RADIO BROADCAST

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Sound: First and Last in Radio

The Romance of Radio—Radio the Superlative Degree of Communication—Sound and Radio—Importance of Scientific Knowledge of Sound in Broadcasting—A Discussion for Layman and Technician Alike

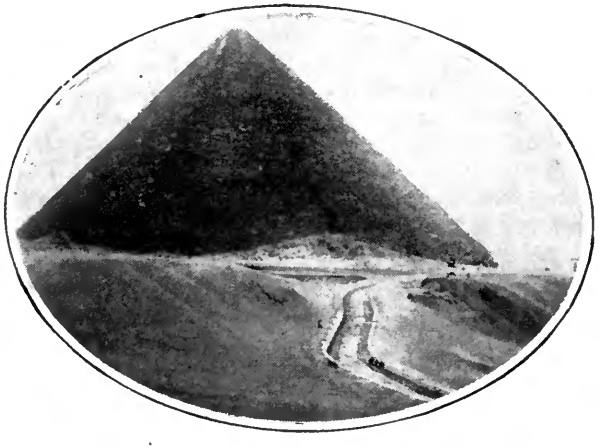
By B. F. MIESSNER

Consulting Engineer, Wired Radio, Inc.

"GENII," said Aladdin to the phantom who appeared as he rubbed his wonderful magic lamp, "build me a palace fit to receive my betrothed, the Princess Buddir al Buddoor. Let it be built of porphyry, jasper, agate, lapis lazuli, and the finest marble of various colors and surmounted by a dome of gold and silver. Let there be a spacious garden, a treasure house filled with jewels and precious metals, kitchens and store houses, stables and horses, and a royal staff of servants."

It was about the hour of sunset when Aladdin gave these orders and the next morning before the break of day, the Genii presented himself saying, "Sir, your palace is finished."

Who among us does not remember with delight this story from the Arabian Nights of the boy Aladdin and his wonderful lamp? He had only to rub his lamp and give his commands to the Genii who immediately appeared to obtain whatsoever his boyish heart desired.



THE PYRAMIDS OF CHEOPS

The secret of their building died with the dynasties that built them. Had modern arts of communication then been developed, the constructional marvels in building them would now be known

If Aladdin were to come to life to-day he would rub his eyes and not his lamp, for millions of real magic lamps are in actual use in hundreds of thousands of homes. He would find the users of these lamps are not in a fairyland of myths and fables, but in a land just as entrancing and even more won-

derful because of its reality. What would he think and feel, and say if you sat him down in your own home before your own magic box with its magic lamps, turned a few knobs and let him listen to the music and voices of half of the world? How could it be possible to hear these wonderful things and still remain at home?

In the twinkling of an eye you can take him on explorations over thousands of miles, from your own cozy fireside to the gay, bustling life of great cities, the shivering blizzards of the North, the languid summers of the South, or the quiet of the great West.

Can there be any among us with imagination so cramped or mind so rigidly harnessed to daily tasks that he cannot see and feel the romance and power of radio?

But now there comes among us a great and wonderful new thing that reaches us, not through the all-seeing eye attributed to God alone, but through an all-hearing ear—radio—which each and every one of us may own. The "Call of the North," the "Voice of the South," the "Heart of the West" all are here in the air we breathe, pervading even our very own bodies, wanting only the magic ear to translate their ghostlike presence into the living, breathing voices of song, of eloquence, of entertainment, of instruction or knowledge.

Something About Sound

Most of us have heard a great deal of talk about "distortion" in radio. That unfortunate word is coming in for a rather severe doing by a great many who have no idea what it means. It is running "efficiency" a pretty close race for the title of radio's most overworked word.

Mr. Miessner, the author of this, the first of a series of articles on the application of acoustics to radio, knows what he is talking about and has that rare ability in an engineer, of making his ideas understandable to others without first insisting upon a thorough discussion of something as remote as the fourth dimension.

Whether you are interested in radio technique or not you will find this accurate statement of fact entertaining and will, we feel sure, when tempted to criticize some flaw in the art, realize that astounding progress has already been made, and marvel with us at the wonderful results now being obtained by the contortions of two little diaphragms.

—The Editor.

RADIO LENGTHENS OUR EARS

IN RADIO, we are developing a means through which the sense of hearing may come to mean more, perhaps, than vision ever meant. All of the value that sound and the hearing of it ever possessed, is now being multiplied thousands and millions of times by this new and wonderful servant, which finds its way into every nook and cranny of the world with the speed of lightning. This sixth sense reaches out over bounds and barriers and brings back to our own hearth stones, the voices and sounds of all the world. Radio is to the ear what the telescope is to the eye.

Progress is impossible without some means of communication, and in radio a new means of communication has been given to mankind. It is a far cry from the crude signalling of olden days, by smoke clouds, semaphores, or runners, to the telegraph, telephone and radio of to-day.

When one Indian, craftier than his fellows, discovered a method of chipping flint for his arrow heads, it took thousands of years for that bit of knowledge to spread over a single continent. What has become of the lost arts of the Egyptians in the rearing of the pyramidal tombs of their Pharaohs, in embalming, in glass making? Think of the tempered copper process of the Aztecs now lost to mankind, wiped out together with its creators, for the lack of means to spread their knowledge to the rest of the world.

The progress of the ages from stone, to wood, to iron, to steam and to electricity, is a story interwoven with the development of communication.

WHAT IF WE ONLY HAD SMOKE CLOUDS?

CONSIDER for a moment the effects on you and me, if we still had only the smoke clouds of the Indians, the runners of the ancient Greeks, or even the town criers of our own Colonial days instead of our telegraph, telephone, cables, newspapers and now the radio. What would have become of Watt's steam engine? It would surely have been buried where it was born and the age of steam might never have come over the world. What would have become of Lister's antiseptic, the printing press of the Chinese, Whitney's cotton gin, Dalton's atomic theory, Daguerre's photography, the motion picture, the phonograph, the flying machine, and the

other stepping stones of our present existence? Where would we be along the road of progress, if Edison's electric light was still only common knowledge in the little community of West Orange, N. J.? How could our great cities and complicated modern life be possible if all the wisdom that individuals and groups have hewn out for themselves the world over were not made available to each one of us by means of our modern methods of communication?

Radio broadcasting is one of the really great developments of this rapidly moving age.

SOUND WE BROADCAST AND SOUND WE RECEIVE

RADIO as we know it to-day is primarily an acoustical instrument. The intelligence we send by radio is the intelligence conveyed by sound. The transmitting and receiving apparatus serve merely to transport sounds from one place to another or to many others. Its intricate electrical factors are merely a part of the whole whose one function is to reproduce *sound*. It is *sound* that we broadcast and *sound* that we receive. From microphone to loud speaker each part serves merely as a link in the chain which connects one place with another by *sound*.

The success of the whole scheme of broadcasting as an instrument of communication depends upon *how accurately* sounds in one place can be reproduced at another. To perfect the instrument then, we must concentrate our attention on this single purpose. We must understand the place of sounds in our own normal existence, know their nature physically, and how the links in the apparatus composing the broadcast chain fit this purpose. We must forget for a while the numberless variations of a few radio circuits, stop talking about batteries, distance, and other incidental matters, and spend some of our collective energy on the real fundamental thing we are most concerned with—the acoustics of radio.

Sound, though few of us realize it, exerts a tremendous influence in our daily lives. Of all the five senses, seeing, hearing, feeling, tasting, and smelling, hearing is surely one of the most important.

How many of us have ever stopped to think of this world of sound and what it means—how sound can tell us of the myriad things going on about us, the presence of which we might otherwise never know! We are constantly alive to these sounds—hearing them, classifying them—picturing the things producing them—interpreting them and their meanings—all without effort, subconsciously—automatically translating them into whatever meaning they may have for us.

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THE TOWN CRIER

Was the time-honored method of communication for a long period. He depended on sound, and to-day, we depend on sound, through the radio, the telephone, and the telegraph

SOUND RULES OUR DAILY LIVES

AS I sit here in my study with all my senses, save hearing, voluntarily cut off from the outside world, I can still retain a remarkable moving picture of what is going on about me as conveyed to my senses, alone through these subtle influences called sound. Because sound is a result of action, it is action or motion of some kind that we sense when we hear sounds. Every sound we hear is produced by motion of some kind. Nearly all sounds, therefore, are suggestive of action and are so interpreted as we listen.

Through my open window I hear a certain sound that is unmistakably the rustling of the leaves of a tree in the breeze. I hear an intermittent banging which is without question a carpenter hammering on a near-by house. A certain snip-snip tells me my neighbor is trimming his hedge—another whirring rattling noise says another mows his lawn. Shrill, trilling sounds tell of crickets,

other of frogs and birds or other insects, quite as clearly. A continuous characteristic rumbling and heavy bumping tells of an approaching automobile. Without seeing, I know it has stopped before my house, that the driver gets out, walks up to our door, raps on it, that the door is opened, that he asks for information, gets it, and departs! I can tell that it is an electrically driven car and know he goes on and not back.

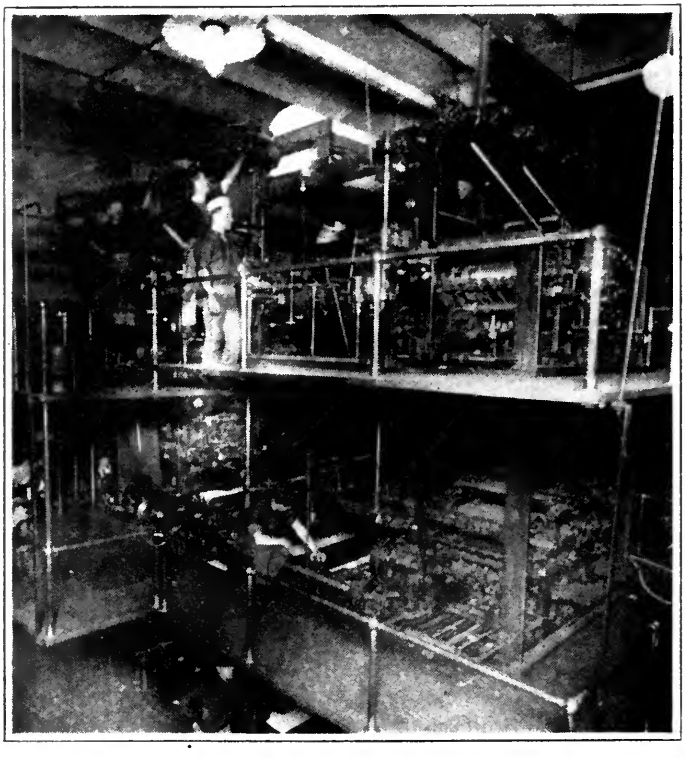
WE CAN ALMOST SEE BY SOUND

ANOTHER car approaches, getting louder and louder. The motor slows and I hear a slight creak of the brake; now the motor races furiously with a short grinding and whining and the motor again quiets with another brake creak; then another furious racing and grinding for a moment and as the pitch lowers these sounds weaken and disappear amid the other remaining sounds.

