec. Supply Co., Trinidad, Colo.	360
KFBU	Bishop N. S. Thomas.....Laramie, Wyo.	283
KFCD	Salem Elec. Co.....Salem, Ore.	360
KFCF	Frank A. Moore.....Walla Walla, Wash.	360
KFCH	Electric Service Station.....Billings, Mont.	360
KFCK	Colorado Springs Radio Co., Colorado Springs, Colo.	242
KFCM	Richmond Radio Shop.....Richmond, Calif.	360
KFCP	Ralph W. Flygare.....Ogden, Utah	360
KFCQ	Motor Service Station.....Casper, Wyo.	360
KFCV	Fred Mahaffey, Jr.....Houston, Tex.	360
KFCY	Western Union Co.....LeMars, Iowa	252
KFCZ	Omaha Central High School.....Omaha, Nebr.	258
KFDA	Adler's Music Store.....Baker, Ore.	360
KFDB	Mercantile Trust Co.....San Francisco, Calif.	509
KFDD	St. Michaels Cathedral.....Boise, Idaho	360
KFDF	Wyoming Radio Corp.....Casper, Wyo.	360
KFDH	University of Arizona.....Tucson, Ariz.	360
KFDJ	Oregon Agri. College.....Corvallis, Ore.	360
KFDL	Knight-Campbell Music Co.....Denver, Colo.	360
KFDO	H. E. Cutting.....Bozeman, Mont.	248
KFDR	Bullock's Hardware & Sporting Goods, York, Nebr.	360
KFDU	Nebraska Radio and Electric Co., Lincoln, Nebr.	240
KFDV	Gilbreth & Silnson.....Fayetteville, Ark.	360
KFDX	First Baptist Church.....Shreveport, La.	360
KFDY	South Dakota State College of Agri. & Mech. Arts, Brooklings, S. D.	360
KFDZ	Harry O. Iverson.....Minneapolis, Minn.	231
KFEC	Meier & Frank Co.....Portland, Ore.	360
KFEJ	Guy Greason.....Tacoma, Wash.	360
KFEL	Winner Radio Corporation.....Denver, Colo.	360
KFEP	Radio Equipment Co.....Denver, Colo.	240
KFEQ	J. L. Scroggin.....Oak, Nebr.	360
KFER	Auto Electric Service Co.....Ft. Dodge, Iowa	231
KFEV	Radio Electric Shop.....Douglas, Wyo.	263
KFEX	Augsburg Seminary.....Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining & Const. Co., Kellogg, Idaho	360
KFEZ	American Society of Mech. Engrs., St. Louis, Mo.	360
KFFE	Eastern Oregon Radio Co.....Pendleton, Ore.	360
KFFJ	Jenkins Furniture Co.....Boise, Idaho	360
KFFO	Dr. E. H. Smith.....Hillsboro, Ore.	229
KFFQ	Markschoffel Motor Co.....Colorado Springs, Colo.	360
KFFR	Jim Kirk.....Sparks, Nev.	226
KFFV	Graceland College.....Lamoni, Iowa	360
KFFX	McGraw Co.....Omaha, Nebr.	278
KFFY	Pincus & Murphy, Inc.....Alexandria, La.	275
KFGC	Louisiana State University....Baton Rouge, La.	360
KFGD	Chickasha Radio & Elec. Co...Chickasha, Okla.	248
KFGF	Buchanan Stevens & Co.....Mt. Vernon, Wash.	360
KFGH	Leland Stanford, Jr., Univ..Stanford Univ., Colo.	360
KFGJ	National Guards Co., 138th Inf., St. Louis, Mo.	360
KFGL	Arlington Garage.....Arlington, Ore.	234
KFGQ	Crary Hardware Co.....Boone, Iowa	226
KFGV	Heidbreder Radio Supply Co.....Utica, Nebr.	234
KFGX	First Presbyterian Church.....Orange, Tex.	250
KFGZ	Emmanuel Missionary Co., Berrien Spgs., Mich.	268
KFHA	Western State College of Colorado, Gunnison, Colo.	252
KFHB	The Rialto Theatre.....Hood River, Ore.	280
KFHD	Utz Electric Co.....St. Joseph, Mo.	226
KFHF	Central Christian Church.....Shreveport, La.	266
KFHH	Ambrose A. McCue.....Neah Bay, Wash.	283
KFHJ	Fallon Co.....Santa Barbara, Calif.	360
KFHQ	Curtis Brothers Hardware Store, Los Gatos, Calif.	242
KFHR	Star Elec. and Radio Co.....Seattle, Wash.	270
KFHS	Robert Washington Nelson....Hutchinson, Kans.	239
KFIB	Franklin Jenkens.....St. Louis, Mo.	241
KFIF	Phillip Laskowitz.....Denver, Colo.	224
KFID	Ross Arbuckles Garage.....Iola, Kans.	246
KFIF	Benson Tech. Student Body.....Portland, Ore.	360
KFIK	Gladbrook Electric Co.....Gladbrook, Iowa	234
KFIL	Windisch Elec. Farm Equipment Co., Louisburg, Kans.	234
KFIO	North Central High School.....Spokane, Wash.	252
KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.	224
KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska	226
KFIX	Reorganized Church of Jesus Christ, Latter Day Saints, Independence, Kans.	240
KFIY	Brott Laboratories.....Seattle, Wash.	236
KFIZ	Dally Commonwealth.....Fond du Lac, Wisc.	273
KFJB	Marshall Electric Co., Inc...Marshalltown, Iowa	248
KFJC	Post Intelligencer.....Seattle, Wash.	233
KFJD	Weld County Printing & Pub. Co., Greeley, Colo.	236
KFJF	National Radio Mfg. Co...Oklahoma City, Okla.	252
KFJM	The Sugar Bowl.....Lake Charles, Calif.	273
KFJI	Liberty Theater.....Astoria, Ore.	252
KFJJ	Carrollton Radio Shop.....Carrollton, Mo.	236
KFJM	University of North Dakota, Grand Forks, N. D.	229
KFJR	Ashley C. Dixon & Co.....Stevensville, Mont.	258
KFJV	T. H. Warren.....Dexter, Iowa	224
KFJW	Le Grand Radio Co.....Towanda, Kans.	226
KFJX	Iowa State Teachers College...Cedar Falls, Iowa	246
KFJY	Tunwall Radio Co.....Fort Dodge, Iowa	246
KFJZ	Texas National Guard, 112th Cav., Fort Worth, Texas	254
KFKA	Colorado State Teachers College...Greeley, Colo.	248
KFKB	Brinkley-Jones Hospital Association, Milford, Kans.	286
KFKH	Denver Park Amusement Co.....Lakeside, Colo.	226
KFKQ	Conway Radio Laboratories.....Conway, Ark.	224
KFKV	F. F. Gray.....Butte, Mont.	283
KFKX	Westinghouse Electric Co.....Hastings, Nebr.	286
KFKZ	Nasour Bros. Radio Co...Colorado Springs, Colo.	234
KFLA	Abner Wilson.....Ruston, La.	263
KFLB	Signal Electric Mfg. Co.....Menominee, Mich.	248
KFLD	Paul E. Greenlaw.....Franklinton, La.	234
KFLE	National Educational Service.....Denver, Colo.	268
KFLH	Erickson Radio Co., Inc....Salt Lake City, Utah	261
KFLP	Everett M. Foster.....Cedar Rapids, Iowa	240
KFLQ	Bizzell Radio Shop.....Little Rock, Ark.	261
KFLR	University of New Mexico..Albuquerque, N. M.	254
KFLU	Rio Grande Radio Supply House, San Benito, Tex.	236
KFLV	Rev. A. T. Frykman.....Rockford, Ill.	229
KFLW	Missoula Electric Supply Co....Missoula, Mont.	234
KFLX	George R. Clough.....Galveston, Texas	240
KFLY	Fargo Radio Supply Co.....Fargo, N. D.	231
KFLZ	Atlantic Automobile Co.....Atlantic, Iowa	273
KFMQ	University of Arkansas.....Fayetteville, Ark.	263
KFMR	Morningside College.....Sioux City, Iowa	261
KFMS	Freimuth Department Store.....Duluth, Minn.	275
KFMT	Dr. George W. Young.....Minneapolis, Minn.	231
KFMU	Stevens Brothers.....San Marcos, Texas	360
WBL	T. & H. Radio Co.....Atlanta, Ga.	360
WSB	May & Co.....Newark, N. J.	360
WBR	Pennsylvania State Police.....Butler, Pa.	286
WBT	Southern Radio Corporation...Charlotte, N. C.	360
WBZ	Westinghouse Elec. & Mfg. Co..Springfield, Mass.	337
WCK	Stix-Baer-Fuller.....St. Louis Mo.	360
WCM	University of Texas.....Austin, Texas	360
WCX	Detroit Free Press.....Detroit, Mich.	517
WDM	Church of the Covenant.....Washington, D. C.	360
WDT	Ship Owners Radio Service, Inc., Premier Grand Piano Corporation, New York, N. Y.	405
WDZ	James L. Bush.....Tuscola, Ill.	278
WEB	Benwood Co.....St. Louis, Mo.	360
WEV	Hurlburt-Still Electrical Co.....Houston, Tex.	360
WEW	St. Louis University.....St. Louis, Mo.	261
WFI	Strawbridge & Clothier.....Philadelphia, Pa.	395
WFY	Cosradio Co.....Wichita, Kans.	360
WGI	American Radio and Research Corporation, Medford Hillside, Mass.	360
WGL	Thomas F. J. Howlett.....Philadelphia, Pa.	360
WGR	Federal Tel. & Tel. Co.....Buffalo, N. Y.	319
WGV	Interstate Electric Co.....New Orleans, La.	360
WGY	General Electric Co.....Schenectady, N. Y.	380
WHA	University of Wisconsin.....Madison, Wisc.	360
WHB	Sweeney School Co.....Kansas City, Mo.	411
WHK	The Radiovox Company.....Cleveland, Ohio	360
WHN	Loew's State Theatre....New York City, N. Y.	360
WHX	Iowa Radio Corporation.....Des Moines, Iowa	360
WIK	K. & L. Electric Co.....McKeesport, Pa.	234
WIL	Continental Electric Supply Co., Washington, D. C.	360
WIP	Gimbel Bros.....Philadelphia, Pa.	509
WIZ	Cinco Radio Mfg. Co.....Cincinnati, Ohio	360
WJD	Richard Harris Howe.....Granville, Ohio	229
WJH	White & Boyer Co.....Washington, D. C.	273
WJK	Service Radio Equipment Co.....Toledo, Ohio	360
WJX	DeForest Radio Tel. & Tel. Co., New York, N. Y.	360
WJY	Radio Corp. of America—Aeolian Hall, N. Y. C.	405
WJZ	Radio Corp. of America—Aeolian Hall, N. Y. C.	455
WKA	Landaus Music & Jewelry Co., Wilkes-Barre, Pa.	360
WKY	Oklahoma Radio Shop....Oklahoma City, Okla.	360
WLB	University of Minnesota....Minneapolis, Minn.	360
WLH	Hamilton Mfg. Co.....Indianapolis, Ind.	360
WLW	Crosley Manufacturing Co.....Cincinnati, Ohio	309
WMA	Arrow Radio Laboratories.....Anderson, Ind.	360
WMC	Commercial.....Memphis, Tenn.	500
WMH	Precision Equipment Co.....Cincinnati, Ohio	248
WMU	Doubleday-Hill Elec. Co.....Pittsburgh, Pa.	261
WNJ	Shotten Radio Mfg. Co.....Albany, N. Y.	400
WNO	Wireless Telephone Co. of Hudson County, Jersey City, N. J.	360
WOC	Palmer School of Chiropractic..Davenport, Iowa	484
WOI	Iowa State College.....Ames, Iowa	360
WOK	Arkansas Light & Power Co...Pine Bluff, Iowa	360
WOO	John Wanamaker.....Philadelphia, Pa.	509
WOQ	Western Radio Co.....Kansas City, Mo.	360
WOR	L. Bamberger Co.....Newark, N. J.	405
WOS	Missouri State Marketing Bureau, Jefferson City, Mo.	441
WPA	Fort Worth Record.....Fort Worth, Tex.	360
WPG	Nushawg Poultry Farm....New Lebanon, Ohio	234
WPI	Electric Supply Co.....Clearfield, Pa.	360
WQX	Walter A. Kushl.....Chicago, Ill.	360
WRC	Radio Corporation of America..Washington, D. C.	489
WRK	Doron Brothers Electric Co.....Hamilton, Ohio	360
WRL	Union College.....Schenectady, N. Y.	360
WRM	University of Illinois.....Urbana, Ill.	360
WRR	City of Dallas (Police and Fire Signal Department), Dallas, Tex.	360
WRW	Tarrytown Radio Research Lab., Tarrytown, N. Y.	273
WSB	Atlanta Journal.....Atlanta, Ga.	429
WSL	J. & M. Electric Co.....Utica, N. Y.	273
WSY	Alabama Power Co.....Birmingham, Ala.	360
WSZ	Marshall-Gerken Co.....Toledo, Ohio	360
WTG	Kansas State Agri. College....Manhattan, Kans.	360
WTP	George M. McBride.....Bay City, Mich.	360
WWI	Ford Motor Co.....Dearborn, Mich.	273
WWJ	The Detroit News.....Detroit, Mich.	517
WWL	Loyola University.....New Orleans, La.	280
WAAB	Waldemar Jensen.....New Orleans, La.	268
WAAC	Tulane University.....New Orleans, La.	360
WAAD	Ohio Mechanics Institute.....Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers Journal.....Chicago, Ill.	286
WAAM	L. R. Nelson Co.....Newark, N. J.	263
WAAN	University of Missouri.....Columbia, Mo.	364
WAAQ	New England Motor Sales Co., Greenwich, Conn.	360
WAAS	Georgia Radio Co.....Decatur, Ga.	360
WAAW	Omaha Grain Exchange.....Omaha, Nebr.	360
WAAZ	Hollister-Miller Motor Co.....Emporia, Kans.	360
WABA	Lake Forest College.....Lake Forest, Ill.	266
WABB	Dr. John B. Lawrence.....Harrisburg, Pa.	266
WABC	Pulwider-Grimes Battery Co.....Anderson, Ind.	229
WABD	Parker High School.....Dayton, Ohio	286
WABE	Y. M. C. A.....Washington, D. C.	283
WABG	Arnold Edwards Piano Co.....Jacksonville, Fla.	248
WABH	Lake Shore Tire Co.....Sandusky, Ohio	240
WABI	Bangor Railway and Electric Co....Bangor, Me.	240
WABJ	Radio Laboratories.....South Bend, Ind.	360
WABK	First Baptist Church.....Worcester, Mass.	252
WABL	Connecticut Agri. College.....Storrs, Conn.	283
WABM	F. E. Doherty.....Saginaw, Mich.	254
WABN	Waldo C. Grover.....La Crosse, Wisc.	234
WABO	Lake Avenue Baptist Church....Rochester, N. Y.	252
WABP	Robert F. Welnhig.....Dover, Ohio	266
WABQ	Haverford College Radio Club...Haverford, Pa.	261
WABR	Scott High School.....Toledo, Ohio	270
WABS	Essex Mfg. Co.....Newark, N. J.	244
WABT	Holliday-Hall.....Washington, Pa.	252
WABU	Victor Talking Machine Co.....Camden, N. J.	226
WABV	John H. De Witt, Jr.....Nashville, Tenn.	263
WABW	College of Wooster.....Wooster, Ohio	234
WAIV	Indian Pipe Line Corp.....Princeton, Ind.	360
WBAA	Purdue University.....West Lafayette, Ind.	360
WBAD	Sterling Electric Co. and Journal Printing Co., Minneapolis, Minn.	360
WBAH	The Dayton Co.....Minneapolis, Minn.	417
WBAN	Wireless Phone Corporation.....Paterson, N. J.	244
WBAO	James Millikin University.....Decatur, Ill.	360
WBAP	Wortham-Carter Pub. Co., The Star Telegram, Fort Worth, Tex.	476
WBAV	Erner & Hopkins Co.....Columbus, Ohio	286
WBAW	Marietta College.....Marietta, Ohio	246
WBAX	John H. Stenger, Jr.....Wilkes-Barre, Pa.	360
WBAY	Western Electric Co.....New York, N. Y.	492
WBBA	Newark Radio Laboratory.....Newark, Ohio	240
WBBD	Barbey Battery Service.....Reading, Pa.	224
WCAD	St. Lawrence University.....Canton, N. Y.	280
WCAE	Kaufman & Baer Co.....Pittsburgh, Pa.	462
WCAF	Michigan Limestone & Chemical Co., Rogers, Mich.	360
WCAG	Clyde R. Randall.....New Orleans, La.	268
WCAH	Entrekin Electric Co.....Columbus, Ohio	286
WCAJ	Nebraska Wesleyan University, University Pl., Nebr.	360
WCAK	Alfred P. Daniel.....Houston, Tex.	360
WCAL	St. Olaf College.....Northfield, Minn.	360
WCAM	Villanova College.....Villanova, Pa.	360
WCAO	Sanders & Stayman Co.....Baltimore, Md.	360