How do I know that this was a Ford motor car and that it turned in my driveway, backed out and around and went back the way it came? That is a difficult question to answer, but I am just as certain as if I had *seen* it with my eyes.

I hear other sounds that I know come from a piano. I know, too, that they come from a house across the street and am sure are produced by a player action and not manually. Only the three first beats are necessary to tell me that the selection is Rachmaninoff's "Prelude in C Sharp Minor."

Our sound memory retains accurate records of literally millions of different sounds just as our visual memory retains pictures of endless kinds and arrangements of visible objects. With vision we classify and distinguish ob-objects by form, position, movement, surroundings, and color. By long accumulated experience we have grown proficient in the art of describing them by words. But with sound it is very much more difficult. We can describe the appearance of a pipe organ unmistakably, but to describe its sound accurately is quite another matter.



THE PRINTING PRESS

Of the newspaper and the magazine and the book spread intelligence today in quantity and efficiency undreamed of in earlier days. The knowledge of how to use the press filtered through Europe and America through the aid of greatly developed methods of communication

We can with relative ease describe a person with whom we are familiar, but are quite completely at a loss in truly picturing the sound of his voice. And so while we live all our lives in this world of sound hardly realizing its presence, it is constantly conveying a remarkably great and accurate knowledge of our surroundings, of the ideas our fellowmen wish to convey to us, and very much more besides by the association of ideas in the realms of the other senses.

Realizing this we become interested in sound objectively. We want to know what it is that we call sound, why sounds differ, and how we hear.

Most of all we are interested in sound because we are interested in radio. We have come to realize what a wonderful, far-reaching influence broadcasting is coming to have, and because we know that broadcasting is the art of instantaneous reproduction of *sound*, we

know that we must understand sound in order to reproduce it accurately.

Radio reproduced sound is *not* the same as the original and the degree of similarity varies with the character of the sound. Some sounds reproduce well enough that our understanding or pleasure in listening is not marred.

HOW RADIO CHANGES SOUND

OTHER sounds reproduce so poorly that we cannot understand or enjoy them. For instance, a banjo or violin, with the best equipment now available, are reproduced with considerable accuracy. The degree of similarity may be as close as that between a man himself and a good photographic likeness. However, in the man himself, many details can be observed which are not shown in the photograph. Likewise with these original sounds and their reproductions. Other instruments like the piano do not reproduce so accurately. Some tone ranges are good, others poor. The upper mid-range reproduces well, but the extreme high and extreme low are poor. The very high notes are far too weak and the extreme low notes are much too thin and lacking in the powerful rounded smoothness produced by the piano tones themselves. Here the likeness may be as close, say, as a pen and ink sketch of the man; it is recognizable, but there is considerable detail missing.

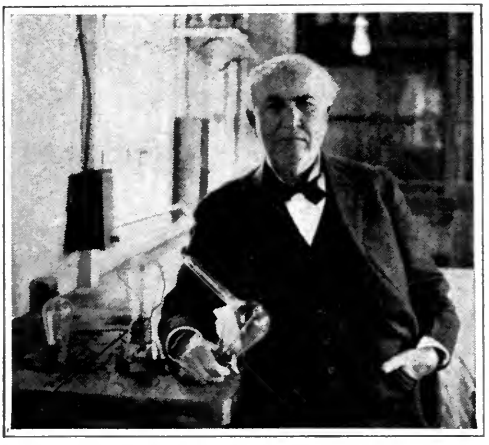
SOUNDS THAT RADIO DOES NOT REPRODUCE WELL

WITH the bass viol, the reproduction amounts to hardly more than a caricature, and it requires considerable imagination to recognize it.

In general, there is a lower level of loudness in the reproduced sounds for high and low pitches, and in somewhat the same manner very weak and very strong sounds are suppressed.

In a broadcasting studio we can easily hear the faint ticking of a clock across the room, but this would never be heard at a reproducing speaker. If a very loud sound like a pistol shot or drum beat were made with almost painful intensity in the studio, the reproduced sound intensity at a receiver would be greatly lacking in volume.

These differences between the reproduced sound and the original are caused by what we call distortions. They are produced in many different ways and cause a wide variation from the ideal true likeness of the reproduction for the original sound.

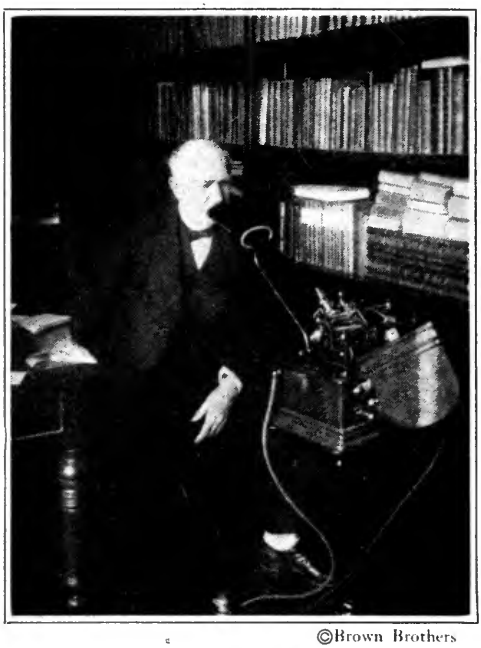


IF THOMAS EDISON AND HIS LAMP
Had been known only in West Orange, the world would still be backward in its development

Who has not viewed himself in a poor mirror or in those of a curved form such as are found in the large amusement parks? Who has not viewed moving pictures from a side seat near the front or looked through improperly fitted eyeglasses? What we see is sometimes a very grotesque and unnatural reproduction of the original which is due to incorrect relation of the various lines and parts one to another. Surely everyone has looked through colored glasses and has seen all colors save one subdued and that one accentuated. A ghastly example of such color distortion occurs in mercury vapor lamp illuminations as used in moving picture studios or factories. Color in Optics, and pitch in Acoustics are very similar, and very similar distortions occur in both.

SOMETHING ABOUT DISTORTION

IF WE take a mixture of all colors such as we have in sunlight or other white light and send them into a room through a colored window glass, the light in the room may be said to be distorted. Objects illuminated by it appear very different than in white light. If the glass be tinted only slightly the distortion may be small, and other colors may pass through in reduced intensity. But if the color be deep, only one color passes through and very great distortion results, such as occurs with the violet mercury vapor lamps. These give out monochromatic or one color light, and only that color in objects illuminated by it is visible.



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THE PHONOGRAPH

Is an excellent example of the development of communication and exchange of ideas by sound

A complex sound like that of an orchestra contains a very wide range of pitch in its tones and is similar therefore to white light in optics. If such a mixture of tones passes through a horn or diaphragm or other acoustic device which possesses a strong tone characteristic, the sound passing through will be distorted. If the tone characteristic is marked as in certain kinds of acoustic windows (glass globes with ear tube and sound opening) called Helmholtz Resonators, practically only one tone will be heard. All others will be suppressed and this one will be accentuated. Obviously, the distortion would be so pronounced that what was heard through the acoustic window would be only a very grotesque acoustic caricature of the actual music of the orchestra.

Horns, diaphragms, and various parts of the electrical equipment in a broadcast system possess this tone color characteristic which greatly influences the final reproduced sound. Furthermore, some sounds entirely absent from the broadcasting studio appear in the reproduction.

NEW SOUNDS IN THE RADIO RECEIVER

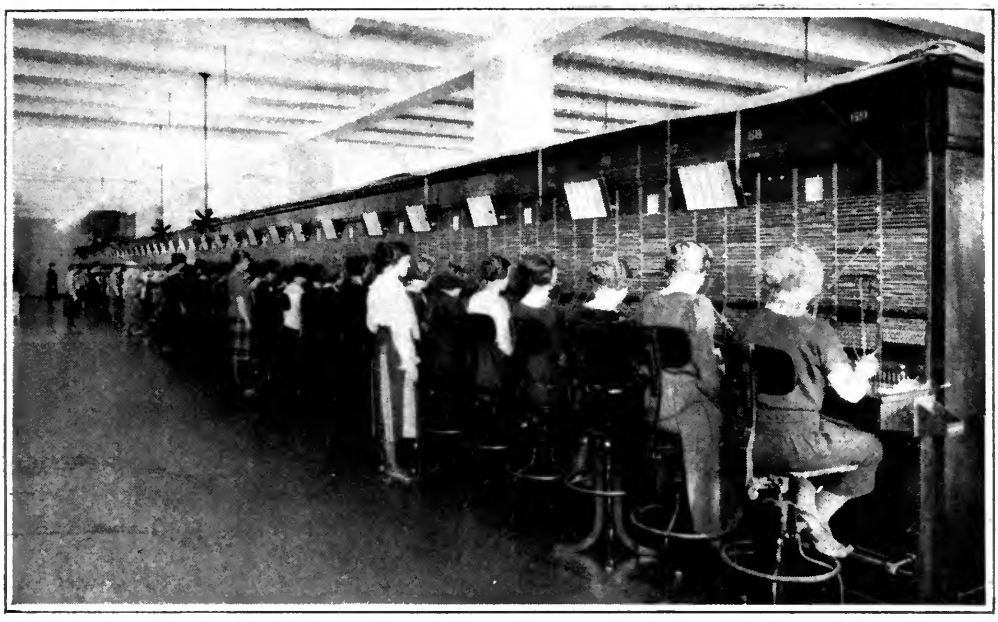
HOW serious this distortion is, few fully realize. But if one has things so arranged in a broadcasting studio that he can listen to either the original sound in the studio or to its radio reproduction from a loud speaker in an adjoining room merely by the opening and closing of a sound-proof door, a tremendous difference is apparent. Until the reproduction is indistinguishable from the original, the true object of broadcasting cannot be accomplished.