WCAP	Chesapeake & Potomac Tel. Co., Washington, D. C.		469
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.	360
WCAS	Dunworthy Industrial Institute,	Minneapolis, Minn.	246
WCAT	South Dakota School of Mines.	Rapid City, S. D.	240
WCAU	Durham & Co.	Philadelphia, Pa.	286
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.	360
WCAX	University of Vermont	Burlington, Vt.	360
WCAY	Kesselman O'Driscoll Music House, Milwaukee, Wisc.		261
WCAZ	Carthage College	Carthage, Ill.	246
WCBA	Charles W. Halmbach	Allentown, Pa.	280
WCBD	Zion Radio Broadcasting Station	Zion, Ill.	345
WDAE	Tampa Daily Times	Tampa, Fla.	360
WDAF	Kansas City Star	Kansas City, Mo.	411
WDAG	Martin J. Laurence	Amarillo, Tex.	263
WDAH	Trinity Methodist Church	El Paso, Texas	268
WDAK	Hartford Courant	Hartford, Conn.	261
WDAL	Florida Times Union	Jacksonville, Fla.	360
WDAM	Weston Electric Co.	New York, N. Y.	360
WDAO	Automotive Electric Co.	Dallas, Tex.	360
WDAP	The Board of Trade	Chicago, Ill.	360
WDAR	Lit Brothers	Philadelphia, Pa.	395
WDAS	Samuel W. Waite	Worcester, Mass.	360
WDAU	Slocum & Kilburn	New Bedford, Mass.	360
WDAX	First National Bank	Centerville, Iowa	268
WDAY	Fargo Radio Service Co.	Fargo, N. D.	244
WDBC	Kirk Johnson & Co., Inc.	Lancaster, Pa.	258
WEAA	Fallain & Lathrop	Flint, Mich.	280
WEAE	Virginia Polytechnic Institute	Blacksburg, Va.	360
WEAF	American Tel. & Tel.	New York, N. Y.	492
WEAH	Wichita Board of Trade	Wichita, Kans.	244
WEAI	Cornell University	Ithaca, N. Y.	286
WEAJ	University of South Dakota	Vermillion, S. D.	283
WEAM	North Plainfield, Borough of Plainfield, North Plainfield, N. J.		252
WEAN	Shepard Co.	Providence, R. I.	273
WEAO	Ohio State University	Columbus, Ohio	360
WEAP	Mobile Radio Co., Inc.	Mobile, Ala.	360
WEAR	Baltimore Am. & News Pub. Co.,	Baltimore, Md.	360
WEAS	Hecht Company	Washington, D. C.	360
WEAU	Davidson Brothers Co.	Sioux City, Iowa	360
WEAY	Will Horwitz, Jr.	Houston, Tex.	360
WEAZ	Donald Redmond	Waterloo, Iowa	360
WFAA	A. H. Belo & Co.	Dallas, Tex.	476
WFAB	Carl C. Woese	Syracuse, N. Y.	234
WFAF	Henry C. Spratley	Poughkeepsie, N. Y.	273
WFAG	Radio Engineering Laboratory,	Waterford, N. Y.	360
WFAH	Electric Supply Co.	Port Arthur, Tex.	236
WFAJ	Hi-Grade Wireless Instrument Co. Asheville, N. C.		360
WFAM	Times Publishing Co.	St. Cloud, Minn.	360
WFAN	Hutchinson Elec. Service Co.	Hutchinson, Minn.	360
WFAQ	Missouri Wesleyan College & Cameron Radio Co., Cameron, Mo.		360
WFAT	New Columbus College	Sioux Falls, S. D.	258
WFAV	University of Nebraska	Lincoln, Nebr.	275
WGAC	Orpheum Radio Stores Co.	Brooklyn, N. Y.	360
WGAD	Spanish Am. Sch. of Telegraphy. Enconada, P. R.		360
WGAJ	W. H. Glass	Shenandoah, Iowa	360
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.		248
WGAN	Cecil E. Lloyd	Pensacola, Fla.	360
WGAQ	W. G. Patterson	Shreveport, La.	360
WGAW	Ernest C. Albright	Altoona, Pa.	261
WGAX	Radio Electric Co., Washington Courthouse,	Ohio	360
WGAY	North Western Radio Co.	Madison, Wisc.	360
WGAZ	South Bend Tribune	South Bend, Ind.	360
WHAA	State University of Iowa	Iowa City, Iowa	283
WHAB	Clark W. Thompson	Galveston, Tex.	360
WHAD	Marquette University	Milwaukee, Wisc.	360
WHAG	University of Cincinnati	Cincinnati, Ohio	222
WHAH	Hafner Supply Co.	Joplin, Mo.	283
WHAK	Roberts Hardware Co.	Clarksburg, West Va.	258
WHAM	Eastman School of Music of Univ. of Rochester, Rochester, N. Y.		283
WHAP	Dewey L. Otta	Decatur, Ill.	360
WHAR	Paramount Radio and Elec. Co., Atlantic City, N. J.		231
WHAS	Courier Journal & Times	Louisville, Ky.	400
WHAV	Wilmington Elec. & Supply Co., Wilmington, Del.		360
WHAX	Huntington Press	Huntington, Ind.	360
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	380
WIAB	Josiyn Automobile Co.	Rochford, Ill.	360
WIAD	Howard R. Miller	Philadelphia, Pa.	254
WIAF	Gustav A. De Cortin	New Orleans, La.	234
WIAH	Continental Radio and Mfg. Co., Inc., Newton, Iowa		258
WIAI	Heers Stores Co.	Springfield, Mo.	252
WIAK	Journal Stockman Co.	Omaha, Nebr.	278
WIAP	J. R. Rudy & Sons	Paducah, Ky.	360
WIAQ	Chronicle Publishing Co.	Marion, Ind.	226
WIAS	Burlington Hawkeye-Home Elec. Co., Burlington, Ia.		360
WIAU	American Sec. & Sav. Bank	Le Mars, Ia.	360
WIAW	New York Radio Laboratories,	Binghamton, N. Y.	360
WIAX	Saginaw Radio & Elec. Co.	Saginaw, Mich.	360
WJAD	Jackson's Radio Eng. Lab.	Waco, Tex.	360
WJAF	Press Pub. Co.	Muncie, Ind.	360
WJAG	Norfolk Daily News	Norfolk, Nebr.	283
WJAJ	Y. M. C. A.	Dayton, Ohio	360
WJAK	Rev. C. L. White	Greentown, Ind.	254
WJAM	P. C. Perham	Cedar Rapids, Iowa	268
WJAN	Peoria Star Co.	Peoria, Ill.	280
WJAR	The Outlet Co.	Providence, R. I.	360
WJAS	Capper Publications	Pittsburgh, Pa.	360
WJAT	Kelly-Vawter Jewelry Co.	Marshall, Mo.	360
WJAU	Union Trust Co.	Cleveland, Ohio	390
WJAZ	Chicago Radio Laboratory	Chicago, Ill.	448
WKAA	H. F. Paar	Cedar Rapids, Iowa	268
WKAD	Charles Looff	East Providence, R. I.	240
WKAF	W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.		360
WKAN	Alabama Radio Mfg. Co.	Montgomery, Ala.	360
WKAP	Dutee Wilcox Flint	Cranston, R. I.	360
WKAQ	Radio Corporation of Porto Rico,	San Juan, P. R.	360
WKAR	Michigan Agri. College	East Lansing, Mich.	280
WKAS	L. E. Lines Music Co.	Springfield, Mo.	360
WKAV	Laconia Radio Club	Laconia, N. H.	254
WKAW	United Battery Service Co.,	Montgomery, Ala.	226
WKAY	Brenau College	Gainesville, Ga.	280
WLAG	Cutting & Washington Radio Corp., Minneapolis, Minn.		417
WLAH	Samuel Woodworth	Syracuse, N. Y.	234
WLAJ	Waco Electrical Supply Co.	Waco, Tex.	360
WLAK	Vermont Farm Mach. Co.	Bellows Falls, Vt.	360
WLAL	Tulsa Radio Co.	Tulsa, Okla.	360
WLAN	Putnam Hardware Co.	Houlton, Me.	283
WLAP	W. V. Jordon	Louisville, Ky.	360
WLAQ	Arthur S. Schilling	Kalamazoo, Mich.	283
WOAR	Henry P. Lundskow	Kenosha, Wis.	229
WLAS	Central Radio Supply Co.	Hutchinson, Kans.	244
WLAT	Radio and Specialty Co.	Burlington, Iowa	360
WLAV	Electric Shop, Inc.	Pensacola, Fla.	254
WLAW	New York Police Dept.	New York, N. Y.	360
WLAX	Greencastle Community Broadcasting Station, Greencastle, Ind.		231
WMAB	Radio Supply Co.	Oklahoma City, Okla.	360
WMAC	J. Edward Page	Cazenovia, N. Y.	261
WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	360
WMAH	General Supply Co.	Lincoln, Nebr.	254
WMAJ	Drovers Telegram Co.	Kansas City, Mo.	275
WMAK	Norton Laboratories	Lockport, N. Y.	360
WMAL	Trenton Hdw. Co.	Trenton, N. J.	250
WMAN	First Baptist Church	Columbus, Ohio	286
WMAP	Utility Battery Service, Inc.	Easton, Ohio	246
WMAQ	Chicago Daily News	Chicago, Ill.	448
WMAV	Alabama Polytechnic Institute	Auburn, Ala.	250
WMAW	Wahpeton Elec. Co.	Wahpeton, N. D.	360
WMAY	Kingshighway Presby. Church	St. Louis, Mo.	280
WMAZ	Mercer University	Macon, Ga.	268
WNAC	Shepard Stores	Boston, Mass.	278
WNAD	Oklahoma Radio Eng. Co.	Norman, Okla.	360
WNAL	R. J. Rockwell	Omaha, Nebr.	242
WNAM	Ideal Apparatus Co.	Evansville, Ind.	360
WNAN	Syracuse Radio Telephone Co.	Syracuse, N. Y.	286
WNAP	Wittenberg College	Springfield, Ohio	360
WNAQ	Charleston Radio Elec. Co.	Charleston, S. C.	360
WNAR	Rhodes, C.	Butler, Mo.	231
WNAS	Texas Radio Corporation and Austin Statesman, Austin, Tex.		360
WNAT	Lenning Bros. Co.	Philadelphia, Pa.	360
WNAV	Peoples Tel. & Tel. Co.	Knoxville, Tenn.	236
WNAW	Henry Kunzmann	Fortress Monroe, Va.	360
WNAX	Dakota Radio Apparatus Co.	Yankton, S. D.	244
WNAY	Ship Owners' Radio Service	Baltimore, Md.	360
WOAA	Dr. Walter Hardy	Ardmore, Okla.	360
WOAC	Maus Radio Co.	Lima, Ohio	266
WOAD	Friday Battery & Elec. Co.	Sigourney, Iowa	360
WOAE	Midland College	Fremont, Nebr.	360
WOAF	Tyler Commercial College	Tyler, Tex.	360
WOAG	Apollo Theatre	Belvidere, Ill.	224
WOAH	Palmetto Radio Corp.	Charleston, S. C.	360
WOAI	Southern Equipment Co.	San Antonio, Texas	385
WOAJ	Ervin's Electrical Co.	Parsons, Kans.	360
WOAK	Wm. Evans Woods	Webster Groves, Mo.	286
WOAN	James D. Vaughn	Lawreneeburg, Tenn.	360
WOAP	Kalamazoo College	Kalamazoo, Mich.	360
WOAT	Boyd Martell Hamp	Wilmington, Del.	360
WOAV	Pennsylvania National Guard	Erie, Pa.	242
WOAW	Woodmen of the World	Omaha, Nebr.	526
WOAX	Franklyn J. Wolff	Trenton, N. J.	240
WPAB	Pennsylvania State College	State College, Pa.	283
WPAC	Donaldson Radio Co.	Okmulgee, Okla.	360
WPAG	Central Radio Co., Inc.	Independence, Mo.	360
WPAH	Wisconsin Dept. of Markets	Waupaca, Wisc.	360
WPAJ	Doolittle Radio Corporation	New Haven, Conn.	268
WPAK	No. Dakota Agricultural College	Fargo, N. D.	360
WPAL	Superior Radio & Telephone Co.	Columbus, Ohio	286
WPAM	Averbach & Guettel	Topeka, Kans.	360
WPAP	Theodore D. Phillips	Winchester, Ky.	360
WPAQ	General Sales & Eng. Co.	Frostburg, Md.	360
WPAS	J. & M. Electric Co.	Amsterdam, N. Y.	360
WPAT	St. Patrick's Cathedral	El Paso, Tex.	360
WPAU	Concordia College	Mooriehead, Minn.	360
WPAY	Bangor Radio Laboratory	Bangor, Me.	360
WPAZ	John R. Koch	Charleston, West Va.	273
WQAA	Horace A. Beale, Jr.	Parkersburg, W. Va.	360
WQAC	E. B. Gish	Amarillo, Tex.	360
WQAD	Whitehall Electric Co.	Waterbury, Conn.	242
WQAE	Moore Radio News Station	Springfield, Vt.	275
WQAF	Sandusky Register	Sandusky, Ohio	240
WQAH	Brock Anderson Elec. Eng. Co.	Lexington, Ky.	254
WQAK	Appel-Higley Electric Co.	Dubuque, Iowa	360
WQAL	Cole County Tel. & Tel. Co.	Mattoon, Ill.	258
WQAM	Electrical Equipment Co.	Miami, Fla.	360
WQAN	Scranton Times	Scranton, Pa.	360
WQAO	Calvary Baptist Church	New York, N. Y.	360
WQAQ	West Texas Radio Co.	Abilene, Tex.	360
WQAS	Prince Walter Co.	Lowell, Mass.	266
WQAT	Radio Equipment Corporation	Richmond, Va.	360
WQAV	Huntington and Guerry, Inc.	Greenville, S. C.	258
WQAW	Catholic University of America, Washington, D. C.		236
WQAX	Radio Equipment Co.	Peoria, Ill.	360
WRAA	Rice Institute	Houston, Tex.	360
WRAD	Taylor Radio Shop	Marion, Kans.	248
WRAF	Radio Club, Inc.	Laporte, Ind.	224
WRAH	Stanley N. Reed	Providence, R. I.	231
WRAL	Northern States Power Co.	St. Croix Falls, Wisc.	248
WRAM	Lombard College	Galesburg, Ill.	244
WRAN	Black-Hawk Electric Co.	Waterloo, Iowa	236
WRAO	Radio Service Co.	St. Louis, Mo.	360
WRAV	Antioch College	Yellow Springs, Ohio	360
WRAW	Horace D. Goodspeed	Reading, Pa.	238
WRAX	Flexon's Garage	Gloucester City, N. J.	268
WRAY	Radio Sales Corporation	Scranton, Pa.	280
WRAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	380
WSAA	B. S. Sprague Elec. Co.	Marietta, Ohio	360
WSAB	Southeast Mo. State College, Cape Girardeau, Mo.		360
WSAC	Clemson Agri. College	Clemson College, S. C.	360
WSAD	J. A. Foster Co.	Providence, R. I.	261
WSAH	A. G. Leonard Jr.	Chicago, Ill.	248
WSAI	U. S. Playing Card Co.	Cincinnati, Ohio	309
WSAJ	Grove City College	Grove City, Pa.	360
WSAL	Franklin Electrical Co.	Brookville, Ind.	246
WSAN	Allentown Radio Club	Allentown, Pa.	229
WSAP	Seventh Day Adventist Church	New York, N. Y.	263
WSAR	Doughty & Welch Elec. Co.	Fall River, Mass.	254
WSAT	Plainview Elec. Co.	Plainview, Tex.	268
WSAW	Curtice & McElwee	Canandaigua, N. Y.	275
WSAX	Chicago Radio Laboratory	Chicago, Ill.	268
WSAY	Irving Austin, Chamber of Commerce, Port Chester, N. Y.		233
WSAZ	Chase Electric Shop.	Pomeroy, Ohio	258
WTAB	Fall River Daily Herald	Fall River, Mass.	248
WTAC	Penn Traffic Co.	Johnstown, Pa.	360
WTAG	Kern Music Co.	Providence, R. I.	258
WTAH	Carmen Ferro	Belvidere, Ill.	236
WTAJ	The Radio Shop	Portland, Me.	236
WTAL	Toledo Radio and Electrical Co.	Toledo, Ohio	252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio	390
WTAP	Ormdorff Radio Shop	Mattoon, Ill.	240
WTAQ	Cambridge Radio & Electric Co.	Cambridge, Ill.	390
WTAR	S. H. Van Gorden & Sons	Osselo, Wisc.	226
WTAS	Reliance Electric Co.	Norfolk, Va.	226
WTAT	Edison Elect. Ill. Co.	Elgin, Ill.	275
WTAU	Ruecy Battery & Elec. Co.	Tecumseh, Nebr.	244
WTAW	Agricultural and Mech. College, College Station, Tex.		254
WTAX	Williams Hardware Co.	Streator, Ill.	231
WTAY	Iodar-Oak Leaves Broadcasting Station, Oak Park, Ill.		226
WTAZ	Thomas J. McGuire	Lambertville, N. J.	283
WWAB	Swern Hoenig & Co.	Trenton, N. J.	226
WWAC	Sanger Brothers	Waco, Tex.	360
WWAD	Wright & Wright, Inc.	Philadelphia, Pa.	360
WWAE	Alamo Dance Hall	Joliet, Ill.	227
WWAF	Galvin Radio Supply Co.	Camden, N. J.	236
WWAH	General Supply Co.	Lincoln, Nebr.	360
WWAO	Michigan College of Mines	Houghton, Mich.	244

Canadian Broadcasting Stations

CKY	Manitoba Telephone System	Winnipeg, Manitoba	
CFAC	Radio Corporation of Calgary, Ltd.	Calgary, Alberta	
CFCA	Star Publishing and Printing Co.	Toronto, Ontario	
CFCB	Marconi Wireless Telegraph of Canada, Ltd., Vancouver, B. C.		
CFCD	Canadian Westinghouse Co., Ltd., Winnipeg, Manitoba		
CFCE	Marconi Wireless Telegraph Co. of Canada, Halifax, Nova Scotia		
CFCF	Marconi Wireless Telegraph Co. of Canada, Ltd., Montreal, Quebec		
CFCH	Abitibi Power and Paper Co., Ltd., Iroquois Falls, Ontario		
CFCI	Motor Products Corporation	Walkerville, Ontario	
CFCN	W. W. Grant Radio, Ltd.	Calgary, Alberta	
CFCX	The London Advertiser	London, Ontario	
CFPC	International Radio Development Co., Fort Frances, Ontario		
CFTC	The Bell Telephone Co. of Canada	Toronto, Ontario	
CFUC	University of Montreal	Montreal, Quebec	
CFVC	Roy Russell Brown	Courtenay, British Columbia	
CFYC	Victor Wentworth Odium	Vancouver, B. C.	
CFZC	Canadian Westinghouse Co., Ltd.	Montreal, Quebec	
CHAC	Radio Engineers, Ltd.	Halifax, Nova Scotia	
CHBC	The Albertan Publishing Co.	Calgary, Alberta	
CHCA	Radio Corporation of Vancouver, Ltd.,	Vancouver, B. C.	
CHCB	Marconi Wireless Telegraph Co. of Canada, Ltd., Toronto, Ontario		
CHCC	Canadian Westinghouse Co., Ltd.	Edmonton, Alberta	
CHCF	Radio Corporation of Winnipeg Ltd., Winnipeg, Manitoba		
CHCQ	The Western Radio Co., Ltd.	Calgary, Alberta	
CHCS	London Radio Shoppe	London, Ontario	
CHCX	B. L. Silver	Montreal, Quebec	
CHCZ	The Globe Printing Co.	Toronto, Ontario	
CHFC	John Millen & Sons, Ltd.	Toronto, Ontario	
CHIC	Canadian Westinghouse Co., Ltd.	Hamilton, Ontario	
CHOC	Canadian Westinghouse Co., Ltd.	Vancouver, B. C.	
CHYC	Metropolitan Motors, Ltd.	Toronto, Ontario	
CHXC	J. R. Booth, Jr.	Ottawa, Quebec	
CHYC	Northern Electric Co.	Montreal, Quebec	
CJBC	Dupuis Frères	Montreal, Quebec	
CJCA	The Edmonton Journal, Ltd.	Edmonton, Alberta	
CJCB	James Gordon Bennett	Nelson, British Columbia	
CJCD	T. Eaton Co., Ltd.	Toronto, Ontario	
CJCE	Vancouver Sun Radiotelephones, Ltd.	Vancouver, B. C.	
CJCF	News Record, Ltd.	Kitchener, Ontario	
CJCG	Manitoba Free Press Co., Ltd.	Winnipeg, Manitoba	
CJCH	The United Farmers of Ontario	Toronto, Ontario	
CJCI	McLean, Holt & Co., Ltd.	St. John, New Brunswick	
CJCN	Simons, Agnew & Co.	Toronto, Ontario	
CJCS	Eastern Telephone and Telegraph Co., Ltd., Halifax, Nova Scotia		
CJCY	Edmund Taylor	Calgary, Alberta	
CJGC	London Free Press Printing Co., Ltd.	London, Ontario	
CJNC	Tribune Newspaper Co., Ltd.	Winnipeg, Manitoba	
CJSC	The Evening Telegram	Toronto, Ontario	
CKAC	La Presse Publishing Co.	Montreal, Quebec	
CKCB	T. Eaton Co., Ltd.	Winnipeg, Manitoba	
CKCD	Vancouver Daily Province	Vancouver, B. C.	
CKCE	Canadian Independent Telephone Co., Ltd., Toronto, Ontario		
CKCK	Leader Publishing Co., Ltd., of Regina, Regina, Saskatchewan		
CKCR	Jones Electric Radio Co.	St. John, New Brunswick	
CKCS	The Bell Telephone Co. of Canada	Montreal, Quebec	
CKCZ	Canadian Westinghouse Co., Ltd.	Toronto, Ontario	
CKKC	Radio Equipment and Supply Co.	Toronto, Ontario	
CKOC	The Wentworth Radio Supply Co.	Hamilton, Ontario	
CKQC	Radio Supply Co. of London	London, Ontario	
CKZC	Salton Radio Engineering Co.	Winnipeg, Manitoba	

AFLOAT AND ASHORE WITH THE OPERATOR

By W. S. Fitzpatrick

THERE are few radio men who could not find cause to be envious of the excellent record, accomplishments and ability of Steffen F. Nielssen, operator on W. K. Vanderbilt's yacht *Ara*.

Nielssen is the highest salaried marine radio operator in the world, and is in charge of a station on the *Ara* that is equal in cost and effectiveness to any afloat, with the exception of two or three of the largest liners carrying three or more operators. Regardless of at what point the yacht is located on her extended cruises, Nielssen is in daily communication with the WCC station at Chatham.

He is an operator of keen ability both in telegraphing and in his knowledge of the theory and operation of sets, whether they be spark, arc or tube transmitters, or any type receiver. His first schooling in radio was under the personal direction of Poulsen, inventor of the Poulsen arc transmitter, during the early development of that set. Since then he has engaged in different phases of radio, and as an operator has held many important assignments, including that of chief on trans-oceanic liners.

Nielssen is a World War veteran, having served in France with the distinguished Pine Tree Division of the United States Army. He is a polished gentleman, with a personality that attracts and holds friends, among whom his studious nature and acquired education is a matter of comment.

Few know, because of his modest demeanor, that before the war he attended one of the prominent universities in Germany, although not a subject of that country. He is thoroughly conversant with several languages, and is an expert at translating.

* * *

DECORATING the greater number of licenses on the Great Lakes, as well as many on the Atlantic and the Pacific, is the large, bold signature of S. W. Edwards, United States Supervisor of Radio at Detroit. Mr. Edwards is as popular among the radio fraternity as his signature is prominent. He is one of the foremost of the Department of Commerce radio experts and one of the chief advisors of Secretary Hoover.

Years ago he was a ship operator along the Atlantic Coast and between New York and South America. This was before the days of licenses, when an expert knowledge of the apparatus was not an essential, and the old-timers remember him as one of the very few operators of that period who actually knew the "why, what and how" of the sets.

Steffen F. Nielssen, operator on W. K. Vanderbilt's palatial yacht, ARA

There were no radio schools or courses anywhere, but Edwards had graduated from an electrical institute and had mastered the code. Unlike others of the time, he came into the fold, not as operator alone, but scientist as well. He was king among his fellows, and this unique position in the radio field he still retains.

Mr. Edwards is married, has several children and resides in a beautiful home in Detroit.

* * *

OPERATOR J. A. McGOVERN recently performed a remarkable feat in maintaining direct communication with the Chatham, Mass., Station WIM, every day of the voyage of the steamer *Eagle* from San Pedro, Calif., to New York, and again in copying messages from New York while at Portland, Ore., using but one amplifier.

WHAT is thought to be the best long-distance receiving stunt on record was that claimed by Erwin W. Vogel in copying a complete program of press from France while his ship was crossing the 180th meridian in the Pacific Ocean, a distance of 12,500 miles, or half-way around the world.

* * *

SPEAKING of DX work brings to mind a little story about an amateur who made the claim of having received over 12,000 miles on a one-tube set. He explained that he had kept a record of all the stations he had heard and their total distance made up that figure.

* * *

HERE'S a story that goes the others one better. Bill Wallace, who holds a responsible position in the RCA traffic department, is a popular man to-day, but in years gone by every one in the business from top to bottom knew "Windy" Wallace and old-timers can remember listening to his spell-binding "Static Room" orations with wondering thoughts of, "How does he get away with it?"

Bill—or, on this occasion, let's say "Windy"—that's what we used to call him, and it carries our story better—was in reality one of the best operators of the time. This none can dispute! And no one ever did any greater long-distance work with a crystal detector than he. Nevertheless, he did earn that nickname, and with an apparent desire to make a record that would last until communication with Mars is established, told this:

It was late one night when he was endeavoring to get in touch with a distant station while on a ship in the Pacific. He had just finished his long call and threw his switch to listen, when, lo and behold! there was his own call coming back to him.

Wallace's only explanation was that the signals must have gone around the world several times, and he happened to catch them on one of their flies past him. Some of the men, however, voiced the opinion that the signals went to a nearby planet and were reflected back. Whatever the case may be, Wallace is a champion.

RADIO NEWS FROM ALL OVER THE WORLD

New French Radio Regulations

FRENCH authorities have issued a set of regulations intended to encourage broadcasting and the use of radio equipment by amateur throughout the country. It is provided that receiving sets may be possessed by any citizen of France who will sign a formal declaration, receivable at any post office, stating the kind of equipment used and agreeing that no part shall be taken in the transmission of private correspondence. Sets in the possession of foreigners, or used to receive private correspondence, require individual authorization.

The right to operate transmitting sets will be regulated by the Under-Secretary of the French Postal Services, on the recommendation of a permanent commission upon which public service groups, manufacturers, and amateurs, will have representation. Transmitting sets are to be classified as those intended for establishing private communication; public broadcasting sets; portable sets; sets used for technical experiments, and amateurs' sets.

Wave length standards and other technical regulations will be set up for each class by public authority. The use of amateur and experimental sets will not involve the payment of any fees. Public broadcasting is made the subject of individual contract.

New Italian Radio Co.

ONE of the latest developments is the formation in Italy of a huge radio manufacturing and operating organization at Rome, similar to the Radio Corporation of America and the Marconi Company in England. The new company is to be known as the "Societa Annonima Italo Radio per Servizi Radioelectrici," and is understood to be a consolidation of two older organizations. The authorized capital is seven million lire, part of which is to be used for the purchase of the Italian rights to German and French patents and for the purchase of existing equipment in Italy.

Previous to the organization of this national body—it is agreed that at least 55 per cent. of the stock must be held by Italian citizens—Italy depended upon England, France and Germany for her international radio service. In view of its large colonial possessions situated at great distances from Rome, the need for a high-powered radio communication service is as great as in any country, except perhaps Great Britain.

Radio Telephone in Brazil

THERE are about 8,800 radio telephone receiving sets operating in the Federal District of Rio de Janeiro, Brazil.

Broadcasting of music and entertainment is taking place regularly from the Government station at Praia Vermelha and the Radio Sociedade do Rio de Janeiro. A line is being put up to connect the former station with the Instituto de Musica to permit the broadcasting of concerts.

Staff Commander, H. C. Fish, of the S.S. "Leviathan," at the radio compass through which the location of the ship may be ascertained even when the fog is so dense that the sun cannot be seen

Few licenses have been issued outside the Federal District. The first radio receiving set to be installed in the interior of Brazil was set up recently by employes of the Araraquara railway. It is located at Araraquara, in the state of São Paulo, but picks up broadcasting from Rio de Janeiro and Buenos Aires.

Radio Progress in Japan

THANKS to the national calamity of September the obstacles to the extension of wireless telephony in Japan have been removed. The promise of the late Premier, Admiral Kato, is being carried out. Radio broadcasting will no longer be a vain expectation among lovers of this latest scientific triumph for the commercial possibilities are at last beginning to be appreciated.

Late in July the late Admiral Kato, then Premier, keenly alive to the possible greatness and variety of radio's services, gave his promise to aid private capitalists to introduce radio broadcasting in spite of the fact that in so doing he had to alter the traditional policy of the Japanese Government in regard to everything of the kind. But some of his colleagues in the Cabinet were not of the same opinion. Private interception of military or diplomatic radio messages was feared. Perfect protection of such official words over the air was sought. Before the earthquake of September it was deemed impossible for the Government to carry out the late Premier's promise.

The services of the radio, installed as experiments, were, however, very great during the dark days of the quake. Wireless telegraphy did its brave and meritorious service to give news of suffering Tokio and Yokohama to the outside world.

The relative advantages of wireless telegraphy and telephony over the old systems of telegraphy and telephony, too, have been fully demonstrated since the dark days of the quake. Immense labor and capital have been spent to restore the damaged telegraph and the telephone systems, but only partial restoration has been accomplished so far. The best part of Tokio and Yokohama will have to do without their telephone facilities at least for a couple of years to come. To the popular mind as well as experts this is a clear demonstration of the disadvantages of the old systems in comparison with the wireless systems of telegraphy and telephony.

The Department of Communications is perfecting the radio broadcast-

ing regulations planned for some time past. The chief of the telephone service in the Department of Communications says that the radio broadcasting regulations have been nearly perfected, but that it will be some time before they are fully matured and put in effect. "If," says the official, "all go off smoothly, they will be promulgated within the present year."

Japan's radio age begins actually, if his statement is correct, in a couple of months and radio lovers and students who have been content with their tiny model installations and experimental operations under strict official supervision will enjoy radio's facilities in its fullness. "Unless full interference preventive measures are adopted before permission of broadcasting is granted, trouble will develop at once to mar all enjoyment or pleasure of radio," says one official. "In my opinion that can only be avoided by placing certain limitations on the hours of broadcasting, specifying technical methods of operation and regulating the character of apparatus to be installed. The new regulations are framed so as to cover all these limitations which are absolutely necessary for the success of radio broadcasting."

As far as radio circles in Tokio, which are eagerly looking forward to the day of free broadcasting in spite of their recent grave calamity, are informed, the Japanese Government will permit broadcasting at first in Tokio and Osaka only. If possible, some adjacent towns may be included in the chartered zones. The hours of day and night will be divided into several sections, each of which will be assigned to the different lines of business such as the stock market, the grain trade, the silk trade or the cotton yarn trade. Some special hours will also be assigned to the Government services and the press.

Wallace Morley directing a mob scene in a big production a quarter of a mile away by radio

Uruguay Takes Up Radio

KEEN interest in radio is developing in Uruguay. There are only five houses dealing in radio apparatus in Montevideo, two of whom have only just begun to handle radio goods to any extent. One of these concerns intends to erect a small broadcasting station, since the only station now broadcasting in Montevideo gives concerts very irregularly, making it necessary for the Uruguayan radio fan to depend very largely upon Buenos Aires.

Train Control by Radio

AUTOMATIC train control by radio will be installed on at least one division of forty-nine first-class roads of the country by 1925, it was announced at the opening session of the fourteenth annual convention of the Association of Railway Electrical Engineers.

Radio holds possibilities of intercommunication between moving trains and fixed points for personal wire or phone service and holds more promise of real value in the future than broadcast reception, it was stated.

A German View on Broadcasting

By Dr. Eng. Carl Schapira

AFTER Marconi, twenty-five years ago, made the first successful experiments on the basis of the experiments by Heinrich Hertz, radio science soon developed into an everyday necessity in the various countries. This development, however, was not accomplished in the same direction by the different countries. In Germany the World War was responsible for directing radio activities into the field of replacing lost cable and telegraph communication facilities by radio telegraphy. America, to the contrary, was in such financial condition as to always satisfy the continuous demands of their people for sport and pastime. The general prosperity in that country very favorably influenced the development of radio art. People living in the interior of the country and far away from the centers of culture and intellectual education naturally were eager to pick up any new means to get in contact with sources of this kind. It was therefore not surprising that within a very short time an enormous amount of broadcast receiving apparatus could be disposed of to the public.

Compared with this what is the situation in Germany?

In the first place, after the war this country was obliged to use radio as a public service on a much greater scale than in any other country of the world.

Radio equipped car used by the Berlin Police Department

It is a well known fact that with the exception of the English cables, we only had at our disposal for direct overseas communication the stations at Nauen and Eilvese, thereby placing the radio oversea route in Germany in a more important position than in any other country in the world. This in turn again made it a foremost duty of the Government to protect the users of this means of communication, more so than in any other country, against misuse by outsiders in copying messages not intended for them. Besides the oversea communication, also the Inter-European traffic routes were extended or replaced by radio communication. The Government-owned station at Koenigswusterhausen, assisted by Nauen and Eilvese, is now taking care of a considerable amount of traffic exchanged with Russia, Spain, Roumania, Italy, England, Esthonia, Bulgaria, Hungary and Jugoslavia. It is to be understood that these routes are equally entitled to the protection as described above. At the expiration of the war, these communication facilities enabled us to immediately reopen exchange of traffic with other European countries, at the same time creating a source of revenue for the Government.

A unique feature of the radio art in Germany is the "Blitzfunk" service. At record speed messages are transmitted by means of the electric waves which would be impossible on our overcrowded wire system, the exten-

sion of which would be out of question on account of the present financial situation in Germany. This service not only accommodates commercial and industrial firms in the transmission of their most important and urgent messages, but at the same time, means a new and considerable revenue for the Government.

Another feature which, however, may not be as well known as the one above, is the multiple telegraphy and telephony by means of radio over one single wire. More than fifty telegraph and telephone lines are being operated without going to the expense of erecting new wire lines. Without interfering with the messages or telephone conversations carried over the lines by continuous current, further messages and conversations are being transmitted, often two and three at a time, along these lines by means of radio.

As was the case in all other uses of radio the use of broadcasting in the first place had to serve as a public utility and as a means in furthering the interests of the Government. Sport and pastime are signs of prosperity. Aside from the American inclination for sports and pastime, we did not have the necessary funds and, last but not least, the Government had to be careful in taking advantage of every means of revenue.

For development of commerce and increase of profits the original broadcast service, called Commercial Broadcast Service was inaugurated.

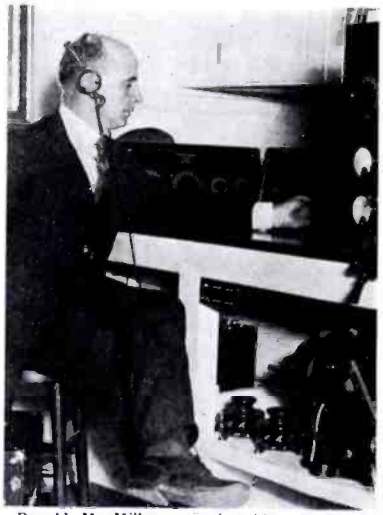
Instead of producing musical entertainments and recitals, the most important commercial news was broadcast immediately upon receipt. This news, however, had to be procured by an organization, which incurred considerable expense. This organization, the "Eildienst G.m.b.H," has numerous representatives in foreign countries. Such a system naturally requires payment of certain tolls and must be protected against misuse by outsiders.

Even an amateur knows that radiotelegraphy does not allow an unlimited use of the air, since each message is transmitted on a certain wavelength. In America only the larger stations reserve a certain number of wavelengths. In Germany, however, a great number of stations are always in operation and the scale of wavelengths extends way down to the small wavelengths used by army, police, aviation and navy stations.

At last, and to the satisfaction of all concerned, it became possible to inaugurate a public broadcasting service to which anybody can subscribe upon payment of a yearly fee of 25 marks. Unfortunately, this service met with objections in the beginning and was misused by certain people to the disadvantage of the public interests.

It was claimed that America does not have any Government control, that no tolls are collected by that Government and that anybody can sell apparatus without considering the production of musical entertainments, nor who pays for same. I am convinced that the reader will agree with me in my opinion of supporting the Government authorities against theft of broadcast matter and by providing the necessary funds for entertainments, concerts, etc.

How can a broadcasting station produce a satisfactory program without being provided with the necessary



Donald MacMillan operating his set aboard the "Bowdoin"

funds? To have one of the large firms—as in America—provide for the concerts free of charge and have the other firms—as in America—be the dodgers is impossible in this country. The apparatus sold in this country is too small for such an enterprise and besides the number of broadcasting stations necessary for more than twelve centers of cultural districts would undoubtedly leave no room for any profit. One only needs to consider the broadcasting situation in England. In that country it was assumed that the same system as in America could be established. Now they are trying, by all means, to obtain more paying members of the broadcasting service.

Medal of Honor to DeForest

THE many honors that have been visited upon Dr. Lee DeForest were signally added to when he was presented with the 1922 Medal of Honor awarded by the Institute of Radio Engineers.

The presentation speech was made by Gen. George O. Squier. The ceremony took place at the Engineering Societies of New York.

Dr. DeForest called his invention the audion after the Latin word "audio," to hear, and the Greek word "ion," meaning wanderer, thus suggesting tiny carriers of the electrical current passing at an enormous speed through the electrodes of the lamp.

The vacuum tube has been deemed by many scientific historians to be the greatest contribution to a great scientific era. It has revolutionized communication; it made possible long distance telephony and is the basis on which the entire art of radio broadcast and reception rests.

A Forecast of Radio for 1924

By DAVID SARNOFF

Vice-President and General Manager of the Radio Corporation of America

RADIO as a "plaything" has given way to radio as a household necessity. The radio public today must be served, not merely amused. With this great increased purpose for radio there naturally comes a corresponding decrease in toleration for some of its temporary shortcomings.

Nineteen-twenty-four, will demand of radio a marble and terra cotta finish for the structure already well founded.

Distribution, on the average, will seek a higher plane and a more stabilized form of operation. The radio dealer will show a greater effort on the whole to build for the future. The industry will grow rapidly during the next few years and the wise dealer will appreciate that in time it will reach a point where new business will flow in a steady stream, to those who measure up by salesmanship and service. The good will and prestige built now will make for permanent customers and a well balanced trade.

Broadcast receivers, will provide greater efficiency, better quality of reproduction, more selectivity, purer amplification and greater sensitiveness. The better grade receivers will eliminate the need for an outdoor antenna and even hide away the loop. Radio sets will be housed by cabinets that are beautiful as pieces of home furniture as well as being completely self-contained receivers.

Broadcast transmission, improving markedly with each passing month will make even greater advances during 1924. This year will undoubtedly take a forward step in the direction of minimizing the interference from the multiplicity of broadcasting stations, spark interference and other sources.

This is a comprehensive schedule of development for radio in 1924. It is being brought about by joint action of the public which expects present deficiencies to be eliminated or improved upon by leading manufacturers whose research, engineering and manufacturing facilities will keep pace with the requirements of this rapidly advancing art and make such improvement possible.

Bergen Station Progressing

APPARATUS for the radio station which is to be built at Bergen, Norway, has been received in that country, according to advices to Washington from Consul George N. Ifft, and preliminary tests have assured the Government of its efficiency. Because of the failure of an appropriation for duplex apparatus which would enable the transmission of messages both ways simultaneously, and the failure of the plan to establish a telephone line between Bergen and the Rundemanden Radio Station, the chief use of the new station will be for the transmission of wireless communications to ships at sea.

Radio Concession in Russia

THE People's Commissioners in Moscow are reported to have granted a radio concession to a French company for the first time. While full particulars are lacking, the concession is for the exploitation of a radio telegraph transmitting and receiving station. According to the agreement, the French company is to build the station for the "Radio Trust" of Moscow, and will assist in running it.

Effects of the Aurora Borealis on Radio and Wire Communication

By G. ARNOLD EDWARD,
Radio Inspector, Canada.

REFERRING to the editorial in the August issue of THE WIRELESS AGE, wherein it was stated that no definite information has ever been available as to whether the Aurora had any effect on radio communication, I would like to mention that during the last season of the Aurora I made a great number of observations in this respect, and found that when it attained any appreciable intensity, whether visible or not, its presence could be detected by very rapid fading as the Aurora waves came over. If the Aurora persisted continuously all evening the effect was as though a blanket of silence had been placed over radio communication.

The effect is more noticeable on long distance continuous wave communication. This, of course, includes phone, as we are 800 miles from WGY, which at the time the observations were made, was our loudest station. To a great extent the signals of the commercial stations, working on 600 meters, were considerably weakened.

I might mention in passing that a part of my regular duties is to make Aurora observations on submarine cables and landlines, noting current and visibility intensities, these observations being eventually used in connection with those of Dr. MacMillan's for research work.

One evening I remember in particular, the Auroral currents reached a pressure of over 300 volts on a 180-mile cable and during this period not a single carrier wave from any radiophone station could be heard, nor could the harmonics from Glace Bay (30KW. CW.) 24 miles away be noticed.

Paul Sellenburger of the Naval Observatory, operator who sends out the time signals twice a day from Arlington. The Naval Observatory is frequently in touch with France and Germany

Some members of Paul Whiteman's Band and the Input apparatus used to broadcast his music from the "Leviathan" at her dock

New Broadcasting Station at Johannesburg

COMPLETION of a large broadcasting station at Johannesburg, South Africa, will be accomplished soon after January 1, 1924. An increasing demand for radio sets is expected to follow.

French Time Re-broadcast in England

STATION 2ZY, Manchester, England, one of the chain of stations maintained by the English Broadcasting Co., now is re-broadcasting time signals from the Eiffel Tower, Paris. A special receiving antenna was installed at 2ZY for the purpose, and a receiver with a powerful amplifier and a loud speaker is used to broadcast the signals. At 11:45 p. m., Greenwich Mean Time, the loud speaker is placed before the microphone of the transmitter, and the time signals from FL thereby re-broadcast on 385 meters. It is calculated that not over 1/500th part of a second is lost in re-transmission.

Radio Sets in Denmark

DENMARK now has officially licensed 3,109 private radio receiving sets. School pupils rank first with 473; commerce, shipping, and industry second with 448; office and store employees have 354; artisans, 341; electrical contractors, 334; and laborers, 324.

Junk This Radio Jargon

Let's Talk for the B.C.L. to Comprehend

By George H. Clark

THERE is nothing more needed in radio today than a large dose of common sense. With the advent of the radio listeners, knowing little of the theory of their new play toy, and therefore credulous in the extreme, has come about an era of more or less deliberate hokum in radio which is doing the art a lot of harm.

The press of today is filled with a

An era of hokum in radio has come about

weird jargon as incorrect as it is weird, that would lead the newcomer to believe that variometers and duolateral coils and honeycombs and spiderwebs are all as different as Ford tractors and Peach Melbas. Radio enthusiasts are led to speak of condensers as 47-plate and 23-plate devices, which is as correct as describing a coin by saying it contains silver, and which is reminiscent of the real old days, when nothing was known about electricity, and when a condenser was described as a "quart jar." Today such loose and in cases incorrect terminology is absolutely indefensible.

Coils should be described in terms of their inductance in millihenries. Condensers should likewise be referred to in terms of their maximum capacity. Further reference to the two devices as variometers, or variable condensers, is permissible. All this has been standard in the radio art for many years. The newcoming jargon is intended definitely to confuse and fool the vast army of radio beginners. There is no defense for this.

Radio in general is simple. The laws that govern its circuits are all well known and there are not many of them. Dr. Austin, the tireless physicist of the Navy Department, has done much to make the fundamentals of radio intelligible to anyone who can read ordinary English, and Professor Pickard, pioneer radio inventor, has done much with his tables which make radio calculation easy. But against these few is the vast army of modern publications which would make it appear that a variocoupler was a piece of apparatus having no feature in common with any other form of inductance. Perhaps the publications have not deliberately aimed at confusing the public, but long contact with the puzzled experimenters who cannot connect up a circuit containing honeycomb coils because their only available diagram shows cylindrical ones has made me clearly see that there must be some conspiracy against the beginner, for no one is trying to lead him out of the obscurity where he is mired.

The magazines are full of freak data concerning antennas. We read of bedspring antennas; of umbrellas as antennas; of winding a few turns of wire around one's waist and going out as one's own tower and aerial. All these freak antennas convey to the beginner the idea that each has peculiar and special merits, whereas the actual facts are, that each may best be described as having its particular defects.

The actual facts are that it is almost impossible not to receive radio signals, if we connect our receiver to any metal object whatever, as long as it is ungrounded. Radio waves are constantly striking our electric light lines, our telephones, the steel structures of our buildings, the Brooklyn Bridge, the "L" structure, the third rail (although no one yet has suggested plugging in on it), every fence wire and metal clothesline in the country; every tree! Some of these are good antennas, some are bad. But the general law that Dr. Austin has pointed out is that the antenna must be well insulated, that it functions better the higher it is, and that for a given wave length it has a certain best length.

What is an antenna? Any insulated conductor which is above ground and which you connect to a receiver. Of course a bedspring is an antenna, and you would get as good results if you ran the lead from your set under the bed and did not connect it at all. Of course the electric light wires are antennas, to some extent. But if a bedspring antenna will give you signals, a wire running from your attic window to some tree a hundred feet away will give you very much better signals! There is no doubt about this. It is clear and well-known.

Of course two nails driven in a tree will pick up signals, but if you forget the partial conductivity of the tree and insulate your lead wire at the nail, using the tree as a tower and the wire as an antenna, your signals will be many times louder. So I leave this message. Any wire or metal object that is insulated will receive radio messages. The best antenna is a single wire, run as high as you can run it, and with a length approximating a hundred and fifty feet overall. Mystery here is replaced by common sense.

When we come to circuits, here is confusion! Many years ago, when only the crystal detector and the electrolytic were known, and when Armstrong was playing ball in the back lot, a book was gotten up entitled, "One hundred circuits." Out of this number, twenty-seven were actually inoperative, for simple reasons such as the telephone short circuited and things like that. The others had all available permutations and combinations written into them, in one case the stopping condenser being on the right of the detector and in the next on the left. There were in all only eight circuits that were at all different. Today, the vast number of circuits that clutter our radio press are merely repeating with Armstrong's aid the mazes of the past.

Professor Pickard has been in radio since radio began. He knows several things that lots or others do not know. One thing he possesses is common sense. He was considering the Armstrong super-regenerative circuit one day, and he noted that coupling between primary and secondary could be

What is an antenna, anyway?

obtained magnetically, capacitatively, by direct coupling, and so on. Likewise the feedback principle could be attained by the ordinary feedback coil, by plate variometers, by the Western Electric two-condenser method, and so on. Lastly, the grid could be biased in different ways. Combining these various degrees of freedom by the ordinary arithmetical laws of combinations, he obtained almost a hundred ways of setting up the Armstrong circuit. More than that, he actually set them up, and found that all were equal-

(*Continued on page 72*)

How to Design Inductance Coils

Constructional Data for Winding Inductance Coils of Known Value

By Samuel C. Miller

A PROBLEM that one is very often confronted with in the construction of a radio set is the design of a coil having definite characteristics. For example, in the case of the tuned grid circuit of a tuned transformer-coupled radio frequency amplifier, a wavelength range of 100 to 500 meters is desired. When using the standard coils purchased on the market, the lowest wavelength that can be obtained is about 200 meters. As there are a number of amateurs who wish to receive on a wavelength as low as 100 meters, a special coil must be designed which will allow the tuning in at the low wavelength desired.