Realizing then that there is room for great improvement in the reproduction of sounds by radio, we must turn our attention first to the physical nature of sound, insofar as it is related to this process of radio reproduction, and then to the various elements of the radio system whose function it is to convert the sound energy into the various other forms necessary in radio and back again into sound. It is here that the inaccuracies and distortions in reproduction creep in. The original sound energy cannot itself be sent to great distances. Radio, a totally different kind of wave energy, is called into play. These radio waves have the peculiarly fitting property of being silent unless properly translated, and they can be sent to an unlimited number of distant localities at once.

Since sound waves cannot be converted directly into radio waves, other conversion steps must intervene. In some of these converting elements of the system, the original sound vibrations exist as physical or mechanical vibrations, in others, as magnetic or electric vibrations. In order to accomplish the final result, many transformations and retranslations of the energy occur.

When one considers the complexity of these processes, it seems remarkable that the final result is so good as it is. Consider for a moment a piece of fine literature of intricate grammatical structure with deep and wide emotional appeal. Let this be translated from, say, the original English first into Chinese, then from Chinese into German, again into Greek, and farther through perhaps a dozen such translations and finally again back into the original English. Would it be surprising if only the crudest outline of the author's meaning appeared in the final retranslation?

And yet, this is what, in effect, is done every day in the process of radio broadcasting and reproduction. The final translation into sound, considering the intricate nature of the process, retains a remarkable likeness to the original. For this degree of perfection thus far attained the major amount of credit must be given to those who have devoted their careful attention and attacked the problem as one of



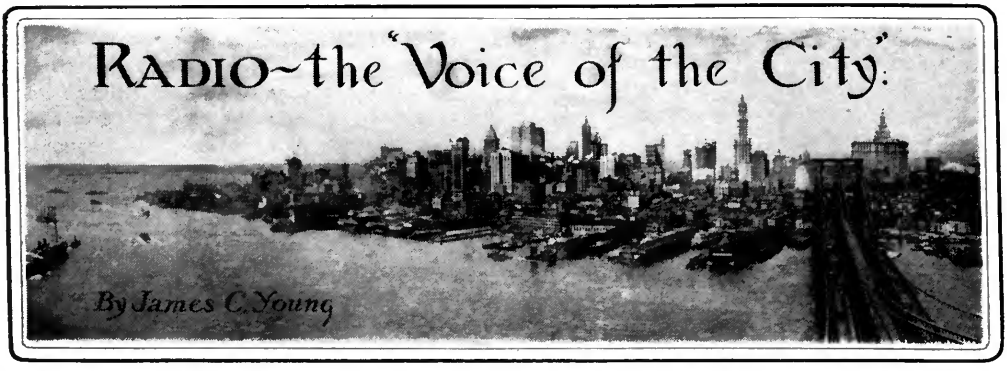
IN THE TELEPHONE EXCHANGE

Enormous quantities of communication by sound pass every day. In wire telephony, as in radio telephony, we send out sound and sound we hope to receive at the other end. Too little attention in radio has been paid to the fact that we want perfect sound at both ends of the circuit

acoustics. Improvement in this art will be made only by a deeper study of the nature of sound and its relation to these many translating devices like the microphone, the amplifier, or the loud speaker which comprise the radio sound reproducing system.

A second article by Mr. Miessner will discuss in a most interesting fashion, the physics of sound. It will appear in an early number of this magazine.

RADIO~the "Voice of the City"



By James C. Young

WHEN WNYC sends out its evening call from the high Gothic tower of the Municipal Building on lower Manhattan Island, it speaks with the voice of the only American city which commands a place "on the air." To put the matter a little differently, this is the single station owned and maintained by an American city. Perhaps it may seem strange that this should be the one truly representative municipal station at a moment when institutions of every sort are turning to radio with a sure instinct for publicity. But plans under way may be expected to result in several new municipal stations. A half-dozen others scattered across the country fall into this classification, although not directly owned by local governments. Thus it may be said that the day of the municipal station has definitely arrived; that the personalities of cities are to be made familiar throughout the ether.

This development brings far-reaching considerations. Some observers affirm that the municipal station will be freer of prejudices and restrictions than any other kind of station possibly could be; but another phase of public opinion holds that the political element is likely to become troublesome. Doubtless, the true estimate lies somewhere between these extremes. It is beyond question that the next year or two will witness the installation of municipal plants in growing numbers.

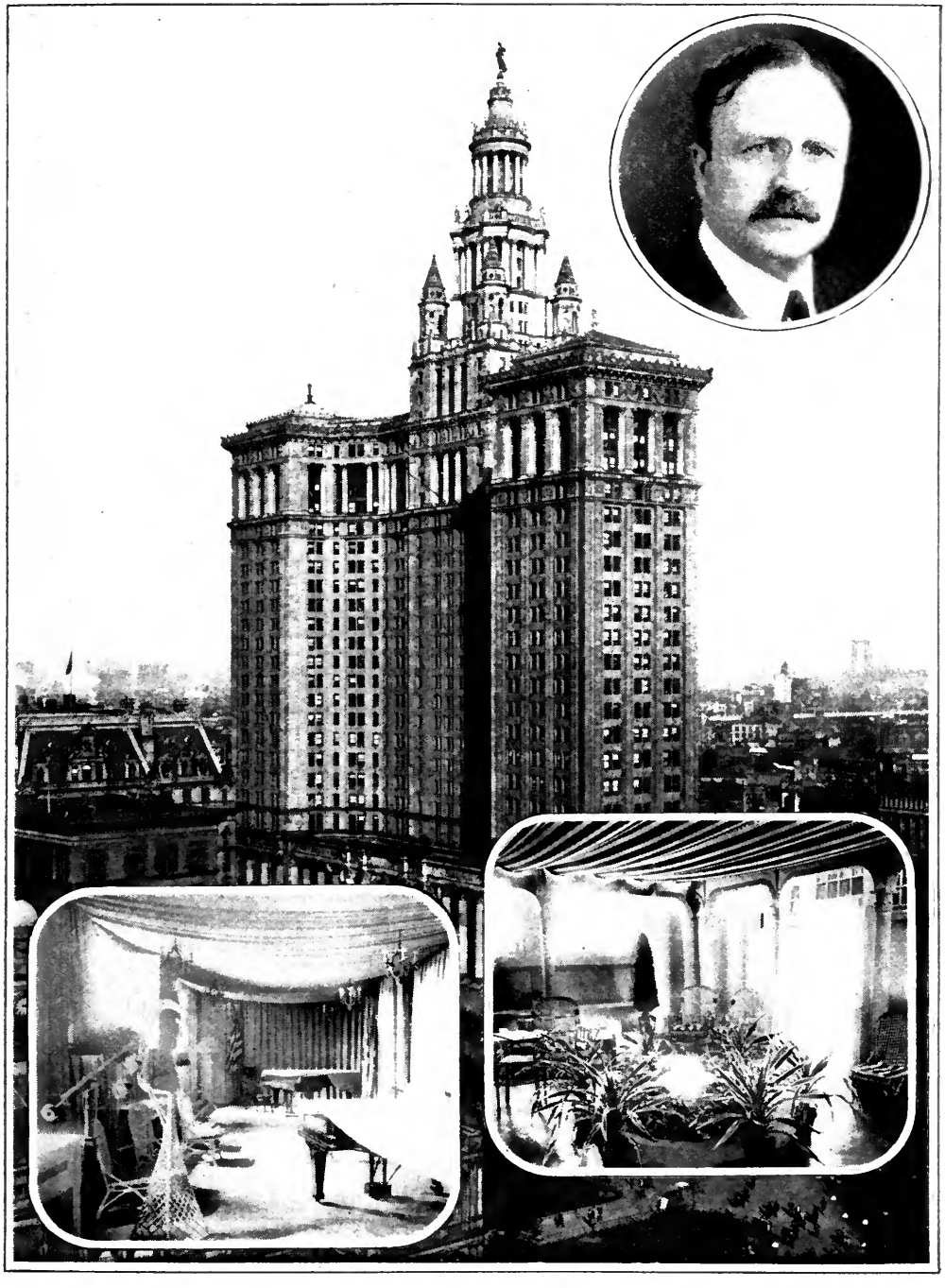
Long ago a famous poet asked the Roman populace to "lend me your ears." That same request is being made to-day in the name of American cities, anxious to command a hearing from the world, by means of radio. A forcible case in point arose when WLAG shut down in Minneapolis. Instantly the city government, the community's business men, and the community itself, felt the loss of prestige. An old friend had departed. Instead of the fair name of Minneapolis being wafted around the world every night, the microphone was silent, and Minneapolis suffered.

Such a condition could not be tolerated in a city so fair and hustling. A number of its citizens said that "something should be done about it," and presently something was done. The Washburn-Crosby Company, the big millers, offered to assume all liabilities in addition to half the cost of maintenance for three years, at $100,000 a year. Ten other business concerns came forward with the necessary $5,000 each, and now Minneapolis has its station going again, better than ever, perhaps; every night cities throughout the world may listen-in across the reaches of space when their neighbor entertains. Incidentally, St. Paul shares in this glory and the expense. Its quota of the $50,000 is 40 per cent.

WHERE MATTER DOES MORE THAN SERVE MIND

THE experience of Minneapolis is a typical instance of the associations that gather around a radio station. It is something more than a mere mechanical creation; indeed, this is a place where matter is harnessed in the service of mind. It is a poor sort of station that does not develop a definite identity in the consciousness of a multitude. If we reason upon the matter, we must see that this result cannot be escaped. Even the voices of announcers become so familiar that the absence of one for a night is promptly detected. When the personality of a man is so easily conveyed and understood, how much greater is the opportunity to spread broadcast the civic spirit which distinguishes many cities.