There are two methods of attacking the problem to obtain the required coil. One method is by winding and rewinding one coil after another until the correct number of turns is found which will give the necessary inductance. The other method is to first calculate for the unknown factors and then to build the coil from the results obtained. It is not necessary to say that the second method is the more feasible one, not only because of the time, material and labor saved, but also in the fact that the problem has been solved along engineering lines.

Where it is desired to find a coil which will give a wavelength range of 100 to 500 meters, there is found that a certain amount of material is on hand. This includes a .001 microfarad variable condenser which has a minimum capacity of 35 micro-microfarads and a maximum capacity of 1,000 micro-microfarads (.001 microfarad); a length of two-inch tubing and some No. 22 double silk covered wire. Before the dimensions and number of turns of the coil can be found it is necessary to first find the inductance required which, when used in conjunction with the variable condenser will take in the range of 100 to 500 meters in wavelength.

The simplest formula for wavelength using common units is $\lambda = 59.6\sqrt{LC}$ where λ = wavelength in meters L = inductance in milhenries and C = capacity in micro-microfarads. As both the minimum wavelength and capacity are known, the first step is to solve for the inductance, using as the factors λ and C the lowest wavelength and the capacity at zero setting of the condenser. To solve for L, the above formula is converted into $L = \frac{\lambda^2}{59.6^2 \times C}$ and with λ = 100 meters and C = 35 micro-microfarads $L = \frac{100^2}{59.6^2 \times 35}$ = .08 millihenry. With an inductance of .08 millihenry required to give a wavelength of 100 meters at zero setting of the condenser, then this value of inductance must also be high enough to give a wavelength of 500 meters at the maximum setting of the condenser. Solving for wavelength $\lambda = 59.6\sqrt{LC}$ with L = .08 millihenry and C = 1,000 micro-microfarads, then $\lambda = 59.6\sqrt{.08 \times 1{,}000}$ = 523 meters. This is a little higher than that desired, but is satisfactory for practical needs. A coil must therefore be designed which will have an inductance of .08 millihenry.

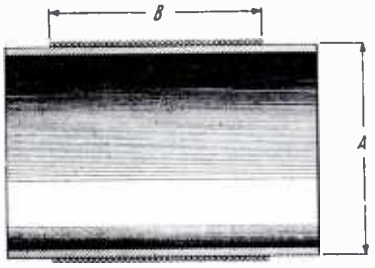


Figure 1

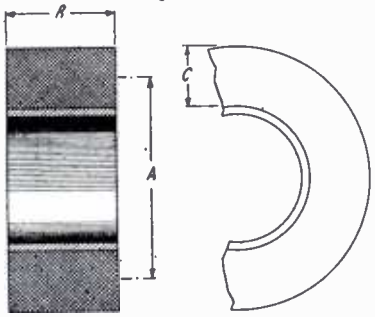


Figure 2

Single and multi-layer coil design

The inductance of a coil depends upon a number of factors and for accurate solution it used to be quite a tedious affair to calculate such a problem until Professor Hazeltine presented his empirical formula. This formula is both accurate and simple to handle as it uses common units for its factors. Professor Hazeltine's formula for inductance is $L = \frac{.0002\ A^2\ N^2}{3A + 9B + 10C}$ where L = inductance in millihenries; N = number of turns; A = mean diameter in inches (see figures 1 and 2); B = axial width of winding in inches and C = radial depth of winding in inches. In a single layer coil as in figure 1 C is so small a factor that it can be entirely neglected; whereas in a multi layer coil as in figure 2 C becomes an important factor and must be taken in consideration for accurate results.

Continuing with the example, the material on hand is a length of two-inch tubing and some No. 22 double silk covered wire. Referring to the formula $L = \frac{.0002\ N^2\ A^2}{3A + 9B}$ (C is neglected as this is going to be a single layer coil) there are three factors known; L = .08 millihenry, A = 2 inches and the size of wire which is No. 22 double silk covered. This leaves the factors N and B unknown and to be found.

The best method of attack with these two factors unknown, is to pick at random a value of N which also gives B as the size of the wire to be used. This will give all factors needed to solve the problem and by using the formula, a value of L is obtained which may be lower or higher than the desired inductance. After two or three tries the correct number of turns can be obtained, which will give the desired inductance.

In the example, 32 turns is taken at random for N. In order to get B or axial width of winding, it is necessary to refer to Table II. Alongside of No. 22 B. & S. gauge wire and below double silk, it is found that 32 turns per inch is obtained when using this kind of wire. Solving $L = \frac{.0002\ A^2\ N^2}{3A + 9B}$ with A = 2 inches, B = 1 inch and N = 32 turns then

$$L = \frac{.0002 \times 2^2 \times 32^2}{(3 \times 2) + (9 \times 1)} = \frac{.818}{15} =$$

.055 millihenry. As the desired inductance is .08 millihenry, the value of N = 32 turns taken at random is too small and must be increased. This time with N = 44 turns and B = 1⅜ or 1.375 inches.

$$L = \frac{.0002 \times 2^2 \times 44^2}{(3 \times 2) + (9 \times 1.375)} = \frac{1.54}{18.3}$$

TABLE I

Turns per 1"	20	24	28	32	36	40	45	50	55	60	65	70	75	80	90	100	110	120	130	150	Diam. of Core
	5	6	7	8	9	10	11	12	14	15	16	18	19	20	22	25	27	30	32	38	1 "
	7	8	9	10	12	13	15	17	18	20	22	23	25	27	30	33	37	40	43	50	1¼"
	8	9	11	12	14	16	18	20	22	24	26	28	30	32	36	40	44	48	52	64	1½"
	9	11	13	15	17	18	21	23	25	27	29	31	33	36	41	46	50	55	60	69	1¾"
Feet	11	13	15	17	19	21	24	26	29	31	34	37	39	42	47	52	59	63	68	79	2 "
of Wire	13	16	19	21	24	27	30	33	37	40	43	47	50	53	60	67	73	80	87	100	2½"
per	16	19	22	25	28	31	35	39	43	47	51	55	59	63	71	79	86	94	102		3 "
Linear	19	22	26	29	33	37	41	46	50	55	59	64	69	73	82	92	101	110			3½"
Inch	21	25	29	33	38	42	47	52	57	63	68	73	79	84	94	105	115				4 "
	27	32	37	43	48	53	60	66	73	80	87	93	100	107	120						5 "
	31	38	44	50	56	63	71	79	86	94	102	110	118	126							6 "
	37	44	51	59	66	73	83	92	101	110	119	128	138								7 "
	43	51	60	69	77	86	96	107	118	129	139	150									8 "
	47	56	66	75	85	94	103	118	129	141	153										9 "
	52	63	73	84	94	105	118	131	143	157											10 "

= .084 millihenry. This value is close enough for practical purposes to the desired value of .080 millihenry.

Having obtained all the factors necessary for making the required coil, the number of feet of wire used can also be found by referring to Table I. Reading across the top "Turns per 1 inch," the number 45 is obtained, which is only one more turn than the actual number required. In the right hand column under "Diameter of Core," 2 inches is found to be the tube diameter to be used. On intersecting 45 turns and 2 inches, 24 feet is directly obtained.

In conclusion, the results of the above example show that an inductance of .08 millihenry combined with a .001 microfarad variable condenser will give a wavelength range of 100 to 500 meters. And that a coil two inches in diameter wound with a single layer of No. 22 double silk covered wire will give the required indudtance of .08 millihenry. Also the required length of wire for winding the above coil is 24 feet.

In the same manner in which the above example has been solved, other problems can be dealt with either for single or multi-layer coils when using the formula and tables herewith given.

TABLE II

Size B. & S. Gauge	Turns per Linear Inch Enameled	Single Cotton	Double Cotton	Single Silk	Double Silk
20	29	25	23	27	26
21	32	28	26	31	29
22	36	31	28	34	32
23	41	34	31	38	36
24	45	37	33	42	39
25	51	41	36	47	43
26	56	45	39	52	46
27	64	49	42	57	52
28	71	54	45	63	56
29	79	58	48	70	62
30	88	64	56	77	67
31	100	69	57	85	72
32	112	75	60	93	78
33	134	81	64	102	84
34	140	87	68	112	91
35	156	94	73	120	97
36	173	101	78	130	104
37	201	108	84	141	110
38	225	115	89	151	117
39	256	122	95	163	123
40	288	130	102	178	129

KGO on the Pacific Coast

(Continued from page 23)

comprises and includes all the best that has been developed at WGY on the Atlantic coast after months of careful study. Located on a wide expanse of free land in the outskirts of Oakland, directly across the sea-filled crater of San Francisco Bay from the city which is the key to the Orient, it has an ideal location.

The new station is rated as a 1,000-watt unit, with duplicate transmitters, so that one may be utilized as an emergency set in case of need. All of the equipment is "special stuff" in the words of the constructing engineers, who include California staff men as well as supervising engineers from the main plant of the company at Schenectady, N. Y.

The studio building, located on a main artery of traffic which links with the famous Lincoln Highway, the national pathway to San Franciso, is one thousand feet away from the operating room and transmitting point. All construction is steel and concrete. The studio itself is a two-story concrete, gray-appearing artistic little affair, surrounded by lawns which remain green the year around and flower borders that blossom twelve months in the year.

In this building is housed the storage battery units, an office and reception room, with a main and auxiliary control room, an artists' waiting room, and other accessory accommodations. The second floor is devoted in the main to the studio itself with its microphonic and amplifier connections to the operating room and the official "listening room" in which necessary outside reception is accomplished.

At the far end of the acreage devoted to this extensive plant—1,000 feet distant, has been erected the giant transmitting masts, the power house and generator equipment, the control and switching panels that handle the powerful transmitting circuits.

The equipment here is General Electric throughout. Huge pliotron tubes—oscillators, modulators and amplifiers, 2,000-volt generators for the amplifier circuits, the distribution panels, the huge rectifiers—all are based on concrete and designed with a view of permanent operation. Two complete equipments have been installed in this building, one at each end of the operating room. In addition there is the usual 600-meter C.W. outfit for ship communication in answering distress and other signals.

The technical equipment includes a dummy antenna for testing, and a multiple tuned antenna, the latter being tuned both inside and outside the operating room to obtain maximum efficiency. Two operators will be constantly on duty at the operating room and two at the control room in the studio building, with other assistants whose duties will include the social phases of the entertainment work.

CLANG! The iron-barred door was closed; the long steel bar was shot home; the key was turned in the lock; the swiftly retreating footsteps of the Guard gave notice that he was on his way to report to the Warden that Number 186 was safely locked in his cell for the night. The Warden believed the report of the Guard but the Guard was mistaken! Number 186 was not in his cell! He was a thousand miles from the New Hampshire State Prison! He was in Chicago listening to the orchestra of the Drake Hotel! A few minutes later he was in Davenport, Iowa, "Where the West Begins!" Another moment and he was in a foreign country, Cuba! Then he made a swift trip to Pittsburgh where he heard Lloyd George! He dropped in at the White House and heard a few words by President Coolidge! He went to Schenectady and enjoyed the drama, "Shavings!" He enjoyed the music furnished by the band of the Canadian Royal Highlanders at Montreal!

In the morning, the Night Watchman, at the end of his tedious round, reported to the Warden that Number 186 had remained safely locked in his cell for the entire night!

In the March number of THE WIRELESS AGE Number 186, a "lifer," will tell you what radio has done and can do for the unfortunates in our prisons.

Jack Barnsley has become a familiar name in the Radio World, and a romantic interest attaches to the story of the young amateur wireless operator whose receiving set brought to his ears the call of MacMillan's Arctic Party, far north of Labrador, who were trying to reach with their own radio waves some waiting and listening station back in the temperate clime. In the March number of THE WIRELESS AGE Jack Barnsley tells how he caught that radio wave, and how by devoted attention to his little station he continued to serve as the link connecting the MacMillan party with their home-land. This story, ingenuously and modestly told by its principal character especially for THE WIRELESS AGE will transport the reader into this British Columbian Station to listen keenly through the long midnight watches with its young owner for those thrilling messages from the land of ice and long darkness.

The Wireless Age Reflex

Loudspeaker Volume With One Tube

By John R. Meagher

Author of "How to Make a One-Tube Reflex Set That's a Knock-Out"

NOTE—Certain patent owners permit amateurs to make up their own radio devices for their own use and not for sale. Relying on this policy this article gives suggestions to aid amateurs in their experimentation, but no license under patents is to be inferred from the publication of these suggestions. The license rights exist only through the generosity of the patent owners and if any owner should object, the amateur should refrain from using the particular invention involved.

REFLEXING, it is interesting to note, although nearly as old as the vacuum tube itself, has only recently been applied with any degree of success to receivers of amateur construction. For the dual use of tubes never proved popular with the old-time amateur as there was no method of obtaining good radio frequency amplification at 200 meters; and commercial engineers were not interested in it as to them the slight additional cost of a straight cascade amplifier was of no importance. Therefore both interest and experimentation lagged.

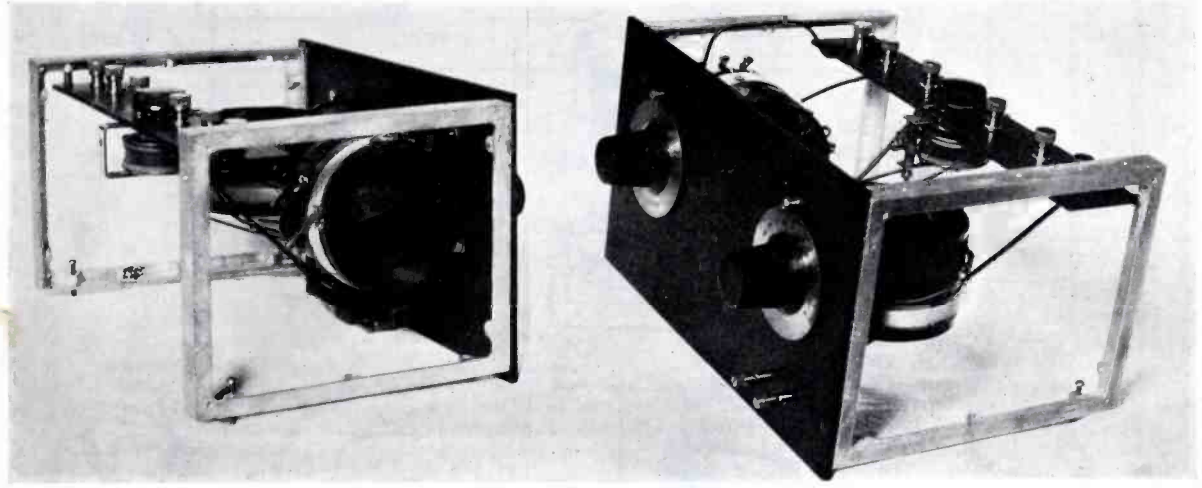
But a year or so ago when "broadcasting" fans first heard about reflexing and the claims that with it, it was possible to secure the result of two tubes with only one; four tubes with two and six tubes with only three, they fell over themselves in a mad rush to make reflexes.

Now at that time there were, unfortunately, only untuned transformers available for inter-tube coupling at radio frequencies and these while suitable for use with vacuum tubes, proved not quite so good in single tube reflexes where a crystal "detector" was shunted across the secondary. For that reason and through careless design of multi-tube reflexes, the majority of reflex receivers failed to "reflect" properly. Therefore after this sudden boom and rather disheartening crash, the market in amateur made reflexes dropped and on the whole they were thereafter viewed as a sort of "interesting, if true—but not for me" subject.

* * * * *

About a year ago we did a great deal of experimental work on tuned radio frequency amplification and reflexing. And when we say a "great deal" we mean just that: Three solid months of work from about four o'clock in the afternoon to four o'clock in the morning gave us a pretty good idea of the relative merits of all types of radio frequency amplifiers and the limitations of reflexing.

One of the receivers we worked out was a two-stage radio frequency amplifier, without potentiometer or balancing controls, that did not oscillate! But that was not so great an accomplishment as the plate inductance had only 8 turns and any—get that—ANY—radio frequency amplifier for broadcasting wavelengths with so few turns in the plate circuit cannot possibly amplify as much as one in which the plate circuit is either tuned or else has an inductance whose impedance is greatest in the center of the wavelength band and the design of which is such as to make it broad or aperiodic over that range. (To digress a moment: Who started the generally accepted definition of aperiodic as a "winding whose natural frequency is lower than the lower end of the range?" And who started the bunk about a step-up ratio and its benefits, and then so conveniently neglected to mention the extremely low voltage drop across the alleged "aperiodic" primary? And who started that stuff about the secondary tuning the primary? If that person will step up we sure would like to hold a few moments conversation with him).



Front and back views of The Wireless Age Reflex Receiver

In experimenting we found that substituting a tuned transformer for the untuned one in a single-tube reflex made a vast difference—indeed an amount that can hardly be appreciated.

Further, we found, by keeping the inductance coupling between plate and grid circuits as low as possible that a real plate inductance could be used. At first, in carefully shielded sets, we used as many as 60 turns on the primary of the plate-detector transformer and with a UV-201-A tube, found no difficulty in keeping the tube from oscillating.

However, in receivers of less elaborate design it was found well to reduce the number of turns on the plate coil in order to minimize the possibility of self-oscillation. (The receiver to be described has only 20 turns.)

* * *

It is then these experiments that

for the background for "THE WIRELESS AGE Reflex," a simple, easy-to-make, inexpensive one-tube set that will generally operate a loud speaker 30 miles from a good station. It is a set with which a transmitter almost 900 miles distant has actually been heard on a loud speaker with a similar set, a station in California has been received in New Jersey!

THE CIRCUIT

Figure 1 is a pictorial representation of the exact circuit. The antenna inductance is untuned and consists of a coil placed in close inductive relation to the grid inductance—which is a variometer. The plate winding is a coil placed in close inductive relation to the crystal tuning element, also a variometer.

Thus it will be seen that two radio frequency transformers are used, each being composed of a variometer as the secondary and a small coil wound on or near the variometer as a primary! That is, the transformers, instead of being tuned with condensers across the secondaries are variometer tuned.

The action of the reflex circuit is generally well known, but briefly described the incoming radio frequency impulses are transferred to the grid circuit from the antenna; they are amplified by the tube at the original radio frequency, then transferred to the crystal rectifying circuit, where, after being rectified, they are retransferred to the grid circuit of the tube and amplified at audio frequency by the "step-up" amplication of the audio-frequency transformer and by the amplifying action of the tube—finally being made audible in the headset or "speaker" connected in the plate circuit.

The effect of tuning the secondaries to the frequency of the energy present in the primaries is to increase the resistance of the primary circuits to some extent. This increased resistance tends to prevent self oscillation of the tube. This is the method used in Austin's "sensitizing circuit" described in E. E. Bucher's "Practical Wireless Telegraphy" and reappearing in identical form in the "four circuit tuner." Unfortunately, in our reflex, we cannot take full advantage of this increased resistance effect in the control of self-oscillations as our tuned secondary is coupled to the plate and not the grid circuit and the effect of increased resistance in the plate circuit is not as great as the same increase in the grid circuit. However, we hope to develop something good along this line in the not too distant future.

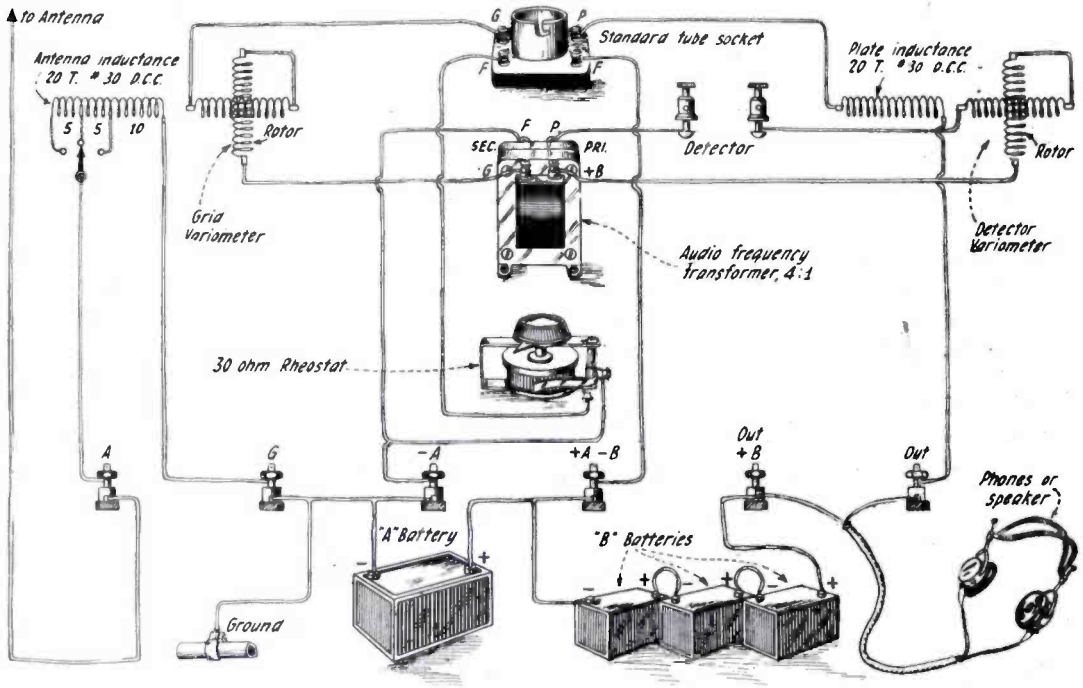


Figure 1—Pictorial circuit diagram of The Wireless Age Reflex Receiver

CONSTRUCTION

First arrange the coils on the variometers; on these pictured a strip of paper was wound over one side of the stator winding and the primary coil wound on top of the paper. The antenna coil has 20 turns tapped at 10, 15 and 20 for long, medium and short aerials, respectively. The plate coil has 20 turns and is not tapped. The wire is No. 30 double cotton covered and the ends are secured in small "anchor holes" drilled in the stator form. The direction of winding is the same as the stator coil and the connections to the coil should be similar to those shown in the diagram.