And cities throughout the land are beginning to understand the possibilities which await. Late they may be in starting, but it is likely that their alacrity in catching up will more than offset the delay. Boston is contemplating a station near the Parkman bandstand on



THE VOICE OF NEW YORK CITY

The New York Municipal Building. The top insert (photo © Underwood & Underwood) shows John F. Hylan, Mayor, under whose administration $50,000 was spent in purchasing the station. The two lower inserts show the elaborate reception room and studio of the station

Boston Common to be connected with all of the sixty-five parks in the city. Many of these parks are provided with stands for music and speakers in the summer months. It has been proposed so to arrange the system that a concert or address in any park could be picked up and radiated from the central station. Or a varied program might be supplied by means of selections from the several parks. At other seasons indoor programs would offer opportunity to let the world know that the spirit which once flared on Boston Common still lives in the breasts of its citizens, but now applied to peaceful pursuits.

Probably no station in the country can offer more of interest than WNYC, New York's own. Situated on the twenty-fifth floor of the Municipal Building tower, it has special advantages of location. At 7:30 P. M., when the station "takes the air," lower New York has fallen into its nightly slumbers, after an intensive day. No place in the country is so much like a deserted village as is this section at that time. The big pile of the Municipal Building rises up in serried floors, overshadowing City Hall Park and the lesser buildings gathered around.

Away up in the tower, so far up that a man in the street below could not see the light, is WNYC. If a visitor be lucky and runs the gauntlet of elevator men, guards, and other functionaries, he arrives at the studio in time for a pleasant illusion. Stepping through the door of WNYC's own home means going from the marble and glass of an office building into a tented palace that seems to have been created for romance. There is a colorful awning suspended below the ceiling and brilliant cane furniture to match, with a fountain in the center where spraying streams converge over the changing hues of an electric globe.

WNYC

The cage antenna of the New York City municipal radio station atop the Municipal Building. The station first went on the air during the Democratic Convention and since has been the storm center for some acrimonious disputes. Mayor Hylan made an address about the transit situation, in which he attacked the Transit Commission. A member of the Commission demanded the right to reply from the same station, but was unwilling to have his speech censored by the Mayor. This was finally done, however

It required a vision of the first order to conceive this station and carry out its installation. The conception was that of Grover A. Whalen, until recently Commissioner of Plants and Structures, and a prominent figure in the administration of Mayor John F. Hylan. Mr. Whalen suggested the plan early in the year. Mayor Hylan thought well of it. Other officials opposed. It would cost too much money, maybe a prodigious sum. But Mr. Whalen said that he wanted merely $50,000. But, it was objected, that would not even purchase the plant. "Give it to me," said Mr. Whalen, in effect, "and I will show you."

From that $50,000 WNYC was installed and developed. Mr. Whalen first cast around for a station. He found that the station used in Rio de Janeiro during the recent exposition there, would be sold. And he became the buyer, in the city's name. The whole apparatus was shipped to New York and set up again. The plant corresponds exactly to the former WJZ station in Newark, of which it is a copy.

The first program was sent out on July 8, 1924. And from that day, WNYC has held a well-defined place "on the air." By degrees its programs have been turned into a definite direction which differs widely from the average program, intended for entertainment only. It is the announced purpose of WNYC to mix a larger measure of instruction and enlighten-

ment with its entertainment. That effort has been carried forward with a degree of success which raises up many interesting possibilities for other municipal stations.

WHAT CAN BE DONE WITH THE STATION

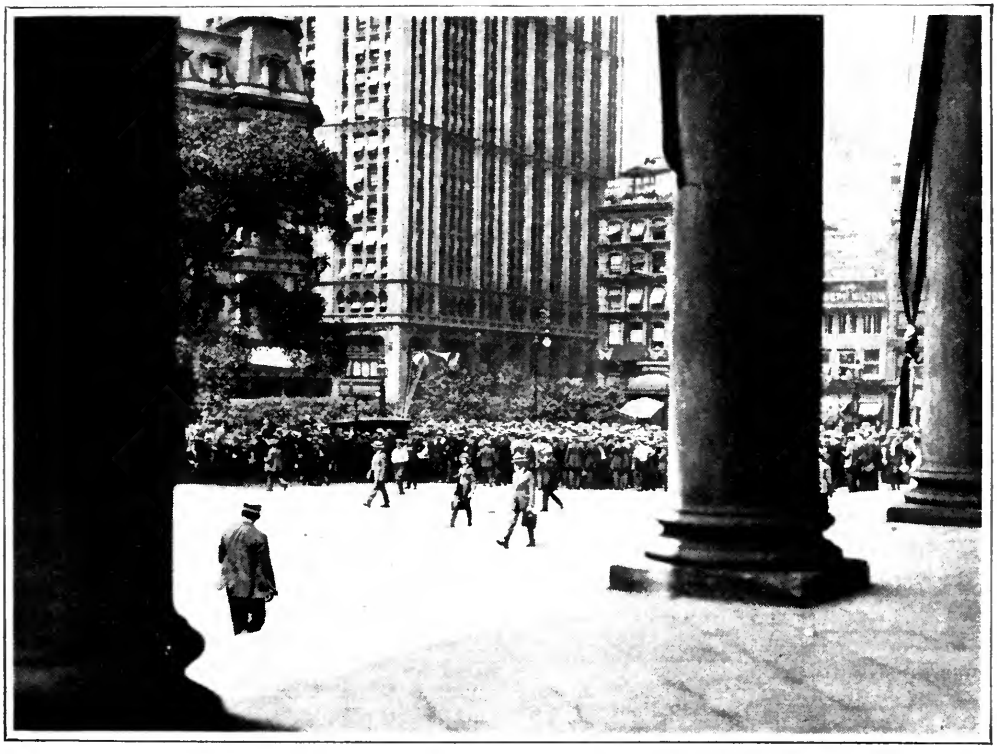
JUST now a plan is under advisement which would link the station with all of New York's 632 schools, scattered through five boroughs, comprehending some 300 square miles of ground. If a lecturer endeavored to visit these schools, one a day for 300 days a year, he could not reach the last in less than two years. Therefore it is impossible for any instructor in the schools to extend his influence beyond a few. By means of WNYC he could achieve the work of two years in a half hour.

That is but one aspect of the station's educational plans. It is expected to open radio extension courses dealing with many themes, along the lines already laid down by a number of colleges. These courses will be devised to reach the adult public sitting by its fire at night. The other educational programs will be broadcast during school hours.

Still another avenue of development has been opened by invitations to workers in almost any field who have substantial achievement to their credit. Not long ago the returning Olympic athletes described from WNYC just how it felt to come back victors from Colombes, after winning from the first athletes of the world. Such a message was largely entertainment, with a dash of instruction. But on the next night, perhaps, speakers from this station discussed such a momentous matter as the future of New York transit, one of the city's most difficult problems. In this case the entertainment was small indeed, but it may be believed that the instruction was not without value.

The mission of WNYC is not always entertainment or instruction. It has a grim purpose in part. Every night at 7:30 and 10:30 a man in blue coat and prominent brass buttons sits down at the microphone.

"WNYC broadcasting," he says, "for the New York Police Department. General alarm for Harry Martin, age 30, 5 ft. 6 in. tall, weight about 140 pounds. Dark face, with bold fea-



HOW THE NEWS IS SPREAD

Important events are broadcast from the municipal radio station and others in New York, and picked up by receivers and amplified so that great crowds may hear. The photograph shows crowds in City Hall Park, New York, in the shadow of the Woolworth Building, listening to broadcasting. The city, Mr. Young points out, may accomplish real service, with a properly run broadcasting station

WHEN SOMETHING IS SAID, PEOPLE LISTEN

Digests of the meetings of the Board of Estimate and Apportionment, the Commissioners of the Sinking Fund, and the Board of Aldermen are put on the air from WNYC in New York on the days these meetings occur. Besides the more political elements of the city programs, they also contain the usual musical and oratorical features

tures and frowning eyes. Has a slight limp. Dangerous man. Escaped from Welfare Island early to-day. Believed traveling west."

The listener rather catches his breath at such use of radio. It is an eerie thing—this pursuit of a man by air. An observer wonders what chance there will be of detecting Harry Martin among all the other men in the country of that general appearance. But his speculations are cut short by a new description which the officer is spreading far and wide. This time another man is wanted. And presently it is another, until the department has sent out particulars of some twelve or fifteen men whom the law demands.

A surprising number of these are apprehended, not always directly by the intervention of radio, but its use has become an invaluable part of an intricate whole. In a number of cases radio has made it possible promptly to broadcast descriptions of dangerous persons, with the result that their arrest soon followed. No quicker method is known to criminal procedure, and it has the power of drama as well. Descriptions of missing persons also are sent out, about four a day. Not long ago a stolen automobile was captured by a policeman on Williamsburgh Bridge within twenty minutes after the number had been broadcast from WNYC.

WHAT OTHER CITIES ARE DOING

LEAVING WNYC, busily engaged in its high tower, the next radio plant which the United States Department of Commerce classifies as a municipal station, will be found at Stevens Point, Wisconsin, using the call signal WLBL, and operated by the Wisconsin Department of Markets.

The West is progressive in the matter of municipal stations, for there is another near by, in Omaha, conducted by the Central High School, and known to many listeners as WNAL. The Boise High School in Boise, Idaho, has a municipal station identified as KFAU. In Dallas, Texas, the Police and Fire Signal Department of the city government operates WRR, while the Detroit Police Department owns and operates station KOP, and there is a sixth station, KFPR, under direction of the Los Angeles County Forestry Department.

These six stations, with WNYC, are commonly classified by the Department under the title of municipal plants. But the New York station has the distinction of being the sole station directly operated by any city government. It is likely that a similar plant soon will "take the air" in San Francisco, where somewhat jealous eyes have been turned toward Los Angeles and its station. The city council and various business organizations there have the details under consideration. If the city does not install a station, it is believed that private enterprise will supply the need.