The front and terminal panel should be drilled in accordance with the panel layouts; making changes, however, for other apparatus.

We would suggest that the panels be grained on both sides as a dull black satin is neater in appearance than a shiny black which shows up every finger mark.

Mount the variometer transformers and the tube socket on the front panel and the rheostat and binding post on the terminal strip. Arrange both on two Quinby "radio" aluminum frames as shown in the illustrations.

Then wire the parts according to the diagram, using No. 18 wire run in cambric tubing.

ANOTHER ARRANGEMENT

If the antenna is short and has a low value of capacity to ground, the antenna inductance may be eliminated and a fixed condenser of .00025 mfd. capacity connected between the antenna post and the grid of the vacuum tube. Results are usually better with this arrangement.

Mr. R. W. Weeks, radio editor of the *Arizona Gazette*, a paper in which we ran a description of a somewhat similar receiver, writes that by con-

necting one side of the detector circuit to ground he obtained a considerable increase in signal strength. He notes, however, that on a few of the receivers this connection increased the tendency toward self oscillation. This checks up with our own experiments and we believe it is usually best to neglect this connection. However, it is such a simple matter to connect a wire from the ground to either terminal of the detector variometer that everyone should try it.

THE CRYSTAL RECTIFIER

It is quite necessary that the crystal stand and mineral be of such design that there is no need for tedious search of a "sensitive" spot, and that once made, an adjustment will stay put for some time. In this connection the synthetic crystals are most satisfactory; being "sensitive" all over and capable of handling a good deal of current—an important point in a reflex receiver.

Personally we always got along well with good Galena and a sharp contact; a fist full of the mineral cost us only 15 cents in the old days and we found numerous good pieces in it. We usually mounted the stand firmly on a solid wall and ran two short separated leads to the receiver. Once set, jars to the table or instrument did not affect the mineral adjustment. Such an idea could well be used with "THE WIRELESS AGE Reflex" and in conjunction with a good synthetic crystal it is doubtful if anyone would have trouble with this part.

OPERATION

With the receiver finished, connect the "A" battery to its terminals on the binding post strip and place a UV-201-A or other vacuum tube in the socket. Turn the rheostat around until the tube filament glows or lights at its usual brilliancy.

Connect the "B" battery, the phones, the antenna, the ground and last, but by no means least, the crystal "detector" to their respective binding posts. Do not forget to connect the ground to the negative filament.

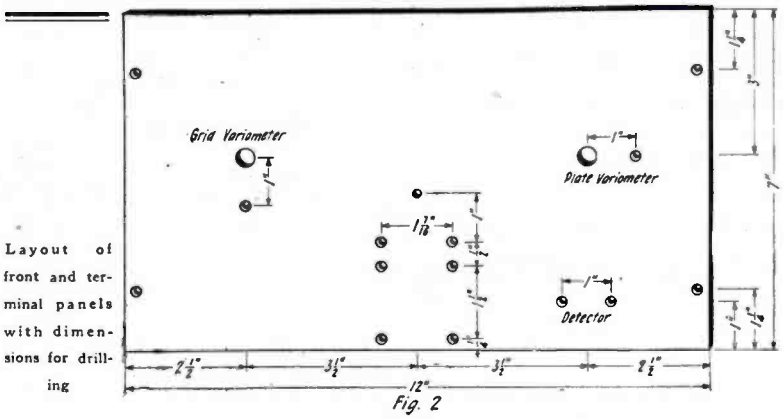
Be reasonably sure that some local station is on the air at the trial and no trouble will be had in turning the two dials to the best points and adjusting the crystal contact for best results.

After a few stations have been tuned in the dials should be adjusted; for instance, if a short wave station is heard with the left hand dial at 20° and the right hand dial at 160°, the latter should be loosened and turned on its shaft until the indicator is in line with the 20° mark.

The dial readings may be recorded so other members of the family will have no bother in hunting for local or DX stations.

* * * * *

Next month we will give instructions on how to build this receiver over into a three-tube set; having one stage of tuned radio frequency amplification, a vacuum tube detector; one stage of reflex audio frequency amplification and one stage of straight audio frequency amplification—a really excellent long distance receiver.



Layout of front and terminal panels with dimensions for drilling

Fig. 2

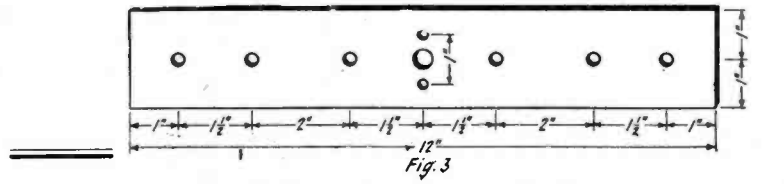


Fig. 3

MATERIAL

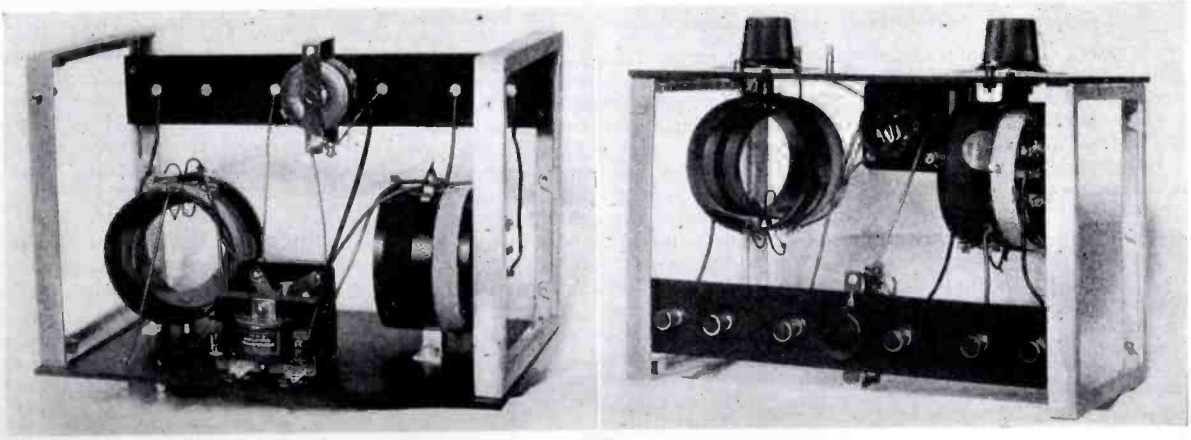
Although the trade names of the parts used in this set are quoted here, one should feel perfectly free to select other makes; especially if it is definitely known that such makes are of good quality.

Two variometers; those shown (Shamrock) are mechanically a trifle weak and the wavelength variation is not as great as can be secured with variometers of the "cup and ball" type in which the windings are close together.

Two 180° dials to fit the shafts of the variometers. (Sleeper.)

One audio frequency amplifying transformer. (General Radio.) This should be of low ratio for no other reason than the reproduction is better. The new Radio Corporation UV-712 (low ratio) will prove satisfactory.

(*Continued on page* 72)



Top and bottom views of the assembled reflex receiver

Workshop & Laboratory

A Regenerative Receiver

Made With the Parts Used in "A Crystal Receiver" Described in "The Wireless Age" for January

Cost: About $20 Range: From 100 to 1,000 miles

BY adding a dry cell vacuum tube to the crystal receiver described in the January WIRELESS AGE the range of reception may be considerably increased and even though the apparatus appears crude it is possible to obtain splendid results through careful handling of the sliders; this combination of single circuit and regeneration makes for good volume and excellent sensitivity.

The material should be gathered together and then carefully arranged on a board with the parts placed in much the same position as they appear in the sketch. It will then be a very simple matter to follow out the circuit in making connections.

In wiring use No. 18 hard drawn copper wire insulated with cambric tubing—or "spaghetti"—as it is more usually termed. Make the filament circuit first. This consists of the rheostat, the two binding posts to which the dry cell is connected and the two terminals marked "F" on the tube socket.

Make the connections exactly as shown and either clamp the wire in the terminals or better still, solder the joints.

Do the plate circuit next. Starting from the terminal marked "P" on the tube socket bring a wire to the first binding post. Connect the two center binding posts together and wire the fourth binding post to one of the slider rods. Connect a ('phone) condenser across the first and fourth binding posts. Connect the other slider rod to the positive dry cell binding post and connect this same post to the ground binding post.

The only remaining part is the antenna-grid circuit. Connect the antenna binding post to one side of the fixed antenna condenser. Connect the other side of this condenser to the beginning of the wire on the tuning coil and also to one side of the grid condenser. The other side of the grid condenser is connected to the terminal marked "G" on the tube socket.

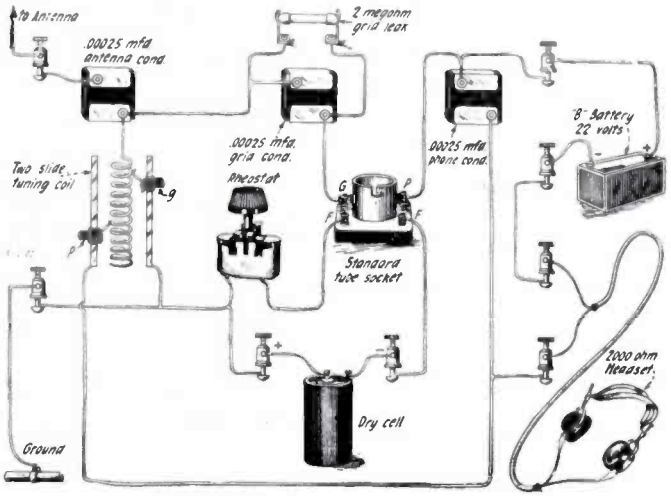
Finally, the grid leak mounting is connected across the grid condenser.

Now place the vacuum tube in the socket. It will be found that a short pin in the tube base just fits into a slot in the socket shell. Make certain that the socket springs are bent upward so they press firmly upon the four small pins set in the porcelain base of the WD-12 tube.

To receive, having connected the antenna and ground, turn the rheostat knob in a clockwise direction till the filament of the tube glows dull red. Move the plate (p) slider to the lower end of the inductance and slowly move the ground (g) slider along the rod until the carrier wave of a transmitter is picked up; leave the slider there and promptly move the (p) slider toward the position of the (g) slider; a point will be found at which the whistling ceases and the "broadcasting" may be heard. Again vary the (g) slider a turn or so for best results.

Then adjust the rheostat to a point where the filament is as dull as possible consistent with good signal strength.

After a time one should become adept at picking up stations without allowing the receiver to oscillate as it is when the "carrier wave" can be heard.



Pictorial hook-up of the regenerative receiver

MATERIAL

1—Two-slide tuning coil.
3—.00025 mfd. fixed condensers.
1—Standard tube socket.
1—Rheostat
1—Two-megohm grid leak and mounting.
8—Binding posts.

ACCESSORIES

1—WD-12 vacuum tube.
1—Pair 2,000-ohm 'phones (headset).
1—Plate "B" battery, 22.5 volts.
1—Filament "A" battery, 1.5 volts (dry cell).

"Why I Became a Radio Fan"

(*Continued from page 18*)

Brighton, of Norwood, Pa., who got her first thrill from WOO over a home-made crystal set. She concludes her letter with the significant words:

> "To any one confined in the home radio is a godsend. I think it helps one to cope with everyday problems better and also gives music-lovers a great treat."

Dr. Sidney L. Rubens, of Chicago, won the Fifth Prize by telling how radio assisted him in his dental work.

Space cannot be devoted here to citing all the various incidents and accidents that have brought our readers into the field of fans. They include the determination not to be stumped by a strange, queer-looking diagram and an unfamiliar branch of technical experiment, as well as the yearning to solace and brighten the hours of a loved invalid. Some of the best of our replies could not be considered for this contest because they far exceeded the number of words allowed. One of them came from a business man who felt the need for a hobby that would give him diversion and at the same time the companionship of his family, especially the boys. One most appealing response came from a "shut-in" in Providence, R. I. "Without radio my world was within the four walls of my room," he writes; "now Aladdin and his Lamp have nothing on me and my Radio." Others speak of the thrill of getting distant stations and of getting louder and clearer reception of the programs of local broadcasters.

FELIX AND HIS FAMILY FONES

And now, to bring this survey of Radio Fans to a fitting close, you are herewith introduced to Felix and his family. Here, it is believed, is exemplified to a notable degree one of the greatest of the virtues of radio: its perfect adaptability to the home, and its tendency, in this day of many outside distractions and attractions, to perpetuate and strengthen our home and family life.

Felix Cadou is manager of the Liberal Light, Ice & Power Co., Liberal, Kans., and is a radio fan who believes in headphones and in the entire family sharing them. So he designed and constructed a special stand to hold the four pairs of phones that are used when he and mother and brother and sister listen in at the same time, as they frequently do. The stand is connected with the receiving set by means of a long flexible cable, so that it can be moved anywhere in the room. In its base is a switch that governs the phone circuit, so that one, two, three or all four headsets may be connected or disconnected, as desired. "Felix" means "happy," and comes from the same Latin word that "felicitations" does, and so when friends felicitate Mr. Cadou on his ingenuity and skill in arranging this stand, their appreciations are doubly earned. He thinks that a loop antenna is to be preferred in selecting one among several conflicting broadcasters, and likes the headphone because it brings to the ears all the delicacy of the fine tones that are broadcast. "We think we get best results with a loop, headphones, and my stand that takes all the inconvenience out of having the receivers on your ears," he says.

IWAJ Broadcasting

(*Continued from page 29*)

"I confess I am getting a little flustered," Harmstrong put in, edging forward.

"They have agreed to the proposition which I have advanced," Russell announced. "And they thought that you would, too."

"What are you going to do, get jobs from all of us?"

"No, sir, but a job from all of you."

"And they engaged you?"

"They did."

"And said I would, too?"

"Yes, Mr. Harmstrong."

"Hum. Well, what's this job of yours?"

By this time the banker was betraying a high degree of interest. His secretary entered the room and was signaled not to interrupt.

"This is the situation in a nutshell, sir," Russell asserted earnestly. "I do not want a job—in the accepted sense of the term. *What I want is—your backing for my hospital for children.*"

Harmstrong was silent.

"You see, Mr. Harmstrong," Russell continued, "I am a doctor, and I have specialized in children's diseases ever since the first year of my six years' practice of medicine. Need I tell you, I have seen the pressing need of another modern institution to relieve present overcrowded conditions in New York, for the treatment of afflicted children, under proper conditions, rich and poor alike. I know you have given thousands of dollars for hospitals, in one way or another. But I feel this is a vital situation in which you and a few other men can offer the solution. I have some means; Sydney Russell was my father. But I could hardly undertake such a project. That's why I want this to be a special contribution, not alone of your means, but of yourself, your continued interest and active support. Will you help to make me director of this new hospital. The Hospital for Children—your hospital?"

The banker hesitated a moment.

"Why didn't you write me about this?" he asked.

"Because I wanted to present the case as strongly as I could. Then again, because you undoubtedly receive a bunch of letters every day, asking for donations, for one cause or another. You must, in your position. You cannot read them all; you can only heed a few. You could hardly be expected to do more."

"No, my secretary attends to them, ordinarily. There are, of course, some things which I handle personally."

"Just that—and that is why I have taken this method of enlisting your interest and support. This hospital—this radio hospital—is wanted right now. And it will take a year to establish."

"Just a minute."

Harmstrong sprang up and walked quickly into another room. Howard smiled at the doctor, and the visitor smiled in turn.

"I bet he's phoning 'em," the secretary remarked.

In a few moments Harmstrong returned, put his hand on Dr. Russell's shoulder, and said heartily:

"Russell, I have talked with Gayne and Dodgworth, and we have come to an agreement. We will back you, 33⅓ per cent. each. I have the pleasure and honor of designating you, on my part as theirs, director of the Hospital for Children.

"Go right ahead, doctor. Get your plans ready. We will put them through. And speaking about children, seems to me I. W. A. J. stands for 'I wish all joy.'"

The happy young physician responded:

"I hadn't thought about that, but it's just what all this means."

* * *

Two weeks later Dr. Donald Russell, looking over a heap of letters which had been addressed to him in care of WFFA, laughed as he tossed one of them to his smiling wife.

"This is from Hurleyville, Pa.," he said.

She read: "Hope you landed that job all right. I had a tough time myself. Couldn't get situated in the city, tried everything but the radio, but no use. So I have taken to farming—and it is all right, with the wireless, etc. I know how you feel. If you got kids dependent upon you—"

The Monthly Service Bulletin of the

NATIONAL AMATEUR WIRELESS ASSOCIATION

Founded to promote the best interest of radio communication among wireless amateurs in America

Guglielmo Marconi, *President* HEADQUARTERS: 326 BROADWAY, NEW YORK H. L. Welker, *Secretary*

Prof. Alfred N. Goldsmith, *College of the City of New York* E. E. Bucher, *Instructing Engineer*

The Trans-Atlantic Amateur Tests

Reported Reception of English, French and Dutch Stations by American Fans Overwhelm Officials

THE American amateur now burns the DX oil through the wee hours listening-in for the distant call letters of foreign fellow fans equally eager to join in the universal game of radio.

American amateurs were urged to listen for signals from amateur stations in Continental Europe during the period of December 22, 1923, to January 10, 1924. It was the fourth series of trans-oceanic tests under the auspices of the American Radio Relay League in an effort to promote better amateur communication between America and Europe.

To facilitate receiving at this end the French and British amateurs transmitted on alternate nights, during the hours from 8:00 P. M. to 1:00 A. M., Eastern Standard Time. It was primarily essential that our fans should not "break in" during the twenty days of testing as every support had to be lent toward the establishment of two-way trans-Atlantic amateur communication. Since the efficiency of our amateur transmitters was adequately proved last winter during the third series of tests there was little danger at the outset that there would be any interference on this side.

But by way of special inducement to insure "quiet air" during the tests, $3,500 worth of prizes were offered for the best reception reports turned into the American Radio Relay League's Headquarters.

And by way of response the American amateurs have literally swamped Mr. Schnell with their reports.

Between breaths Mr. Schnell gasped, "The tests have snowed me under completely and I can see no daylight for several weeks."

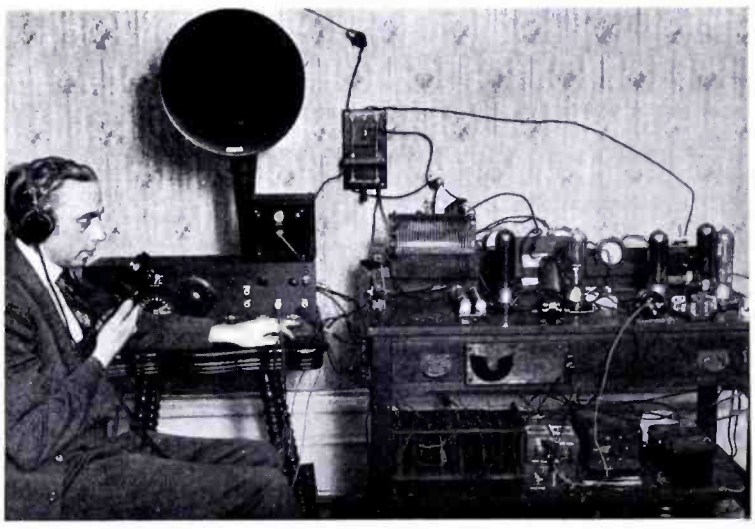
So, nothing for it but to print the full report of the tests in an early issue.

Some of the early reports list the following stations heard by American amateurs:

British stations heard—2NM, 2FQ, 2KF, 2SZ, 2OD, 2KW, 2FN, 2IN, 2SH, 5AT, 5LC, 5PU, 5BV, 5KO, 6NI, 6XX, 6YA.

French stations heard—8AB, 8AE, 8BE, 8BF, 8CT, 8LY, 8ARA, 8AZ, 8BM, 8CD, 8CS, 8JL.

Dutch stations heard—PA9, PC11, PA-0DW, PAR14.



Mr. Kenneth Decker's amateur radio station, 2CMK, a 250-watt transmitter, has been heard in every district of this country as well as Honolulu and Cuba, but he blew out no less than 17 fifty-watt tubes before he had his station working efficiently

San Diego Radio Club

By Dr. A. E. Banks
6XN, 6ZB

SAN DIEGO fans on the 2nd of November 1923, completed the organization of what promises to be an enthusiastic, progressive and useful radio club. The nominal membership approximates six thousand, and is made up of all those individuals residing in the County of San Diego who are licensed operators, broadcast listeners, owners of broadcast stations or anyone interested directly in radio.

The San Diego Radio Club has in its first president, Judge Eugene Daney, all that could be desired as an executive head.

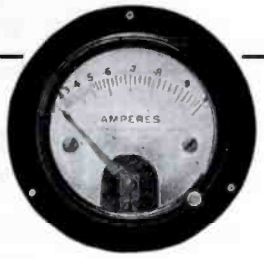
The old amateur organization, Sunset Radio Club, has joined hands with the broadcast listeners and others, in the making of the new club. It is the theory of the San Diego amateur and broadcast listener that the use of the ether for any specific purpose must be a matter which is interesting to all classes of operators alike. With co-operative support well developed, the mother organization will take care of all subdivisions of activity. According to the plans of President Daney the business sessions of the club will be more or less infrequent, perhaps once a quarter, at which time matters will be brought up which interest the membership as a whole. On the other hand sectional programs are to be arranged which specifically apply to the various types of membership. That is to say the amateur may have his technical meetings, the broadcast listener another type of program, the broadcast station owners their special sessions.

San Diego, while ideal for almost everything, has been one of the worst places for radio reception. Being a port city and having powerful Naval radio stations both arc and spark located in its midst, continued interference from improperly installed, poorly maintained and operated apparatus has been the rule. Efforts to obtain relief is where the San Diego Radio Club will find its mission.