Municipal radio stations enjoy some peculiar privileges. One of these is the willingness of entertainers to contribute their services. Although many entertainers find radio so rich in prestige that they are willing even to pay for the opportunity of broadcasting, it is one of the unsettled questions confronting the public and the owners of stations, as to how these services shall be compensated. In the case of municipal plants it seems generally agreed that the stations do not yield a profit to anybody concerned, and entertainers more willingly extend their help. This is an important consideration that calls up many other questions which must be answered. As the municipal plants develop and the demand for radio entertainers increases, people will certainly compare the municipal station with the other stations. And so now we have the old question of governmental competition—in a new way.

THE GREAT AND SILENT VOID WAITS

INSOFAR as the political phase is concerned, there seems little reason to believe that any city administration would overlook such opportunity to sound its praises. That is not in the nature of things—human or radio. But it is just as certain that any fulsome use of radio to spread word of the deeds performed by Mayor What's-his-name would be likely to fall upon a great and silent void. The radio public probably makes up the most sensitive audience which any speaker could be summoned to address. Political propaganda is not wholly unwelcome, as evidenced in the recent campaign for President, where it was tested on a larger scale than ever before. But it soon was learned that the best political speech was the shortest, a policy rigidly followed by speakers of all political shadings.

There is no reason, of course, why a political address should be objectionable. On the contrary, it frequently is enlightening. Few matters have a larger influence on the welfare of the nation than its government, and politics is but another name for government. The political address properly is a part of radio. But when all this has been granted, it is even more certain that the American radio public would not yield its ears for even five minutes to the man who dispensed bombast about himself. So it may be believed that the good sense of the public will be the surest check on the misuse of municipal stations by spellbinders.

With so many advantages evident to city, nation, and public arising from municipal stations, it requires but one scant glance to perceive that a number of these stations will be added to the radio resources of the United States. Perhaps in time the municipal station will take the place, in some measure, of the numerous stations which have sprung up because there was nothing better in the neighborhood. It is a fair guess that the average municipal plant will draw about it the best to be had in any city, as concerns both entertainers and public confidence. Such stations inevitably will crowd to the wall others of uncertain status that merely fill a gap in the evolution of radio.

SELLING PRESTIGE

IT IS wholly conceivable, even distinctly probable, that municipal stations will be rapidly financed in some such manner as the Minneapolis station. If a similar proposal should be submitted to the business communi-

ONE OF THE TWIN CITIES

—Minneapolis, Minnesota. When WLAG recently closed, business men of both cities felt that civic pride and actual definite benefits both demanded that the locality continue to have a broadcasting station. They raised sufficient money to operate the station and WCCO is the result. Mr. Young points out that a city broadcasting station can give a very important idea of the character and advantages of the city to listeners in other parts of the nation

LISTENING TO POLITICAL BROADCASTING

Interested politicians during the recent Democratic Convention in New York kept tally cards of the balloting in Madison Square Garden. The municipal service may be extended beyond this, however. New York plans, for example, to broadcast market information daily to New York housewives. At a given hour each morning, housewives who own radio sets may tune-in and learn what foods are cheapest and what in the most abundance, and govern their purchases accordingly

ties of almost any city above 100,000, a plant would be the probable result. Proceeding along a slightly different line, cities may supply plants and call upon organized business to undertake maintenance for the common good. Whatever the method, it cannot be doubted that the municipal station will have a rapid expansion. There are so many evident advantages that it may be wondered why these stations have not come into their own long ago. But it need be only pointed out that the whole radio industry is so new and still in such a highly formative state that many goals are yet to be reached.

There is something of inspiration and much of glory in the thought that before the lapse of many years municipal stations strung across the country will keep American cities in intimate touch, day or night, through their own plants. The assurance that these will be operated for direct public benefit is one of importance. They never can be accused, as all other stations have been, of fostering private enterprise. Assuredly there is nothing to be censured in this enterprise, considered by itself, but wherever private interests enter, the possibility of criticism also must arise. Municipal stations will have nothing to sell—unless it be the prestige of their cities; and if some candidate occasionally oversteps the bounds of radio, he may depend upon a prompt tuning out, his worst punishment.

The prediction is familiar that the number of commercial stations must decrease rather than expand. But despite the closing of some stations the number has gone steadily upward instead of down. Even with the stations now projected, it is probable that this expansion soon must reach its logical working out. And the moment additional municipal stations are opened, the pressure on weaker commercial plants will be hard to resist. It is likely that municipal enterprise will help to correct a condition that has caused some concern. In any event, an America girded with plants owned by its cities will be a fine evidence of civic spirit; a spirit which well may serve to draw the whole nation closer together by the invisible bonds of the air.

HELP FOR THE EXPERIMENTER

A NEW department will appear in RADIO BROADCAST *regularly which contains helpful contributions from readers. We have had many excellent suggestions about little kinks of construction which were proved so helpful that we think all our readers ought to share in them. We invite contributions which must be typewritten and not over three hundred words long. We are not interested in freak ideas but will only consider those which are of decided value. Payment of between $5 to $10 will be made for each suggestion accepted.*

A Motor-Generator Unit for Radio Battery Charging

How to Assemble a Simple Mechanical Unit, Efficient, and Particularly Low in Upkeep—The Parts are Easy to Secure

BY JAMES MILLEN

IN PRESENTING this construction article on the building of a battery charger, RADIO BROADCAST feels that it is giving to its readers a device of great value and usefulness. While the method here described of charging storage batteries is not by any means new, Mr. Millen has simplified the motor-generator charging method in usable form for the average radio fan. This charger is comparatively cheap in first cost and upkeep, and what is highly important, will charge a set of radio, or any other batteries much more quickly than usual methods at the command of the radio enthusiast.

—THE EDITOR

MANY radio fans have no doubt often desired a more rapid means of recharging their storage A batteries. As, at best, a storage battery delivers only 75 per cent. of the energy fed into it, it will take longer to charge the average battery by means of the ordinary two-ampere charger than it will to discharge the battery when used with some of the modern multi-tube sets. Of course the so-called five-ampere chargers will do the job more quickly, but they are both more noisy and more expensive. The approximate time required to charge a 100 ampere-hour six-volt battery by means of several of the chargers in most general use is given in Table 1.

It is a well known fact that the motor-generator is one of the most efficient and rapid methods of battery charging, but due to the high initial cost of such machines, they have never come into popular use.

The purpose of this paper is, therefore, to describe the construction of a motor-generator type charger which can be made from standard parts which ought to cost no more than the best of the five-ampere type chargers now on the market. Such a motor-generator will completely charge an empty 100 ampere-hour battery in about twelve hours at a total cost of about twenty-five cents for the current consumed.

In large cities which are usually supplied with direct current, there are only two methods of battery charging. The most convenient of these two methods is the direct use of the house current through a suitable resistance to the battery. The efficiency of such a system is very low, however, due to the high IR drop (about 100 volts) which must take place across the resistances. Thus, when charging a 6-volt battery at a ten ampere rate from a 110 volt d. c. line, the power consumed by the resistances and dissipated as heat is 102 x 10 or 1020 watts, while that consumed by the battery is only 8 x 10 or 80 watts. Thus the efficiency of this method of charging is only eight per cent. The cost of charging a 100 ampere-hour battery is about ninety cents. The only other method of charging batteries from d. c. is by means of a motor-generator, whose efficiency is much higher. The initial cost and space oc-

TABLE 1

TYPE CHARGER	TIME IN HOURS
Two-ampere tube charger . .	80
Five-ampere tube charger . .	36
Three-ampere chemical charger .	55
Motor generator	12

This table shows the approximate time required to charge a fully discharged 100 ampere-hour 6-volt storage battery by means of several different types of chargers. It costs with generator approximately twenty-five cents to charge completely an entirely discharged 100-a. h. battery, in about twelve hours.

cupied by a motor-generator is generally, however, much greater, so that where considerable use of a single six-volt battery is not to be made, the ultimate value of a motor-generator is questionable.

THE VALUE OF THIS OUTFIT

FOR use on alternating current, though, where some device is necessary to convert the alternating current into at least pulsating direct current, the motor-generator offers many advantages when used with batteries of from 60 to 100 ampere-hour capacity. With larger batteries, the use of the motor-generator becomes almost essential.

The use of a motor-generator charger is not advisable with batteries of less than 60 a. h. capacity. In the recent comparative tests made by the Bureau of Standards at Washington with the different type battery chargers available for radio use, the motor-generator was found to be the most efficient.

Some of the advantages of the motor-generator are:

1. Highest efficiency
2. Quickest method of charging
3. Longest life (no bulbs, etc. to burn out)

The only disadvantages possessed by the motor-generator is its high initial cost. This is true of the complete units available in the electrical market, but it is the purpose of this paper to describe a motor-generator type charger which in many cases can be had for the mere effort of assemblying it and in any case for a less financial outlay than is required for the ordinary five-ampere charger.

THE CHARGER COST TWELVE DOLLARS

THE photograph shows an exceedingly well made and efficient charger which cost less than $12. Of this, $9.90 was for the motor. It was a new $\frac{1}{6}$ h. p. self-starting split phase General Electric induction motor which turns over at 1725 r. p. m. on 110 volts 60 cycle a. c. The Westinghouse generator was obtained from a wrecked Chalmers which had come into the possession of the local garage. This charger has now been in use for more than a year, and has never had to be adjusted or tinkered with.

Excellent generators may be obtained at junk prices at any of the automobile wrecking yards. The average price is $5.00 for a guaranteed generator. It is also possible, however, to purchase second hand generators in good condition at a reasonable price at most garages and repair shops. Inquiries made at a number of local garages revealed the fact that it is quite easy to obtain a very satisfactory second hand generator from this source for less than $10. New generators cost from $17 up, depending upon the make. The points to watch in buying an old generator are:

Reason for selling
Condition of commutator
Condition of windings
Condition of bearings
(most generators have ball bearings, which, if not in good condition, may be readily replaced)

In order that the motor might also be used for other purposes it was mounted as shown in the photograph and connected to the

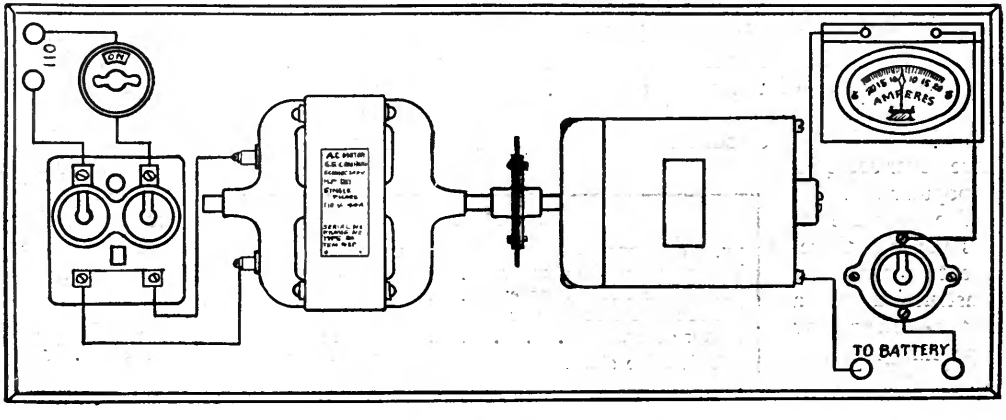


FIG. 1

A picture diagram of the charging layout. The 110-volt line is fused directly after the switch. A single fuse is also included for protection in the charging circuit

generator by a belt instead of directly with a universal joint. This also makes possible the use of different sized pulleys for obtaining different generator speeds, and thus altering the charging rate. Slots are provided in the base in order that the two shafts may be properly lined up and the belt kept tight. The base was made from a piece of 18″x 10″ x 2″ oak. The pulleys were home-made, but if a lathe is not obtainable, then they may be purchased from a dealer in second hand machinery, or they may be turned directly on their own shafts as was the case with those shown in the photograph. In order to run the generator as a motor from the storage battery for this purpose, it is merely necessary to press the cut-out contacts together. A one inch single-ply belt was used, although an automobile fan belt is also admirably adapted to the purpose.

In order to eliminate any possibility of belt trouble, especially where the motor is not to be put to any other use, (such as running a small lathe, emery wheel, etc.) the generator may be directly coupled to the motor by means of a universal joint. The universal joint (or coupling) which comes with most generators will prove ideal for this purpose. The shafts of the motor and generator should be carefully lined-up and the two units securely fastened to the base. The universal is then securely fastened in place by means of the tapered pins and Woodruff key provided for this purpose. Of course a high order of precision is not absolutely essential in this work as the flexible coupling is more than able to take care of a slight inaccuracy in alignment.

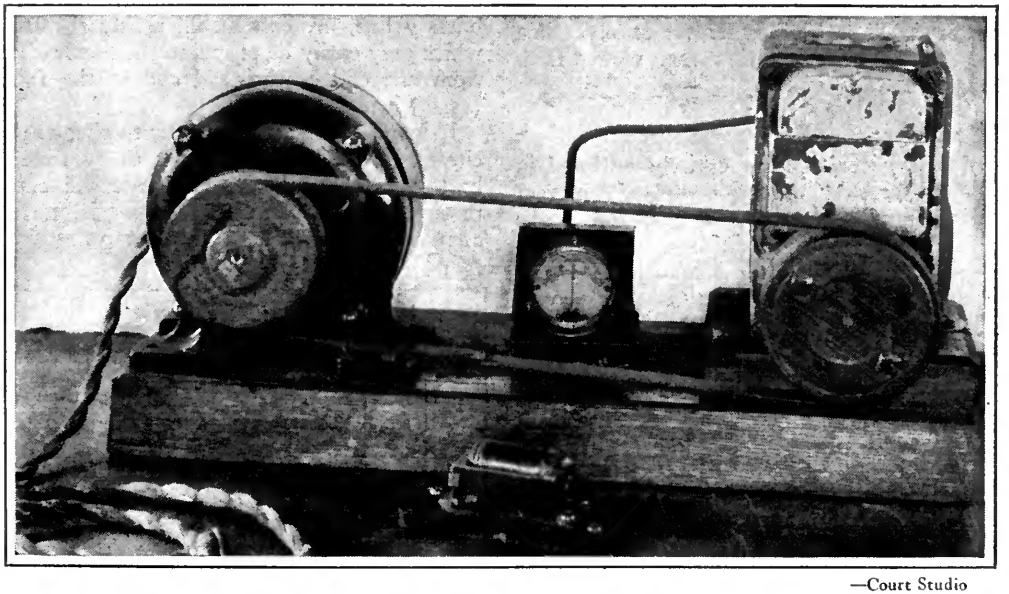
Another substitute for the belt is the chain drive. The average chain drive is slightly more expensive, more noisy, more difficult to install and must be lubricated. It will, however, make a very satisfactory drive where it is not deemed advisable, to use direct coupling.

In order to test out the efficiency of the belt drive, a revolution counter was attached to both the motor and generator and frequent checking showed that the losses due to belt slipping could easily be kept negligible.

THE PARTS AND THEIR COST

A GOOD motor-generator charger can be made entirely from new material for approximately $29, or about the same price as a five-ampere tube charger. (List price about $28). The following parts will be required:

New Ford Generator, with cut-out	$17.00
New $\frac{1}{6}$ H. P. Induction motor	9 90
Wood base	1.50
Ammeter	1.50



—Court Studio

THE COMPLETED UNIT

Containing a $\frac{1}{6}$ horsepower motor, driving an old automobile generator. The motor is at the left and the automobile generator at the right, with an ammeter between. The separate automatic cutout is shown detached. This is merely a rough model. An accompanying drawing shows a suggested base layout

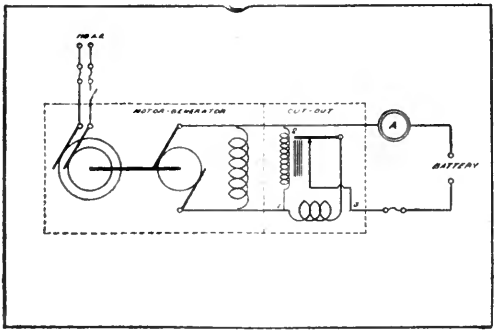


FIG. 2

A complete hook-up, showing the apparatus illustrated in the photograph. 1, 2, and 3 are connections to the cutout device shown as separate in the photograph. A is the ammeter. Note the fuses indicated in the 110-volt alternating current line

Re-built Ford generators sell for $10 at almost all Ford repair shops.

When a high grade second hand generator of the two brush type, similar to the one shown in the photograph, can be obtained in good condition, its use will result in a more efficient and flexible charger.

Ford generators deliver 11 amperes at 8.5 volts to the average six volt 100 a. h. battery when directly coupled to a 1725 r. p. m. motor. As the voltage of these generators is not readily alterable, it is advisable to use a belt drive where a lower charging rate is desired, as in the case of small capacity batteries. The Ford generator revolves in a counter-clockwise direction when viewed from the commutator end.

CARE OF MOTOR AND GENERATOR

MOST generators are entirely enclosed in metal shells which completely protect them from dust, oil, and water. The only attention they require is a few drops of oil occasionally. If a second hand generator is to be used, then it may be necessary to clean the commutator and possibly to replace the brushes. In order to get at the commutator, remove the steel band that is fastened around one end of the case. If the commutator is found to be corroded or rough, it may be easily cleaned and smoothed with No. 00 sand-paper. Never under any circumstances use emery cloth on the commutator of any motor or generator. All the small particles of copper, carbon and sand dust should then be carefully removed. The commutator should also be examined to see that none of the segments are shorted together. If a small piece of copper from one segment touches the next, it should be scraped away. Next examine the brushes to see that they make an even contact, but without pressing hard enough on the commutator to cause excessive heating and wear. The pressure on the brushes is controlled by means of small springs. If the brushes are worn to such an extent as to need replacing, then it is advisable to get just the right kind from the maker of the generator. Make-shift brushes are merely a source of continual trouble. In replacing the brushes care should be taken not to crack any of the insulating bushings which support the brush holders, as they must be well insulated from the generator frame. Extreme care must also be exercised to keep all oil and grease from the commutator and brushes.

The third or adjustable brush found on many generators may be shifted in order to change the charging rate of the generator for any given speed. When this brush is displaced in the direction in which the armature turns, the charging rate will be increased, and vice versa. The charging rate of the Westinghouse generator previously referred to (which has only two brushes) is alterable by means of the small adjusting screw on the end of the case. On some generators, such as the Ford, there is no method of altering the charging rate except by changing the speed. Under such conditions it becomes necessary to use a rheostat in the 110-volt line, cone pulleys for changing the generator speed, a rheostat in the battery line, or, best of all, a field rheostat, which may easily be placed in the line leading from one end of the field coil to the third (small) brush.

It is not necessary, however, to change the charging rate by such means every time a battery is charged, as the charge will automatically taper. Thus if charging is started at 16 amperes it will have dropped to 10 by the

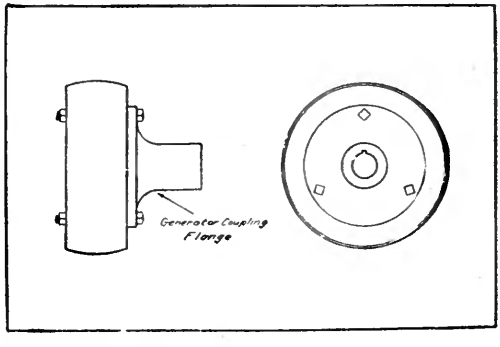


FIG. 3

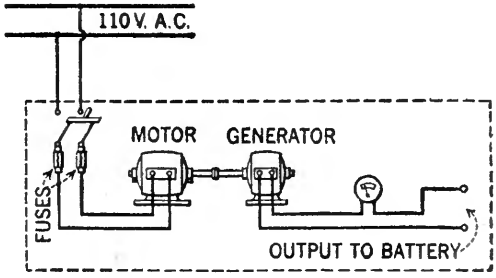
Details of the generator coupling-flange

time the battery has become nearly charged. An initial rate of 8 amperes will taper to about 4 amperes, which is, perhaps, the best all round rate at which to charge a 100 a.h. battery. Under such conditions the time required for a complete charge will be about 20 hours. Some generators will not deliver more than 18 or 20 amperes without danger of burning out the armature. The maximum safe charging rate can be ascertained from the plate on the generator.