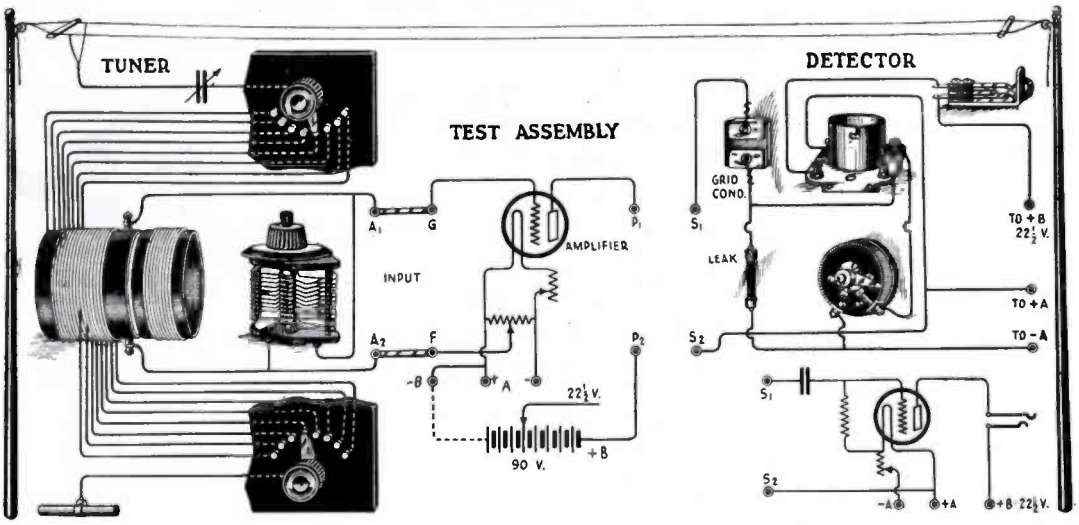
One of Mr. Daney's first announcements upon assuming the chair was to the effect that he sincerely hoped that the club would manage in some way to rid the ether of useless interference.

THE TEST TABLE

A REGULAR MONTHLY DEPARTMENT OF AUTHORITATIVE INFORMATION ABOUT RADIO APPARATUS



BY
R. P. CLARKSON
AUTHOR
RADIO DATA SHEETS



RADIO FREQUENCY

At the right we have a detector tube circuit. Its output goes to our phones. The input terminals (grid and filament) require as great an amplitude of oscillating voltage variation applied to them as possible so that the plate current fluctuations which affect our receivers will be large, especially on weak signals. We may connect detector input terminals S_1 and S_2 direct to the tuner output terminals A_1 and A_2 and rectify the received signal, but weak signals might be lost by doing this. One alternative is to increase the signal strength before attempting to listen in. This is the purpose of R.F. amplification.

Figure 1—R.F. transformer

We may take the test assembly of last month and to the tube input (always grid and filament) connect the output terminals A_1 and A_2 of any form of tuner. Using a hard tube the weak signals impressed on its grid will be amplified, there will be none of the rectifying losses, and if plate output terminals P_1 and P_2 are connected together to complete the circuit, there will be plate current flow which fluctuates with greater amplitude than the voltage fluctuations at the tuner output terminals.

Now we have the problem of affecting the detector with this plate current flow. We can't just break the circuit at P_1 and P_2 and connect in the detector tube. That would take the positive potential off the plate, would interrupt the current flow and short circuit the B battery. It would not apply amplified voltage variations to the detector grid. The obvious thing is to couple the two circuits together with two coils. If the coupling is fixed it is the ordinary form of R.F. transformer. The primary is connected to P_1 and P_2 and the secondary to S_1 and S_2. Because the coils are of fixed inductance and capacity, some particular wave length will pass through much more easily than others.

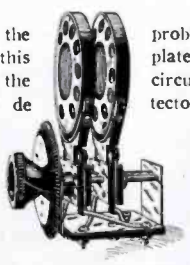


Figure 2—Variable coupler

We might use two honeycomb coils in place of the transformer windings. Varying the coupling between them would help selectivity, but decreasing the coupling would decrease the signal strength. To tune the circuits and still pass on all the signal strength, the natural device is the same as used in a single circuit receiver. Put in a variometer between P_1 and P_2 or some other form of inductance shunted with a condenser for tuning, and connect S_1 to P_1. Do not connect S_2 to P_2 as they are already connected through the filament battery. This arrangement is called tuned impedance.

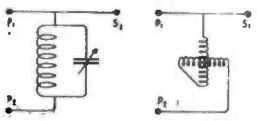


Figure 3—Tuned impedance

We might substitute a high fixed resistance—about 70,000 ohms—in place of the tuned impedance. What we want is to have the fluctuating current which normally passes between P_1 and P_2 go through some opposition—resistance, inductance or capacity or any combination of them. Then there will be a difference in voltage between these two points, varying as the plate current varies. This amplified voltage we pass on to the detector.

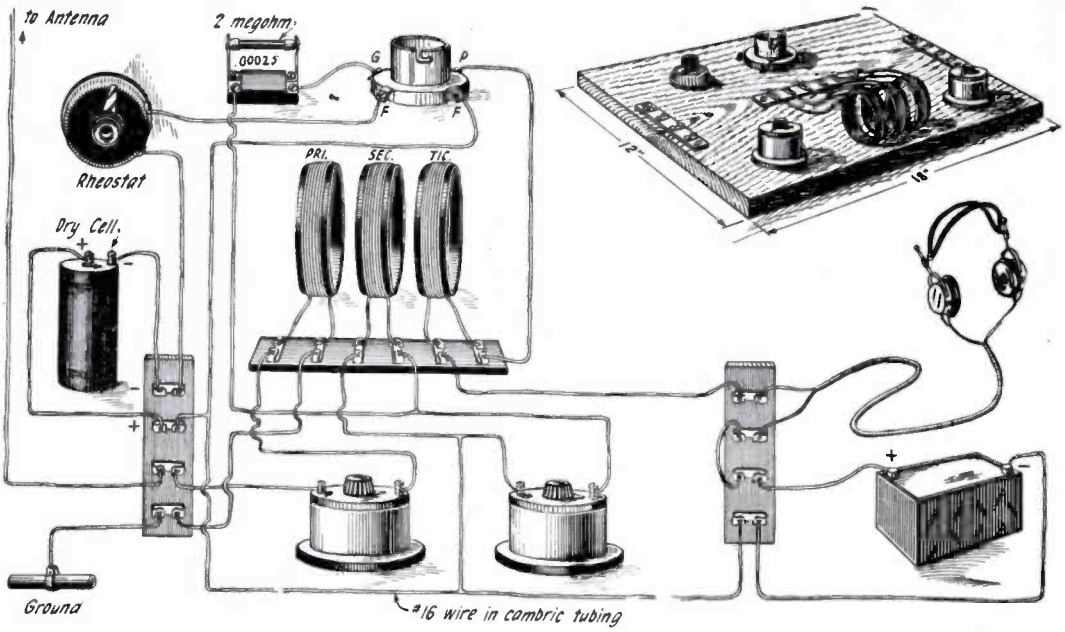
We might well combine tuned impedance and resistance coupling by winding our variometer with resistance wire. This will stabilize our circuits.

Figure 4—Resistance coupling

RADIO ENGINEERING

An Experimental Home-Laboratory Course in Simple and Advanced Radio Design

By John R. Meagher



THE HOME LABORATORY OUTFIT WILL COST ONLY FROM $20.00 TO $30.00 COMPLETE

MANY an amateur enthusiast would like to know all that a radio engineer is supposed to know; he would like to be independent of the opinion of "experts"; he would like to be able to say what is good and what isn't good in radio design. More—he would like to be able to design apparatus and complete instruments himself—without having to guess about a single thing.

But he finds it difficult to learn radio through a study of text books alone for they are either too elementary or so full of detail that one must be an engineer to understand them; equally difficult does he find experimental work, for the power of his observation is limited by the extent of his knowledge.

In truth, there is only one way to learn radio; and that is to dig into it in a systematic and wholehearted manner; combining text book reading with actual experimental work. For without one the other is almost useless while both combined makes the study of "Radio Engineering" an easy, enjoyable and often profitable pastime.

Such a course is to be given in THE WIRELESS AGE. Here in this column from month to month we will indicate the line of basic experiments to be followed and we will suggest to the student what text books are to be read. The experimental equipment and books will cost but little; the former can be used in regular receivers at any time; the latter are always handy for reference.

The material required for this home-laboratory course consists of the following:

Two .0005 mfd. (23-plate) variable condensers, enclosed for table mounting. If any "panel" type are on hand they may be mounted in neat, shellacked boxes made from cigar box wood; or they may be mounted under the test board with only the knob and two Fahnestock terminals on top. Secure a good make of variable condenser, as they may be used over and over.

Three coils each wound on a thin rubber or shellacked cardboard form 3 inches diameter and 1 inch long with 50 turns of No. 28 or 30 double cotton covered wire; use small Fahnestock clips on each form for connections. Dry the coils in a warm oven and apply a light coat of collodion (one ounce—at any drug store) to the windings.

One standard tube socket, preferably porcelain; replace the four binding posts with large Fahnestock clips.

One table mounting rheostat of 6 or 30 ohms.

One .00025 grid condenser and a grid leak.

Three terminal strips of hard rubber 1 x 6 inches equipped with double Fahnestock clips as shown.

One sandpapered and shellacked wood base of the size indicated.

Arrange the apparatus as shown in the sketch, screwing the material to the base with brass wood screws and wire in exact accordance with the pictorial diagram—keep the connections close to the base.

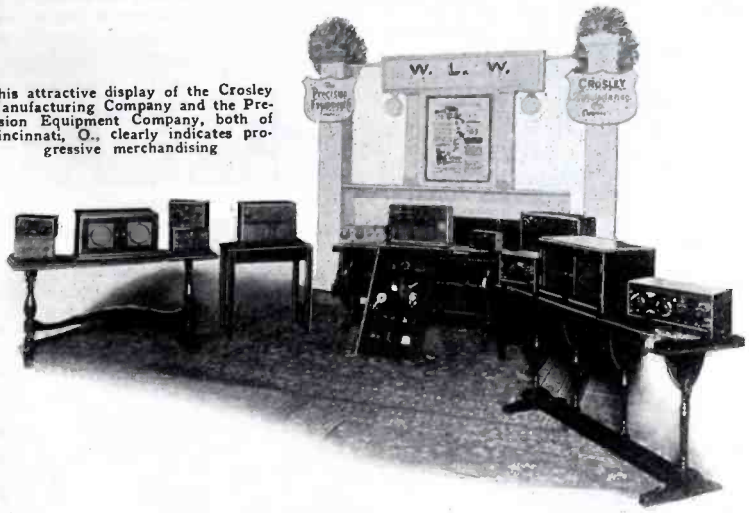
Any vacuum tube may be used, but if none is on hand we suggest the purchase of a UV-199 (C-299) and adaptor. In this case the filament battery should be of 3 cells instead of one and the rheostat must be of 30 ohms.

No operating instructions or experiments will be given this month, but the student should become familiar with the assembly and learn the correct method of tuning by himself. Next month he may see how his ideas check up with Radio Engineering.

As for text books—the first to be secured is E. E. Bucher's "Wireless Experimenter's Manual," which may be secured from the Wireless Press, Inc.

(To be continued)

INDUSTRIAL INKLINGS



This attractive display of the Crosley Manufacturing Company and the Precision Equipment Company, both of Cincinnati, O., clearly indicates progressive merchandising

J. L. LEWIS, a New York retailer, held a radio show at his store, 132 W. 32nd Street, which lasted one week in celebration of the 25th anniversary in business, of which radio has lately been a large part, and to emphasize the fact that the firm is going into wireless stronger than ever. Two window displays devoted to radio were changed frequently and radio displays were arranged in the store by several prominent manufacturers.

HARRY C. GAWLER, for the past three years connected with the sales department of the Radio Corporation of America, is now Sales Promotion Manager of the General Radio Company, Cambridge, Mass.

THE Multiple Electric Products Company, Newark, N. J., has prepared an original display card to set off their Atlas Amplitone Loud Speaker. The well-known picture of a beautiful girl singing out of the horn has been executed on a not too large display card which dealers may secure upon request. Another mark of their enterprising methods is contained in a rather costly booklet, "Marketing and Distribution of Radio."

HERMAN ROSE, president of the Shamrock Manufacturing Company, entertained one hundred and fifty retailers in the Newark territory. Mr. Mortimer Salzman and Mr. Sparer of the Wholesale Radio Equipment Company of Newark, were prominent in aiding Mr. Rose in conducting the affair. The theater party and banquet were so successful the guests had to ride home with the milkmen.

THE United States Post Office has warned advertisers against the common practice of omitting their street address in their advertising. Postal employees cannot memorize all the locations of even the largest concerns and as a result some 80,000 pieces of mail are received daily at New York that must be delayed in its distribution to points of delivery. Quite often, non-delivery is the result of street address omission.

THE "RADIO LIMITED," a cyclonic trade crusade through the Great West —Pacific Coast and return—was under the personal direction of James F. Kerr, 127 N. Dearborn Street, Chicago, having been organized to boost the radio interests through the Middle West. This train, carrying 125 passengers, left Chicago January 27th, arriving in Los Angeles ahead of the opening of the Biltmore Hotel Radio Show, conducted by the American Radio Exposition. On the way out stops were made at Omaha, Denver, Salt Lake and Los Angeles, and on the return trip, San Francisco, Portland, Seattle, Spokane, Butte and Minneapolis. Publicity agents preceded the excursion to round up the dealers and jobbers, to "place" billing and advertising and to consummate all arrangements for the reception of "The Radio Limited."

THE Diamond State Fibre Company, Bridgeport, Pa., has prepared a catalogue that presents "Condensite Celoron" products in a thoroughgoing manner. Condensite and Celoron are described and the various uses for the product are discussed at length, elaborating on the grades and tests. A commendable fact about the booklet is that it has been made up in a clear and altogether interesting fashion.

THE Central Radio Laboratories of Milwaukee, Wis., have been advised that their CRL Non-inductive Potentiometers and CRL Grid Leaks, have been selected and approved by the engineers of the National Radio Engineering Company and the report forwarded to the Association of Railway Electrical Engineers.

HENRY L. SEIDMAN, Chairman of the Radio Trade Association Cost Finding Committee, has solved one of the "troubles with the world" in his analysis of the inventory evil. He tells how to keep an automatic inventory by a simple system of cards. A separate card for each item, ruled and filled out with data of date purchased, quantity purchased, from whom purchased, cost each and the amount all to be totalled yearly, will enable the dealer to keep perpetual check on the stock by items and the individual costs. The system is unique in its simplicity and ease of keeping up-to-date.

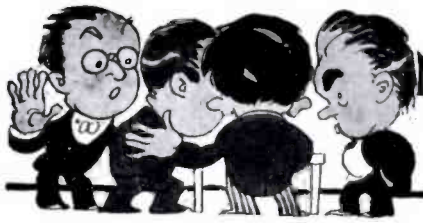
THE name "Mahoganite" is owned exclusively by the American Hard Rubber Company, and they alone have exclusive right to its use on materials and parts. Other manufacturers using the name "Mahoganite" on any of their products are guilty of infringement.

THE Smith Radio Manufacturing Company of Washington, D. C., will go into production of the SMITHTONE Radio Receiving Sets.

The Smithtone will be produced in five models with a capacity of fifty sets a day.

Howard Carter who for many years was associated with the automobile industry from its pioneering days will be the production manager.

Window display at Commonwealth-Edison, Chicago, showing the $6,000 worth of prizes awarded in the listeners' program vote held by stations WJAZ, KYW, and WDAP. Of the 600 articles, 30 were complete sets. Incidentally, the drawing for these prizes was one of the events that made the Chicago Radio Show "go over" big



NEW APPLIANCES AND DEVICES

Bel-Canto Loud Speaker

THE new model of the Bel-Canto Loud Speaker shows several changes in design. It is now equipped with a fibre horn and the base has been re-designed adding materially to its attractive appearance.

Co-incident with the introduction of the new model, the Bel-Canto Manufacturing

Bel-Canto Loud Speaker

Company have adopted a new sales policy and are offering their loud speaker direct to the user at a material reduction in price.

New Pacent Plug

TO the end of meeting the demand for an inexpensive yet practical plug, the Pacent Electric Company engineers have developed the improved "Forty" Universal Plug, which is shown in the accompanying illustrations. Here is a plug that is immediately attached to the usual telephone cord tips in the manner shown, with a per-

New Pacent Plug

nament bull-dog grip of entirely new design. The pushing of the cord tips into place by the mere assembling of the plug shell locks the grip of the connection clips, while taking the shell apart unlocks the grip and releases the cord tips. The new Pacent plug is neat, small, and convenient for use anywhere. The metal parts have a heavy nickel satin finish. Its conducting parts insure perfect contact and conduction of weak radio currents, while its molded insulation insures against the leakage of currents. No live parts are exposed. The gripping members have polarity data stamped on them. Finally, the ingenious design and simplified construction, together with a large output, has served to bring down the cost of this plug to a modest price which now makes it feasible to use many plugs for radio reception and experimentation.

Simplified Grid Control

THE Randel Wireless Co., Newark, N. J., has brought out a combination variable condenser and variable grid leak called "The Grewol Vari-Grid." The claim is made that it entirely displaces all 11 and 23-plate condensers and the old type grid leaks with an attractive appearing, all-enclosed, compact instrument that takes up but 1¾-inch of space on the panel. The Grewol Vari-

Simplified Grid Control

Grid can be used separately either as a variable condenser or as a variable grid leak. The makers claim considerable improvement in distance and clarity by using this instrument, and recommend its use in the aerial and secondary circuit as well as in the grid circuit. Only one hole is required for mounting.

Freshman Condenser

WITH an evident realization of the importance to clear-toned radio reception, of affording the best possible soldered connections in fixed condensers, the Chas. Freshman Co. of New York City, have made a radical improvement in the design of all capacities of their tested noiseless mica condensers, which should prove a boon to manufacturers and radio enthusiasts who build and tinker with their own outfits.

A lug of special construction is riveted by means of an eyelet to each terminal of the mica condenser. The lug is equipped with three grooves, permitting the wires to be laid properly, and held in place while being soldered.

Another most important advantage is that in wiring a set the connection can be made temporary without soldering. In this way the circuit can be tested and varied so as

Freshman Condenser

to give the most efficient results. When this is attained the connections are soldered.

New "B" Battery

A NEW type of "B" battery constructed so that most of its bulk is raised vertically instead of occupying valuable horizontal space, is now available to radio fans whose table area is limited. The new battery is No. 764 of the National Carbon Company. It gives 22½ volts, and is only 3⅛ inches wide. Its height is 5⅝ inches.

The new battery has twice the life of the small portable "B" battery, while standing on practically the same size base, and the cost is only about one-fourth more than the cost of the small one. It was developed after months of experimentation by engi-

New Eveready "B" Battery

neers of the National Carbon Company, who knew that many radio users were increasing their battery operating cost in order to economize on space or to save in first cost. The new battery gives much lower operating cost without appreciable sacrifice in table space.

The Crosley XL Receiver

THE growing popularity of the furniture idea is upon us, and to meet this growing demand comes the Crosley Model XL, a beautiful piece of furniture incorporating the radio panel behind the left hand door, and the loud speaker and amplifying sound

chamber behind the right hand door. In the rear of the cabinet, easily accessible by raising the hinged lid, is ample room for six or eight dry cells to supply the filament current, and a shelf for the necessary "B" batteries.

One stage of tuned impedance-coupled radio frequency amplification, a vacuum tube detector and two stages of audio frequency

Crosley XL Receiver

amplification are used to provide long distance, loud speaker reception. The inductances are in the form of a staggered spider web; condensers are of the "book" type. Only two tuning controls are employed.

The "Aristocrat" Radio Headset

THE "Aristocrat" Model Radio Headset has just been placed on the market by the Dictograph Products Corporation, New York.

This headset is a decided improvement over the previous designs. The ear caps are of hard rubber finished in black streaked with orange. They are made extra large to insure comfort while wearing. The head band and cords are finished to match the caps. The phones are exceedingly light in weight, and can be worn for hours without fatigue. In both distance work and volume this headset excels. Like a watch, it is a sensitive, finely constructed precision instrument, made to give service for years.

Dictograph radio headset magnets are made of the two pole, or bipolar type, each pole being wound with 4,500 turns of No. 44 B. & S. gauge enameled copper wire, having a resistance of 750 ohms each, all being connected in series, giving a total resistance of 3,000 ohms per headset. The minuteness of this wire can be realized from the fact that 500 of these could be laid side by side within the space of an inch.

New Eisemann Adapter

THE Eisemann Resistance Adapter has been developed to provide a method for utilizing either UV-199 or C-299 Radiotrons

New Eisemann Adapter

in a radio receiving set equipped with standard base sockets and low resistance rheostats.

If the rheostats in the receiver are of low resistance the A battery should have a value of 4.5 volts.

The change may be made by connecting to a filament battery of proper voltage and inserting the resistance adapter.

Jefferson R. F. Transformer

JEFFERSON Radio Frequency Transformers will function with equally efficient amplification over the entire new wavelength band (200 to 650 meters) in standard radio frequency, reflex, inverse, duplex or neutrodyne circuits.

Jefferson R. F. Transformer

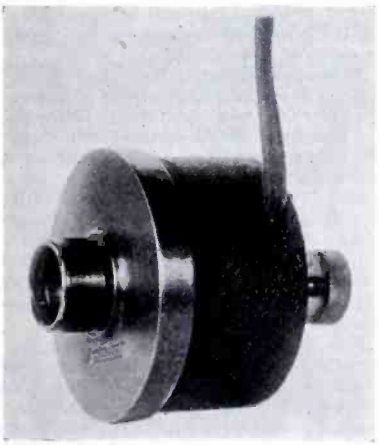
It is necessary in any radio frequency amplifier to keep the capacity coupling between coils as low as possible and yet maintain good inductive coupling. This has been done with the Jefferson transformer by making the primary and secondary coils in the form of distributed windings. The silicon laminations take care of the required inductive coupling; at the same time shielding the winding from any external capacity that might be detrimental to tuning.