The efficiency of the generator whose charging rate could be varied without varying the speed, was found to vary with the charging rate. This is mainly due to the rapid decrease in efficiency of a. c. motors when operated at less than the rated load. With the previously mentioned Westinghouse generator running at a constant speed of 1400 r. p. m., the maximum efficiency (30 per cent.) was obtained at 13 amperes. (Generator efficiency alone was 80 per cent.)

The ammeter shown in the illustrations is a Weston 20-0-20 but a cheaper automobile dash meter, although not necessarily accurate, will serve to show when the battery is properly connected and the approximate charging rate.

Some generators, such as the Westinghouse, have built-in cut-outs, while those that do not will require external ones. The cut-out is necessary in order to prevent the battery from discharging back into the generator in case the



The basic wiring circuit of the motor-generator unit

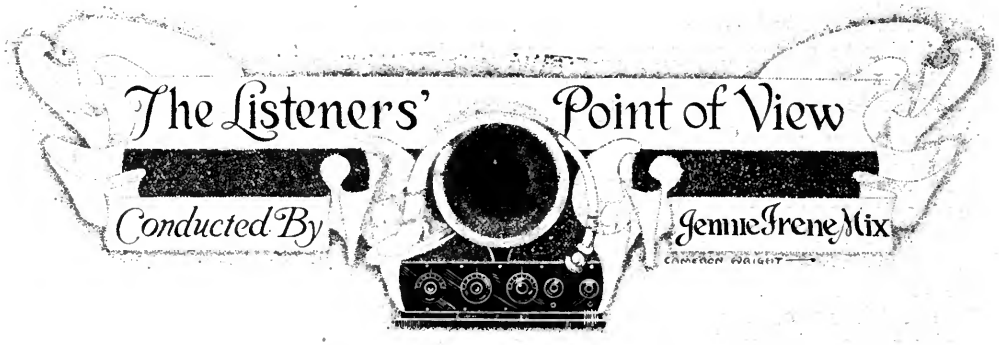
motor should stop when no-one is around to disconnect the battery. All low voltage wiring should be done with No. 10 or heavier wire.

And now a few words about battery charging. Contrary to general opinion a high initial charging rate is not in any way injurious to a battery as long as the temperature of the electrolyte does not exceed 110° F, and the gassing is not excessive. Excessive gassing tends to loosen the active material in the battery plates, and thus shorten the life of the battery.

Unless a cut-out is being used, it will be necessary to disconnect the battery from the generator when not charging. This may be accomplished by means of a single pole knife switch.

THE FACTS ABOUT REFLEX CIRCUITS

ARE informatively and interestingly told in another article by Julian Kay in his excellent "What's In a Name?" series. Mr. Kay tells what the various types of reflex circuits are, and how they work, in addition to the general radio information which many of our readers have followed in his previous articles with much profit and interest. This article will appear in an early number.



How the Radio Public Should Be Pleased

SOME day large delegations of radio listeners-in are going to march from one broadcasting station to another and the managers of each will be informed with much sternness that their own passionate fondness for the sort of music called jazz is not shared by anything like a majority of the people who buy receiving sets."

This was the opening paragraph of an editorial on radio music that appeared recently in the New York *Times*.

We can easily visualize that procession. Tens of thousands, increased town by town by other tens of thousands, growing and growing, until there are millions of them. This is no exaggeration. Protests against radio musical programs are universal.

Unfortunately, the people who object to having the radio monopolized by jazz are the sort of people who do not voice their objections through letters to broadcast directors. Were it otherwise, many of the stations would be so flooded with mail that all other work than reading it would necessarily cease for the time being, which would be a good thing, for that would mean at least a temporary cessation of jazz.

To make a conservative statement, more than a billion dollars are spent in this country each year for good music, meaning by this term the greatest music ever composed. This money is spent in patronage of concerts and grand opera, and for music lessons and the buying of music scores. With but few exceptions, the greatest musical artists of Europe find in America's patronage of music their chief source of income. And they are accorded this patronage year after year, from the people of big cities and of small cities, because the American public knows good music when it hears it and wants to hear as much of it as possible.

THE GRAND PIANO

Finished in old ivory to correspond with the style of the studio at station CKAC, *La Presse*, Montreal, Canada. In front can be seen the magnetic Marconi type microphone, used exclusively by this station

These same people are spending millions of dollars each year that their children may have musical instruction. Taking this country as a whole, the standard of such instruction is high. Even in the smallest towns may be

MRS. CARL CHINDBLOM

Wife of Representative Chindblom of Illinois and an outstanding figure in the musical life of Washington

found teachers who are guiding their young pupils toward an appreciation of the best in music. The day when Susie Simpkins of Simpkinsville, as her highest musical ambition, looked forward to the day when she could play "Hearts and Flowers," has long since passed. All the Susies in all the Simpkinsvilles are now playing Haydn, Mozart, Mendelssohn, and Beethoven sonatas, and the simpler pieces of Grieg and Schumann. And they like this music, like it far better than the cheap stuff of which they would grow tired if they practiced it for a week.

In the larger communities the musical instruction of the young people is so advanced, and on so high a plane in every respect, that, nowadays, a student beginning before ten has a well-developed taste for the best music long before he or she is out of the 'teens.

But it costs the parents much money to give their children such musical opportunities, and requires intelligent supervision as well.

Times without number has the editor of this department heard a mother or a father say:

"No, I will not have a radio set in my home. Under no circumstances would I permit the developing musical taste of my children to be influenced by such music as is broadcast night after night."

One man said:

"No one would think of calling me highbrow if I refused to have a mechanical contrivance in my home that for hours each day talked aloud and murdered the English language with every sentence. Why, then, should I be called highbrow if I refuse to have something in my home that, day after day, distorts and murders music? All I can say is, if this means being a highbrow, then may I live and die one!"

Another man, after hearing a so-called musical program broadcast by a commercial firm, exclaimed:

"I'll never buy one of their products! I'll bet they're just as bad as that music!"

The program had been composed wholly of jazz with numerous unspeakable saxophones predominating.

Fourteen Red Hot Mamas

CAME a woman's voice over the telephone:

"Are you the one that writes that 'Listeners' Point of View' in RADIO BROADCAST?"

"Yes."

"Well, I want to tell you that we've bought a radio set and it's perfectly awful!"

"What kind of a set have you?"

"Oh, I don't mean the set is awful. It's wonderful. We can get all the stations. But the music! Last night we tuned-in four-

THE KDKA LITTLE SYMPHONY ORCHESTRA

Victor Saudek, Conductor. Seated, left to right: Milton Lomask, Pierre De Backer, Leo Kruczek, violins; Elmer Hennig, 'cello; Raymond Bandi, viola; James Younger, 'cello; Herbert Saylor, viola; Rest Baker, violin. Standing, left to right: Stephen Konvalinka, trombone; John J. Harvey, trumpet; William Nugier, drums; Karl Haney, bass; Victor Saudek, Conductor; Stephen Miller, Jr., piano; Alvin Hauser, flute; S. Sapienza, clarinet

Thomas Coke Knight

HELEN TAYLOR, MILDRED DELNA, AND ANNA PINTO

Who have been heard from WJZ. Miss Taylor is a coloratura soprano who recently made her radio debut from this station. Miss Delna, a soprano, has been heard with pleasure by WJZ's audience. The tones of Miss Pinto's harp have pleased radio listeners at various times for more than three years

teen stations and every one announced that the orchestra would now play 'Red Hot Mama'! And everything else was just like that."

She talked for quite a time. She complained justly that she had no guide in the advance programs published in the papers as to where she could get the good music. All that the programs indicated was that at such or such an hour a musical program would be given. "And it's always such rot!" was her wail.

When Good Music Is Broadcast

OF COURSE, it isn't "always such rot." Taking the country by and large, quite a bit of good music is broadcast each week. But it is insignificant in quantity when compared with the cheap and tawdry stuff that is sent out over the air. And it is generally so mixed up on a program that contains the worst as well as the best that many people who might hear it fail to do so because they have tuned-out in disgust.

To quote again from the *Times* editorial:

"Jazz, especially when it depends much on that ghastly instrument, the saxophone, offends people with musical taste already formed, and it prevents the formation of musical taste by others, and even its votaries are cautious enough—have enough respect for their reputations with civilized people to say, 'Oh, we don't ever listen to it. We only dance to it.' But the often mentioned radio audience does not dance, at least while it is justifying its name, and there is no imaginable excuse for giving it jazz, hour after hour, every evening from nearly all the stations."

From Mr. Gordon Balch Nevin, well-known author of various books on music, a composer and organist of the First Lutheran Church at Johnstown, Pennsylvania, some comments have been received upholding the policy of this department in decrying the hodge-podge musical program so prevalent at present in broadcasting. A portion of Mr. Nevin's letter reads:

> I am not one of the class of musicians who dislike popular music, the music of the day, even jazz, for that matter. I do not adopt an up-stage attitude in regard to this class of music. In fact, there are times when, for perhaps half an hour, I find good jazz played by a real orchestra to be a mental tonic. But I do most certainly object to the very thing so often mentioned in "The Listeners' Point of View"—the haphazard and scrambled arrangement of most radio programs.
>
> I wonder if the broadcasters are not missing an opportunity to evolve the novel and unusual type of program. In my own recital work I have found the all Wagner, or American, French, or German type of program, also, to some extent, the historical or chronological type, to be very good and helpful for the listener. At least, there is a certain coördination and continuity that gets somewhere.
>
> I hope to see some competent singers giving programs, each selected from some one composer or nationality. When they do this there will be enough of us who will not spin the dial on them.

Mr. Nevin then goes on to cite an example of the mentality of some listeners-in. He was in a broadcasting station while a Bible lesson was being sent out. The instant this pro-

gram closed, some "half-wit," as he so aptly describes him, telephoned in requesting that "Hot Mama Blues" be played. "Comment is futile," he adds.