The transformers are assembled in handsome black enameled steel cases. The nickel-plated binding post terminals are set in bakelite bushings and are brought out at a convenient angle near the top of the case.

Accuratune Phonograph Unit

THIS is a new item in the line of the Mydar Radio Company.

Designed to harmonize with the instruments with which it will be used, its rugged construction and adjustable air gap insures the satisfaction given by other Mydar products.



Mydar Phonograph Unit

The unit is equipped with flexible cord with terminals marked to indicate polarity.

The heavy shell and cork inserts prevent chattering and vibration. No extra battery required for operation. Finish—black with lacquered brass trimmings.

Broadcasting in the British Isles

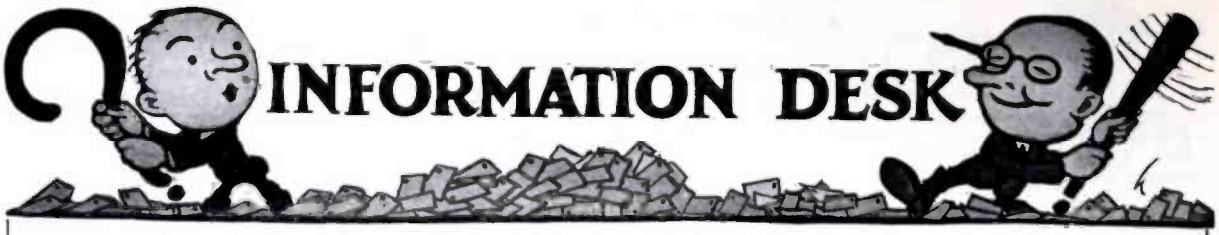
(*Continued from page* 41)

We were also faced at one time with threats from the concert organizers which looked like making things very difficult for us. There are certain concert platforms in London which are a sort of Mecca for young artists, and artists look forward to appearances on these platforms as essential stepping stones in their careers. The director of the principal series of concerts issued a letter pointing out that artists singing at our stations would not be allowed to sing in his programs, and this line of action was also taken by another group responsible especially for Sunday evening concerts, of which there are a great number. Fortunately the British spirit of freedom again asserted itself and a group of leading British artists refused to be intrigued. These have been given useful contracts and are touring all stations providing the high-water mark of musical performance. Their action has had a steadying effect amongst younger artists and we are confident that our obstructionists will learn ere long how unwisely they have acted.

Our relations with the several gramophone companies are cordial and our correspondence from listeners indicates unmistakably that broadcasting is giving material assistance to the publishers and retailers of music and records.

Personally I believe that broadcasting can strengthen old and create new tastes and that the organizations now endeavoring to hinder broadcasting are wasting in a futile manner energy which if applied to co-operation with the broadcaster might considerably assist them in the difficult times. If we, by sheer necessity, are forced to produce our own plays, then there is just the risk that listeners will stay at home who otherwise would have visited the theaters. In this case the boycott more than defeats its own object.

We, who are responsible for the development of broadcasting in England, are alive to the fact that we are working with a medium having positively astounding possibilities. We realize our responsibilities and would welcome a regular exchange of views with those engaged in an even more extensive manner with the same developments in other countries, particularly in the mother country of the movement—the United States of America. Our only regret is that owing to time differences which cause practically all British transmissions to take place in your hours of daylight, it is not possible to listen to our performances and form first-hand judgment on our activities.



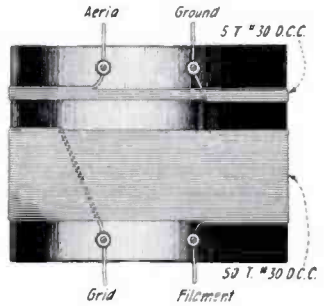
CONDUCTED BY JOHN R. MEAGHER

A self-addressed stamped envelope will insure a prompt reply to any queries on radio

More About the Uni-Control Receiver

OF all the inquiries about the uni-control described in THE WIRELESS AGE of December, 1923, most have been concerned with the probable cost; where the parts may be purchased and what disadvantages are to be expected.

Starting with the last mentioned subject it might be of interest to know that the other evening we had the uni-control at home (in New York) for the purpose of hearing Major Howe, the editor, speak from WJY. A loop was not available so we used a single No. 18 wire about 80 feet in total length erected only a few feet above the roof. A small fixed coupler, similar to that shown in the sketch, was used with this improvised antenna. The receiver worked very well and after enjoying Major Howe's talk we "fished" around for "DX" stations, the best of which was WDAP, Chicago, Ill., received with such volume that actually it was necessary to shout to make oneself heard in the room! And as for distance, KFKX, Hastings, Neb., rolled in with a comfortable intensity: and when he signed off, KOP, the excellent and albeit appropriately called police station in Detroit came in.



The only evident disadvantage was distortion on the third stage. However, this was considerably reduced by connecting a variable resistance across the secondary of the third audio frequency amplifying transformer or by connecting it between the grids of the second and third audio frequency amplifying tubes. The resistance should have a minimum value of 50,000 ohms and a maximum of a half megohm (500,000 ohms) or more. I believe there are some variable "grid leaks" that have a minimum value between 50 and 100,000 ohms; they will be satisfactory.

It was found advisable to ground the filament (either terminal) and to change the tubes around for best results. A very good tube in the last socket will make all the difference in the world.

Neither more nor much less "B" battery voltage should be used as the operating point of the audio frequency amplifying tube grid will in either case be driven to an unfavorable point on the grid-plate characteristic curve. If difficulty is experienced in making the uni-control oscillate, a small .00025 mfd. fixed condenser should be shunted across the primary of the first audio frequency amplifying transformer.

The last stage may be cut out by connecting the output (loud speaker) between the positive "B" battery terminal and the plate connection of the second audio frequency amplifying tube—thus placing the output in shunt to the primary of the second audio frequency amplifying transformer. Indeed a small binding post may well be soldered to this point in order to facilitate such a change. The last tube must be left in its socket however, or otherwise the first radio frequency amplifying tube filament circuit will be open. Of course, the base of a broken UV-199 tube may be fitted with a 50-ohm resistance between the filament studs and used instead.

We were really surprised at the lack of "ringing" noise from the tubes—indeed it is not noticeable when a loud speaker is used. But a point which should not be overlooked is the reaction of the sound waves from the horn upon the tube; this reaction causes an audio frequency "howl" which, while it may be considered as musical, is ear piercing and decidedly annoying.

To avoid this keep the "speaker" isolated from the set and if possible use a closed up cabinet with rubber feet.

Dry cells may be used for filament supply and four of them should be connected in series. Standard cells will last from 100 to 150 hours or about five weeks to two months at a rate of 20 hours a week.

Now about the parts: The radio frequency transformers cost approximately $6.00 each; the audio frequency transformers $3.00 each; the completely drilled subpanel with "spun-in" sockets about $8.00, and the condensers, potentiometer switch, and extras about $10.00. Thus the cost will be close to $40.00. (Incidentally the Kardon Products Company is located at 101 Varick Street, New York City.)

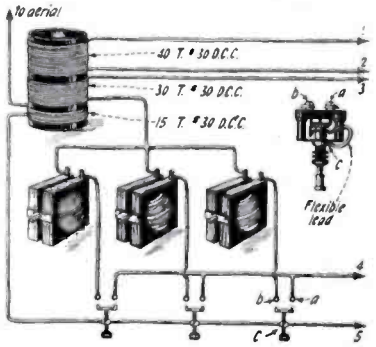
For the extras, 6 UV-199 or C-299 tubes list at $39.00, though a discount may possibly be secured on this quantity.

If the factor of low filament current consumption is not of major importance we would earnestly urge the use of two UV-201-A tubes in the second and third audio frequency amplifying stages; they will prove much superior to the UV-199. The only trouble will be to find a loud speaker that will stand the "gaff"! We personally have a Uni-Control at home for regular use with UV-201-A's as detector and audio frequency amplifiers and UV-199's as radio frequency amplifiers. The UV-199 tubes work excellently in conjunction with DX-Virbren radio frequency transformers and we can wish for no better receiver.

And More About the Push Button Receiver

Mr. Lee Galvin's "Push Button" set described in the January, 1924, WIRELESS AGE has already excited considerable comment; not from "DX" amateurs, but from people who are interested in the advancement and simplification of radio.

As noted, the description was of only a single adaptation of his system, and the slider method of tuning was selected merely because of its simplicity and low cost. Very good results have been secured with the original push button set, but it is quite necessary that the sliders be arranged to touch but one turn of the tuning coil at a time. This can readily be done by using a spacing cord of greater diameter than the wire. If the secondary coupling coil is not coated with some form of insulating fluid and if the secondary leads are very short, so that there is very little distributed capacity across the secondary, it becomes necessary to shunt a small fixed condenser from the grid condenser (terminal away from the grid) to the filament. This condenser should have a value of about .0001 mfd. and may be made by placing two .00025 mfd. fixed condensers in series.



A better arrangement for tuning is suggested in the sketch, which represents three variometers in a branched circuit; using Cutler-Hammer switches for selecting the desired branch. Potentiometers of 200 (or even lower resistance if they can be secured) may be used.

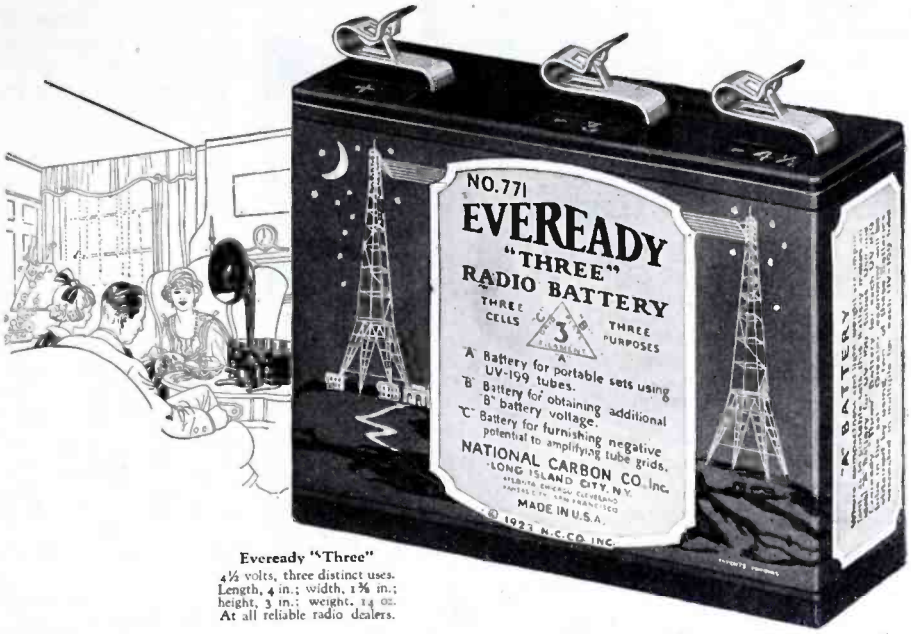
A. C. Filament Supply

Mr. Herbert Cosgrove of Troy, New York, writes: "I have noticed an advertisement of a device with which it is claimed alternating house current may be used for filament supply of a receiving set in place of the usual 'A' battery; what is this device composed of—is it practicable?"

Usually the devices you mention are made up of a step-down transformer to reduce the 110-volt house supply to 6 volts; a potentiometer of any resistance value connected across the six-volt supply; and three

(*Continued on page* 80)

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"



Eveready "Three"
4½ volts, three distinct uses.
Length, 4 in.; width, 1⅝ in.;
height, 3 in.; weight, 14 oz.
At all reliable radio dealers.

This "C" Battery is a Wonder Worker

YOU can make the loud speaker respond with a new fullness and naturalness of tone. You can save money by adding months to the life of your "B" Batteries. These things you can do by using the new Eveready "Three" as a "C" Battery.

You already have an "A" Battery for the filament and a "B" Battery for the plate. A "C" Battery is connected to the third element of your vacuum tube, the grid, affording a control that is marvelous in action on audio frequency amplifiers.

As a "C" Battery the Eveready "Three" prevents distortion and excessive flow of current from the "B" Battery, lengthening its life. It is a wonder worker that saves its small cost many times over. Connect it in your audio frequency amplifier and note the difference. Full directions on the label and in "How to Get the Most Out of Your 'B' Battery," a booklet on "B" and "C" Batteries, sent free on request.

This triple-use battery can also be used as an "A" Battery in portable sets. Light and full of pep. Its third use is as a "B" Battery booster.

Use the Eveready "Three"—a tested product of the world's leading electro-chemical battery laboratory. It serves more radio uses and effects more economies than any radio battery heretofore developed.

If you have any battery problem, Radio Battery Information Headquarters will solve it for you. Write G. C. Furness, Manager, Radio Division, National Carbon Company, Inc., 198 Orton Street, Long Island City, New York.

NATIONAL CARBON COMPANY, INC., New York—San Francisco
Headquarters for Radio Battery Information
CANADIAN NATIONAL CARBON CO., Limited *Factory and Offices:* Toronto, Ontario

EVEREADY
Radio Batteries
—they last longer

Aladdin's Magic Lamp

(*Continued from page 39*

voltages of either of these tubes; it is necessary merely to keep the filament current at or slightly below the normal value and to restrict the plate voltage to the limit indicated on the instruction sheet enclosed with each tube.

On the whole, better results for radio frequency amplification may be expected with storage battery tubes, i. e., those having a comparatively heavy filament current. And, of all the receiving tubes on the amateur market, the UV-201-A (C-301-A) is doubtless best for this purpose. The filament of this tube consumes but one-quarter of an ampere; the tube is an excellent amplifier, and it is remarkably quiet in operation.

As a detector, the UV-200 (C-300) is generally agreed superior to other tubes; especially if provision is made for smooth regulation of the filament current through use of vernier or carbon pressure rheostats. With this tube a tapped "B" battery of 15 to 22½ volts will prove of much benefit. Remember if the negative terminal of the "B" battery is connected to the positive terminal of the filament battery that the voltage of the latter (filament battery) must be added to the voltage of the "B" battery. In other words, if the plate battery voltage is 22½ and the negative "B" is joined to the positive side of a 6-volt filament battery, then the effective voltage on the plate (neglecting the external plate circuit resistance) will be 28½ volts with respect to the *negative* terminal of the filament.

There are two ways of obtaining the negative grid voltage; one method is to place the filament rheostat in the negative battery lead and connect the return lead from the grid to the negative side of the battery. (See the amplifier circuit with the chart.) In this way there is a difference of voltage between the negative "A" battery, to which the grid is connected, and the negative terminal of the filament. The value of this negative voltage depends upon the resistance of the rheostat and the resistance of the tube filament and the voltage of the filament battery. If the tube is a UV-199, the filament resistance of which is 50 ohms, with a 25-ohm rheostat and a 4½-volt battery, the voltage difference between the negative filament and the grid will be 1½ volts, which is the value of the voltage drop across the rheostat. The other method is to provide a special "C" battery in the grid return lead. The negative terminal should be connected to the grid, and the positive terminal of the "C" battery should be connected to the negative side of the filament.

The Wireless Age Reflex

(*Continued from page 59*)

One panel mounting socket. That shown, a "Bell," is entirely satisfactory, but there are any number of equally good ones on the market. For use with a UV-199, the Frost rubber cushioned type is suggested. For those who want the highest efficiency a porcelain socket is preferred.

One rheostat (Cutler-Hammer) of 30 ohms so a UV-199 tube may be used with a 4.5-volt filament battery. And as this rheostat will pass ¼ ampere safely it may be used with a UV-201-A; though the resistance with that tube and a six-volt battery need be no more than 4 ohms.

One crystal detector stand—see text for suggested type.

One front panel, standard size 7 x 12 x 3/16 inches. (Radion.)

One terminal strip 12 x 2 x 3/16 inches. (Radion.)

Two Quinby aluminum frames for 7-inch panel.

SMALL PARTS

Two small binding posts for connecting the crystal "detector."

Six large binding posts for terminal strip. (Eby.)

Six flat head 6/32, ⅝-inch brass machine screws.

Mounting screws for the variometers and the rheostat.

One-eighth pound of No. 30 double cotton covered wire.

Three strips of thin cambric tubing.

Ten feet of No. 18 soft drawn bare copper wire.

ACCESSORIES

One vacuum tube, UV-201-A, or else a UV-199—although any tube can be used.

One "A" battery of proper voltage for the tube to be used.

One "B" battery consisting of three blocks of dry cells giving 22.5 volts each or 67.5 volts total.

One antenna 60 to 200 feet in length, single or double No. 14 wire; porcelain insulated.

One ground, water pipe or buried wire.

One 2,000 or 3,000-ohm headset or a "speaker."

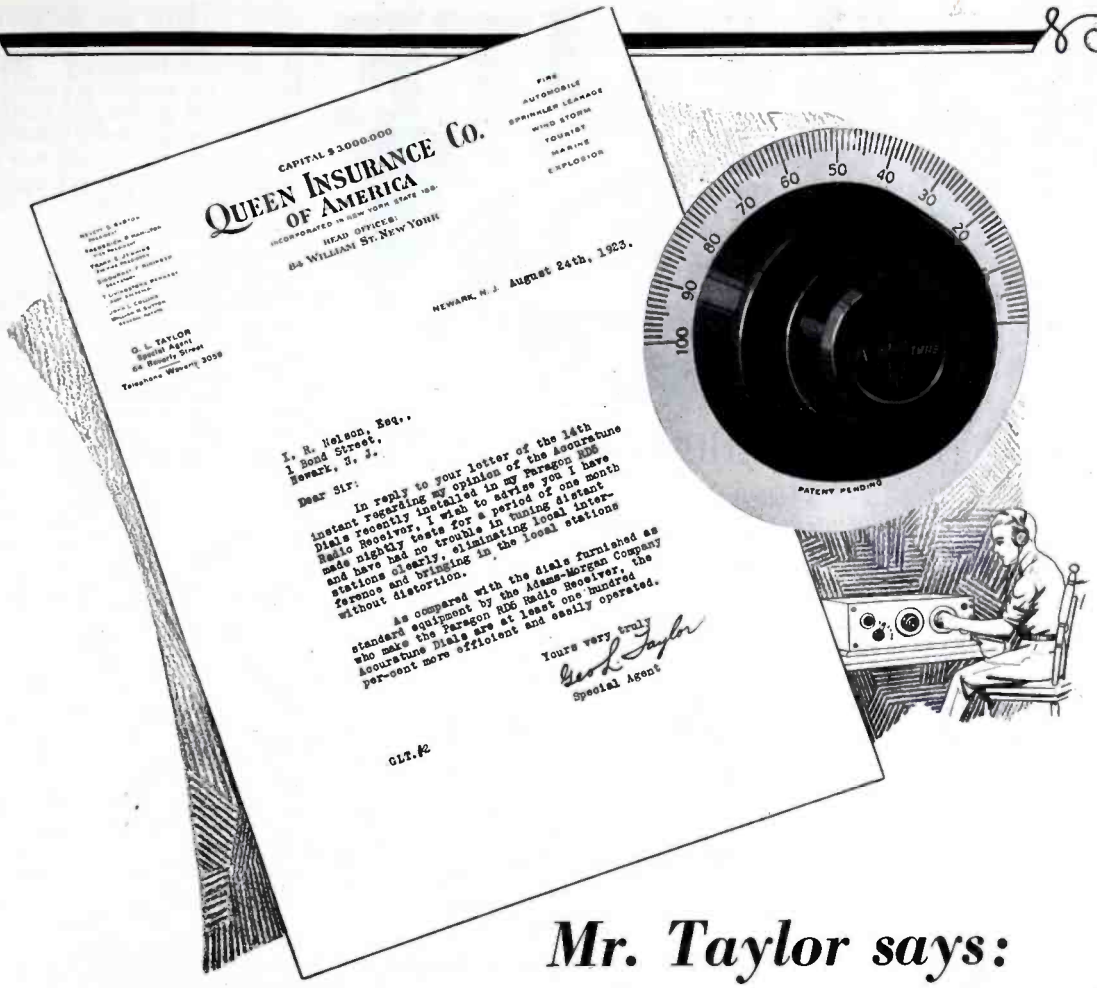
Junk This Radio Jargon

(*Continued from page 54*)

ly operative—and difficult! This number of circuits ought to supply that portion of the radio press that is willing to deceive the public for some weeks. One of these circuits ought to be called, in all due deference, the Pickard circuit!

Then when it comes to schematic diagrams, everyone seems to consider that unless a schematic diagram contains a horde of jacks and double-pole double-throw switches it is not worth printing. There is quite an art in schematic diagram work, the underlying idea being to show the actual features of the circuit in as simple a way as possible. This is apparently unknown to much of the modern radio press.

The real facts of the case are that much of the radio press of today is proceeding on the incorrect principle of government by a minority. A



Mr. Taylor says:

"No trouble tuning distant stations"

Universal micrometer action and easily fingered knobs are the outstanding features of the Accuratune Control. The larger knob is used for coarse adjustments, the smaller knob operates the micrometer mechanism. Either action will swing the dial through the full 360 degrees. Your dealer will supply you with Micrometer Controls for your present set, or if you buy a new set, choose one equipped with Accuratunes.

HE is pleased not only in this capacity, but he adds that he has no trouble tuning CLEARLY.

It is no little stunt to bring in a distant station, with all local and other disturbances in the air. But with an Accuratune fine adjustments are easy, and the slightest turn of the micrometer knob will throw interferences out of the way, and bring in the station you want CLEARLY. The Accuratune is not a mere dial, but an actual Micrometer Control ten times more efficient than any tuning device.

For such satisfactory reception the Accuratune was created, and though the price be slightly higher than ordinary dials, it will prove its worth the first time you use it.

MYDAR RADIO COMPANY
9-A Campbell Street, Newark, N. J.

Manufacturers of Popular Sets. Equip your apparatus with Accuratune products. Increased efficiency and beauty will advance your sales.

ACCURATUNE

MICROMETER CONTROLS

EVERY ACCURATUNE PRODUCT IS A GOOD PRODUCT

couple of years ago, the amateur was in the saddle, and to the amateur complexity is indeed dear. Today, the ranks of the amateur are about as unity compared with ten for the radio listener, and the latter is gaining day by day at a far more rapid rate than the former. The amateur, I hope, we will have with us always. He forms the nucleus from which we professional Armstrongs and Godleys graduate. But some one must recognize that for the newcomer, who does not even speak the technical jargon, the present complication in the press merely confuses while it does not enthuse. For him there must be a Moses, leading him out of the wilderness with real facts, simply stated, with the fundamentals of this wonderful new art stated in terms of his understanding. Then, and then only, we will have common sense in radio.

How to Be a Radio Salesman

(*Continued from page 33*)

book very quickly showed that they did, for the salesmen were given a commission in addition to their salaries. What was more important, however, they showed that he was not merely a machine connecting the shelves with the counter.

You have had the experience probably, of buying a collar in an emergency, when you needed only one because you had plenty at home. Yet the clerk tried to sell you half a dozen or at least two. Failing that he rattled off a list of shirts, socks, neckties and handkerchiefs. But not Charlie. He managed something like this:

A man dropped in for a socket to put in a new set. Without openly delaying about producing the type of socket asked for he took out of the case one of a more expensive make. "There's one with better contacts and better insulation on the base." Then without stopping he went after the kind the man specified. Seeing the good one first the other suffered by comparison. If the customer said he liked it, but it wouldn't fit there was no argument. The next shot:

"Have you got an amplifier for your set?" If not—"Here's a new issue of the 'Radio Wave' with some good dope on a two-step. You'll find there all the construction dope and a complete list of parts and prices. Better take this along so you'll have the article when you're ready to put on an amplifier.

"When you're ready to build it I can give you all the parts and help you out if there's anything that puzzles you. By the way if you haven't decided exactly on the details of your set look over that set of blue prints on the wall.

Build Your Own Radio Set!

—It's Easy—with

KARDON

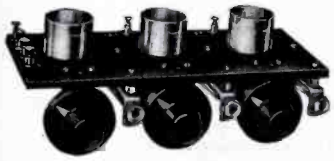
RADIO UNITS

There isn't any guess work in making receivers if you use Kardon radio units, because Kardon units come to you all assembled, wired up and TESTED ready to operate.

You can use Kardon units with any circuit and with any tuning devices.

Your just add the tuner you want.

And you are assured of 100% satisfaction with any Kardon products. They are absolutely guaranteed.



Kardon detector and two stage audio frequency amplifying unit. Mounted on sub-panel, sturdy spun-in sockets; smooth running rheostats and special circuit jacks. This can be used in any circuit and it is easy to mount in your set.

Recommended by experts.

Mail the Coupon Now!

KARDON PRODUCTS CO.
101 Varick Street, N. Y. C.

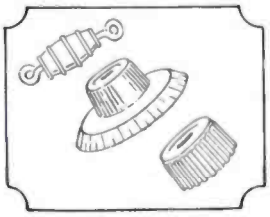
Without obligations please send me the new Kardon Radio Unit catalogue.

Name .....

Address .....

18 Stock Sizes Radion Panels

6 x 10½	6 x 14	6 x 21
7 x 9	7 x 10	7 x 12
7 x 14	7 x 18	7 x 21
7 x 24	7 x 26	7 x 48
9 x 14	10 x 12	12 x 14
12 x 21	14 x 18	20 x 24



Mahoganite has the Beauty of Polished Mahogany

Mahoganite Radion Panels have a satin-like finish comparable to that which age and a skilled cabinet maker give to mahogany. Radion Dials and Knobs are also made in Mahoganite to match.

At all good dealers or write to

AMERICAN HARD RUBBER COMPANY, 11 Mercer St. N.Y.

RADION

The Supreme Insulation

PANELS

Look for this stamp on every genuine Radion Panel. Beware of substitution and imitation.

They are for building the set you see at the end of the counter." If the customer went to look at the prints Charlie made a quick decision. If the man was going to buy the prints, and some more parts, he stayed with him, but if he expected the customer to glance over them, return, and say, "No, I guess that's all," he started with the next customer. However, he did not try to wait on two customers at a time letting first one stand around and then the other. Instead, with a second customer waiting for him, he had the regular "Good morning sir," and "if you can wait two or three minutes I'll be with you."

Think of your own feelings when you go in a store to buy. With all the afternoon ahead of you you become impatient if the clerk pays no attention to you, but if you are asked politely to stand by to be attended next though you may think the other man is slow in making up his mind you don't blame the clerk for keeping you.

Charlie's salesmanship succeeded because he never forgot that his salary came from the money he took in; that the goods were not in the store for exhibition or to be played with; and because he sold others as he liked to have others sell him. He soon had friends among the experimenters, but he seemed to discipline them in a way that made them respect him. Many people came to him for advice and suggestions. He told them what they wanted to know and usually sold a book which covered the points in question. He was friendly without being sociable. While watching everything loose on the counter he never appeared suspicious.

But unfortunately for us he soon outgrew his job behind the counter. Within a year he was back in Fort Worth, operating a store of his own. At least it is a store within a store. If you ask for the radio department at Stripling's you will find Charlie Farris on the job, the old smile and the bright "Good morning," still making friends, while parked behind the building is a snappy-looking Buick sedan waiting to take him home to lunch; for Charlie was one of those boys who in order to make a success of radio selling put in the work which success requires.

Little Journeys Into Radio Computations.

(*Continued from page 37*)

in the same units of meters, microhenries, and micro-microfarads. Now, if the inductance varies as the square of the number of turns, and the wavelength varies as the square root of the inductance, as shown by (7) and (8), then it follows that the wavelength varies directly as the number of turns. This affords a very useful short-cut in

computation, for it means that when we have a coil of a known number of turns which has been found by test to tune to a certain wavelength, in order to reach a higher wavelength all that is necessary is to increase the turns in the same ratio. For example, given the trap described above, using a 25-turn coil and a 0.0005 mfd. (500 mmfd.) condenser, which can be used as a rejector up to about 300 meters, how many turns will be required to trap out marine stations on 600 meters, instead of amateurs? For the latter purpose the circuit must be capable of tuning to 700 meters maximum. The ratio of 700 to 300 is 2.33 approximately. The number of turns required is therefore 2.33 times 25, or 58 approximately. A 60-turn spiral will therefore fulfill the conditions. In the same way the required number of turns for any other wavelength may be found almost instantly.

For parallel plate condensers the case is different. The wave length, as we see from (7) and (8), varies as the square root of the capacity. The capacity of any system depends, in general, on the area between the surfaces. But in a parallel plate condenser the effective area increases directly as the total number of plates, minus one. Hence the wavelength goes up as the square root of the number of plates, and if we substitute for a 23-plate condenser one of the same size, but with 43 plates, the new maximum wave length will be only 1.41—the square root of 2—times the former. The subject of calculation of capacities is treated adequately in the circular on

"Radio Instruments and Measurements" mentioned above.

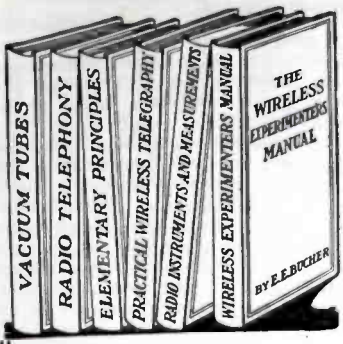
A word is in order about the general relation of mathematics to radio. Mathematics, being a specialized form of exact thinking, with its own rules and technique, is very distressing to many people. Just as many broadcast listeners are interested only in what radio can bring them, and refuse to bother with technical terms and procedures, so numbers of experimenters, who are trying eagerly to become competent technicians in the new field and are garnishing their conversation with so many engineering expressions that their friends can no longer understand them, balk at the exact statements and analyses which constitute practical mathematics. The position of the non-technical BCL's is, however, strictly logical; they demand the product and are willing to pay others to develop it. The experimenter who shies at an equation is in a much less tenable position. He wants to know how the thing works and why, and at the same time he discards the only means of definitely arriving at the answers to these questions. This gets him nowhere. There is no royal road to knowledge, and in order to solve physical problems one must use the specialized form of logic developed for that purpose. For most purposes, in the radio field, an acquaintance with simple algebra is sufficient. Whatever fourth dimensional calculus may be, algebra is not a forbiddingly difficult subject; anyone who really wishes to can learn it and make himself independent of the cumbersome analogies and picture puzzle devices which encumber the semi-technical press. Hydraulic analogies and the like have their place, and I do not mean to criticize their use, within limits, and as auxiliary methods of teaching; but outside of their proper sphere they merely complicate the problems they attempt to deal with. For those who are seriously interested the best procedure is to learn the proper method in the first place.

Information Desk

(*Continued from page* 68)

terminals—two of which are marked "filament" and connected to the six-volt supply and the other marked "grid" which is connected to the slider of the potentiometer. (See 2.)

When the slider is adjusted to the midpoint of the resistance there is no voltage variation at this point. Therefore, if all return leads to the filament from the plate and grid circuits are connected to the slider, the voltage on these electrodes will not vary as would be the case if the return leads were brought to either side of the filament. It is not necessary to use a potentiometer;



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on

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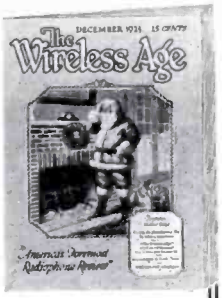
Pick out the books you want and Buy at these Rock Bottom Prices



Here is the greatest list of radio books ever presented. In this list are books that are known and used the world over.

Our stock room is overcrowded—we must reduce the weight per square foot. This gives you the chance to buy these books at a tremendous saving. Take advantage of this opportunity to complete your radio library.

BOOK	AUTHOR	Regular Price	Class No.
Practical Wireless Telegraphy	E. E. Bucher	$2.25	35
Vacuum Tubes	E. E. Bucher	2.25	35
Wireless Experimenter's Manual	E. E. Bucher	2.25	35
How to Pass U. S. Government Wireless Exams.	E. E. Bucher	.75	10
How to Conduct a Radio Club	E. E. Bucher	.75	10
Alexanderson System	E. E. Bucher	1.25	18
Radio Telephony	A. N. Goldsmith	2.50	37
Practical Amateur Stations	J. A. White	.75	10
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Acquiring the Code	Gordon	.50	6
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Pocket Dictionary of Radio	Ward	1.00	15
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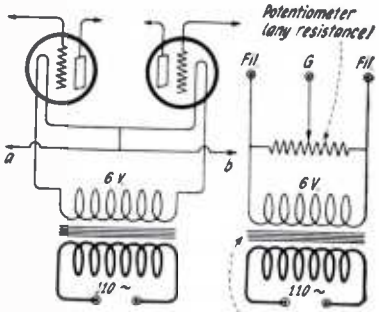
the center or neutral point may be obtained by a center tap on the secondary of the transformer or by a suitable arrangement of the filament circuit as shown at (1). However, best results may be had by use of a potentiometer.

A few years ago we conducted numerous experiments with this arrangement and found that it was well to limit its use to one tube (preferably in a regenerative detector circuit) and that the filament should have slow heating qualities so that the rapid variations in filament supply would not appreciably affect its temperature, for otherwise the plate current would vary in accordance with the filament fluctuations. It was found advisable to have a condenser in the ground lead—or use a counterpoise—rather than a direct ground.



a and b : return leads from grids and plates
Fig. 1

Step-down transformer
Fig. 2

As to the practicability of this system we would hesitate to recommend its use to any but experimenters, especially as much superior results may be had with the "dry cell tubes" now on the market.

Are "By-Pass" Condensers Necessary?

Mr. Frank Johnstone of Chicago, Ill., writes: "In a recent issue of THE WIRELESS AGE, *I notice several diagrams in which 'by-pass' condensers are not shown—why is this?"*

They were omitted because they were not necessary. We have found, in countless experiments, that on the whole by-pass condensers are uncalled for—provided the low frequency output is located in the low potential side of the radio frequency section as it usually is. In reflex circuits the condensers spread here, there and everywhere are usually unnecessary as the writer has proved not only to himself, but to many people in radio.

Incidentally the omission of unnecessary parts is one of the main endeavors of the Technical Department.

Storage Battery I. C. W. Transmitter

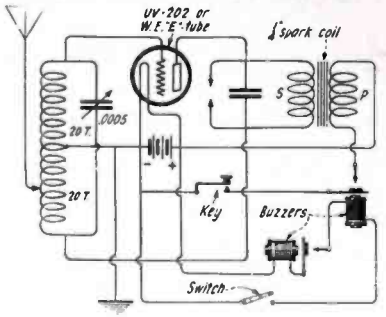
Mr. H. E. Boyle of New York wants "a diagram of an I. C. W. transmitter with a six-volt storage battery for the filament and plate supply."

We are showing on these pages a circuit diagram of a one-tube transmitting set using a "spark coil" operated from a storage battery for plate supply.

The inductance may be wound on a form 4 inches in diameter with 40 turns of No. 18 wire spaced about 1/16 inch. Taps are made from the plate end of the coil to the center at every other turn. The filament is connected to the center tap. The tuning condenser should be one that can safely stand moderately high voltages and should

be of good electrical and mechanical design, of course. A porcelain tube socket is preferred.

Either a small ¼-inch spark coil or a specially designed step-up transformer can be used in the plate circuit. The vibrator is screwed down tightly and two buzzers are arranged to make and break the primary circuit. By placing the key in the indicated position there is less chance of the contacts "sticking"; consequently a pleasingly smooth tone can be secured.



The value of the condenser across the secondary should be sufficient to reduce the plate voltage to a safe point; this can be determined experimentally by adding capacity till there is no "spark over" in the tube.

Connections to the secondary of the spark coil should be turned about for best results.

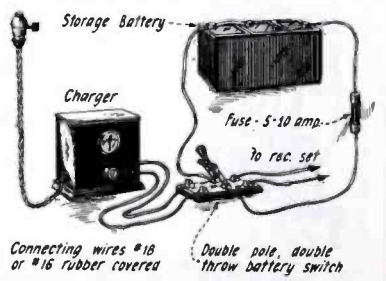
The equipment may be mounted on a hard wood base about 10 inches long and 8 inches deep. If desired the tuning condenser and switch (together with an 0-1 antenna ammeter) may be mounted on a small front panel. Wiring may be of No. 18 or heavier hard drawn copper wire.

Much additional construction and operating data on all types of modern C. W. transmitters may be found in "Radio Telephony for Amateurs" by Stuart Ballantine, published by The Wireless Press, New York.

No Fussing With This Battery Switching System

Mr. O. W. Holmes of Dallas, Texas, writes: "Please publish a circuit diagram of a battery switching arrangement which will enable me to throw the 'A' Battery on or off charge instantly."

A suitable circuit is shown on this page. A double-pole double-throw battery switch is employed; the two center contacts are



connected to the "A" battery with a fuse in one line. Two of the remaining contacts on the switch connect to the charger while the last two switch contacts are connected to the filament battery binding posts on the receiver.

STATIONS WORKED AND HEARD

Stations worked should be enclosed in brackets. All monthly lists of distant stations worked and heard which are received by the 10th of each month will be published in the next month's issue. Spark and C. W. stations should be arranged in separate groups.

8YAE, 8ZE—OBERLIN COLLEGE, Oberlin, Ohio.

(1ajx), (1aqi), (1aze), (1bhk), (1biz), (1cki), (1il), (1ju), (1mp), (1zd), (2aco), (2anm), (2auy), (2ax), (2beo), (2bgd), (2bms), (2bqh), (2cfb), (2cqd), (2chq), (2cvj), (2bms), (2bqh), (2cfb), (2chq), (2cvj), (2cwj), (2cxl), (3ajg), (3bfs),) (3bva), (3blc), (3cbl), (3cbv), (3cg), (3cn), (3sp), (3wf), (4eb), (4hs), (4jk), (4mi), (4mv), (5amh), (5gj), (5in), (5nl), (5uk), (6xb), (5zav), 6bm, 6ec, 6ez, 6gt, 6gr, 6if, 6ii, 6ka, 6kg, 6lv, 6sk, 6zh, 6zw, 6zv, 6aak, 6afq, 6akz, 6alk, 6aos, 6apw, 6arb, 6aru, 6avv, 6awt, 6bbc, 6bcl, 6bck, 6bic, 6biz, 6bkx, 6bmc, 6bnc, 6bnt, 6boe, 6bqb, 6bua, 6buo, 6bum, 6bve, 6bvg, 6cbw, 6cdg, 6cgd, 6cfm, 6cgw, 6chl, 6cib, 6ckp, 6ckr, 6cmh, 6cmr, 6dlf, 6xad, 6zar, (x6tv), 6zba, (x6cfi), 7abb, 7adr, 7afo, 7bj, 7co, 7hg, 7it, 7iw, 7ot, 7px, 7zg, 7zu, (9aav), (9adw), (9amz), (9ape), 9apf, (9aps), 9avs, (9awk), (9ayp), (9bav), (9baz), (9bgi), (9bfi), (9bhn), (9bkb), 9bji, (9bjl), 9bjk, (9brk), (9brt), 9bto, (9chn), (9clq), (9crx), (9cyf), (9daw), (9dc), (9dkv), (9dky), 9dqh, (9dxl), (9eak), (9ebt), (9ehm), (9ej), (9elq), (9mf), (9ot), (9zt).

Canadian—(2bn), (2cg), (3ia), (3xn), (3bm), (3om), 5cn, 5go.

RAYMOND GROEBE, Elizabeth, N. J. (December).

4ai, 4aq, 4ay, 4db, 4eq, 4hs, 4ja, 4jz, 4ob, 4sm, 5aac, 5adh, 5ahj, 5aiu, 5ama, 5amh, 5bm, 5ek, 5er, 5ht, 5iu, 5kr, 5lr, 5na, 5nn, 5ov, 5qd, 5qw, 5vv, 5xk, 5xas, 6ajr, 6aol, 6avv, 6bfg, 6bqk, 6bua, 6bvs, 6cfz, 6cgw, 6chl, 6cmr, 6cnl, 6fp, 6lv, 6zh, 7adh, 7bj, 7co, 7lu, 7zd, 7zu, 9aar, 9apf, 9aqb, 9avn, 9avf, 9awd, 9bji, 9blg, 9boo, 9bri, 9bto, 9bzg, 9ccn, 9ccs, 9ccz, 9cga, 9ckm, 9cmk, 9czg, 9daw, 9dfh, 9dgi, 9did, 9dlm, 9dlw, 9dof, 9dqu, 9ear, 9eea.

Canadian—1dd, 2am, 2be, 2bg, 2bn, 3nf, 3ni, 4cl.

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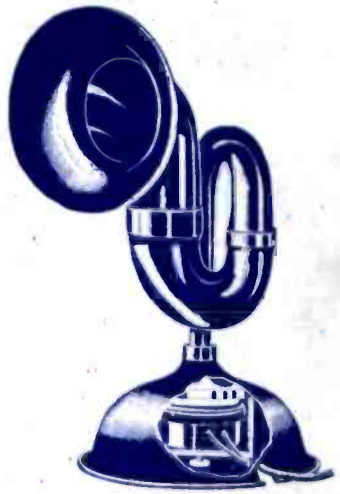

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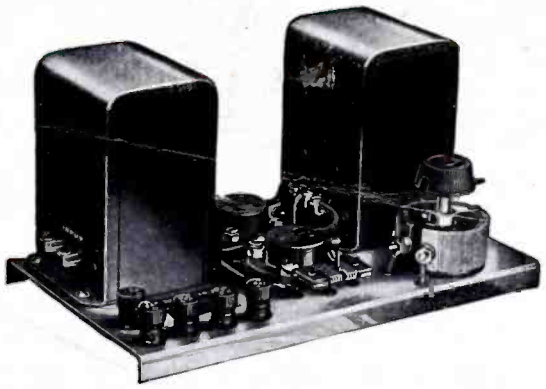

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The type 441 may be used with either the UX-226, UX-326, or UX-171, CX-371 tubes.

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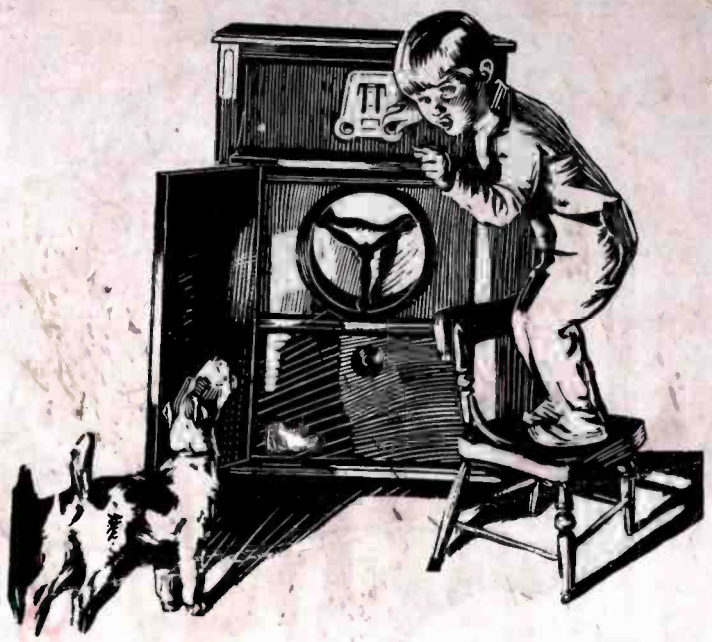

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