The pity of it is that, times without number, program directors accede to such requests. Why do they do it? Do they actually think that the radio audience is wholly composed of morons?

Mrs. Nobody of Podunk is giving a party. She telegraphs to some broadcasting station that they all want to hear such and such numbers. Immediately all the listeners-in, probably tens of thousands of them, are also supposed to want to hear this same trash.

Suppose you had bought a ticket for a public concert. And, suppose, instead of hearing the sort of program you expected to hear when you paid for that ticket, you were obliged either to leave the hall without having had your money's worth, or to sit there and listen to a lot of junk that this, that, or the other person in the audience took it into his head he wanted to hear. What would become of our concert programs if they were conducted in this fashion?

And what is going to become of radio programs if every Tom, Dick, and Harry can telephone or telegraph in and have the numbers he requests played or sung?

"The Public Be Pleased"—How?

BUT we must please the public!" exclaim the broadcast directors.

That is exactly the point we are making. The public is not being pleased with radio musical programs. For the public consists of intelligent people of discriminating taste as well as of those to whom music means only jazz.

Station KSD, which is operated by the St. Louis *Post-Dispatch*, is one of the few broadcasting stations in this country that recognizes the musical cultivation of many among the radio audience. The broadcasting by this station this season of fifteen concerts by the St. Louis Symphony Orchestra is an epoch-making event in radio entertainment. These concerts are not staged simply for the radio. They are the regular subscription programs and are broadcast direct from the Odeon Theater, where all these subscription concerts are given under the direction of Rudolph Ganz.

Five of these programs have already been broadcast, and the remaining ten will be put on the air December 27, January 10, 17, 24; February 7, 14, 21, 28; March 7 and 14. The dates all come on Saturday evening. The concerts begin at 8 o'clock, Central, and 9 o'clock Eastern Standard Time.

The broadcasting of these programs is not only giving a large public opportunity to hear many among the classical symphonic works, but also to hear new works of important significance, among them Vaughn Williams's "London Symphony," the much talked-of symphony by Hanson, Igor Stravinsky's "Fireworks"—one of the most notable among modern compositions—Ernest Schelling's "Victory Ball," Honegger's "Pacific 231," and Respighi's "Three Old Dances."

One can just hear some people saying, "Oh, the public doesn't care for that highbrow stuff!"

Doesn't it? Why, then, are there now in this country fully fifty symphony orchestras that each season give programs of the best orchestral music? And why is it, then, that other cities and towns are making heroic efforts to have their own orchestras?

Why? Because of the widespread public demand for great music.

Do Listeners Want Their Programs Explained?

MR. JAMES C. MOFFET, of Louisville, Kentucky, has written to this department suggesting that radio announcers in presenting a musical program preface each number with some explanatory remarks, given in non-technical language. He believes this would help to popularize good music, and that this form of musical education can be put out better over the radio than through any other medium. He adds:

"The concentration of mind induced by listening-in on any explanation on the radio, with nothing to distract the attention of the listener, as in a public hall or concert room, would make this form of exposition peculiarly valuable. I know that I remember what I hear over the radio better than what I receive as one of a big audience at a concert or lecture."

Although it would not be advisable to preface each number on each musical program broadcast with explanatory remarks, it would undoubtedly be a constructive plan if this were done at stated intervals. There is an unlimited amount of interesting information from which to draw for such talks and still keep them within the comprehension of the layman.

Explanatory programs have indeed been tried, from time to time, by various stations.

So far as the present writer's knowledge of these experiments goes, the prefatory talks generally sounded as if being given, not by an authority on the subject, but by some one who had crammed for the occasion. The results in such a case, no matter what the subject talked about, are bound to be disappointing, to miss fire.

In order to talk about music or any musical composition in a way to hold the interest of the listener, the speaker must know a great deal more about his subject than simply the phase of which he is at the moment presenting. A broadcasting station can never successfully give educational musical programs until willing to pay some thoroughly competent specialist, who is also a good talker, to give these explanations.

All other subjects than music, when discussed over the radio, are discussed by well-known authorities on these subjects. This is as true of astronomy as it is of pugilism. But, as a rule, when anything is said about music, it seems to be considered that anybody can say it.

At present, the most conspicuous exception to this rule may be found in the series of talks on orchestral instruments being given through station KDKA by Mr. Victor Saudek.

As everybody knows who owns a radio set, Mr. Saudek is director of the KDKA Little Symphony Orchestra. But he is much more than this. His current musical work along various lines and his experiences in the past place him among the leading authorities in the country on orchestral instruments and their use.

Mr. Saudek was for many years a member of the Pittsburgh Symphony Orchestra, playing in that organization first under Victor Herbert, then for six years under Emil Paur. He is at present teacher of orchestration in the combined music departments of the University of Pittsburgh and the Carnegie Institute of Technology. He is also director of the Woodwind Ensemble at the latter institution. He has delivered many lectures on orchestral instruments for the Board of Education of the Pittsburgh public schools, and also for various colleges. In addition to his work as director of the KDKA Little Symphony, he is organizing a light opera company for this station.

In his weekly talks on orchestral instruments which are now being given at KDKA, Mr. Saudek divides the instruments into their four natural groups—the strings, the woodwind, the brass, and the percussion instruments. The history of each instrument, or co-related instruments, is briefly given, and this is followed by a clear discussion of the chief characteristics of the instrument, after which its qualities are illustrated by the playing of excerpts from that instrument's part in an accredited orchestral work.

The concluding feature of this series of talks which will continue for some twelve weeks from their inception the middle of last November, will be a concert in which the more unusual instruments, such as the woodwind group and the horn, will be used.

A very interesting feature of this concluding concert will be the coöperation of the radio audience. The instruments will be announced not by name but by number, and the audience will be asked to send in the names of the instru-

Francis Brugiere

THE MADONNA

As she appears when taking the place of the absent Nun in the Cathedral, in Morris Gest's production of "The Miracle," staged by Max Reinhardt at the Century Theatre, New York, and broadcast by WGBS (Gimbel's, New York) during this station's opening week. Lady Diana Manners is here seen in this rôle

ment corresponding to each numbered solo, or the names corresponding to the numbers of such ensemble groups as may be used.

Here, in its most instructive and delightful form, is musical education over the radio, given by a professional specialist in the subject treated. Such a broadcasting feature will go far toward wiping out memories of musical disappointments experienced after one has tuned-in.

Mr. Saudek might well make these illustrated talks on orchestral instruments an annual feature at KDKA. For there is absolutely no question as to their success.

In his work with this Little Symphony, Mr. Saudek has brought the organization to a point of excellence where it has no superior among the orchestras regularly associated with broadcasting stations. Many of the sixteen men who make up the orchestra's personnel are virtuosi, with training gained in regular symphony work. Taking the programs in the aggregate, this orchestra broadcasts much good music. One looks forward to the day when they will set aside one hour two evenings a week and give, during that hour, nothing but music worthy of being heard at a public symphony concert. If, let us say, such a program was given every Tuesday and Friday, or Monday and Thursday, or Wednesday and Saturday from eight to nine, and this was continued month after month, the audiences listening-in would be so large that the other broadcast stations might well rejoice that they could not know how they were being neglected.

Good Music That Is Popular

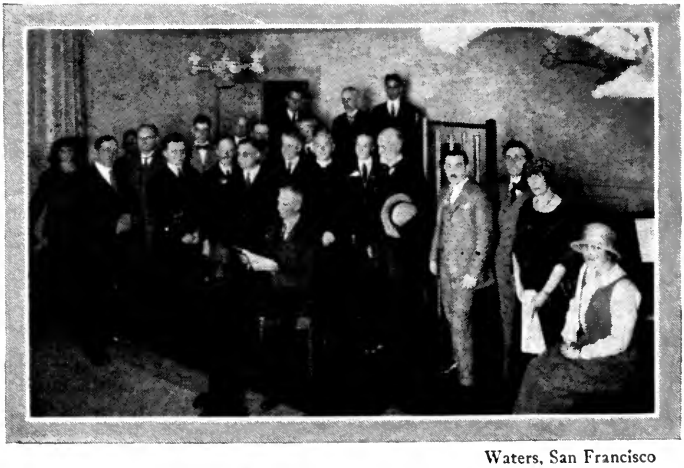
A PIANIST who knows from experience that radio listeners enjoy good music, is Mrs. Carl Chindblom of Washington, D. C., who has been heard a number of times through station WRC of that city.

Endowed with exceptional musical talent, Mrs. Chindblom from childhood had the advantage of training under the best masters. She is the daughter of Hjalmar Nilsson, who has directed Swedish male choruses in this country for twenty-five years and has received decorations for his musical work from the King of Sweden and the Singers' Union in Sweden, as well as in America. At the age of fourteen, Mrs. Chindblom, then Christine Nilsson—"but no relation to the famous singer," she explains—went to Stockholm where she pursued her piano studies.

Mrs. Chindblom is the wife of Representative Chindblom of Chicago, who, next March, will finish his third term as representative of the Tenth District of Illinois, and who is also a member of the Ways and Means Committee. Although corresponding secretary of the Congressional Club which is composed of wives of the members of Congress, occupied with social duties and the management of a home, Mrs. Chindblom still keeps up her musical work through taking lessons and public playing. Her cosmopolitan life has confirmed her natural faith in the people's love for good music provided they have opportunities to hear it.

"It did not occur to me," she said when speaking of her broadcasting experiences, "to play trashy music. For that matter, I could not have played it, anyway, for I have not concerned myself with such music. Why should one, when so many like to hear the best?

"And why should I think, just because I happened to be playing for an invisible instead of a visible audience,



Waters, San Francisco

COMMITTEE AND READERS

A service that is meeting with far-reaching success is broadcast daily at station KPO, San Francisco, immediately after the Naval Observatory time signals. First, the chimes you see in this picture are played, and, as chimes are always very lovely over the radio, the opening of this service immediately engages attention. There then follows a reading of the scriptures, always from those portions that are not controversial, but of a character to make universal appeal. The director of the station may be seen (in gray suit) standing in front of the chimes

White, New York

THE LAMED PIPER

(Werner Krauss), healed at the foot of the wonder-working statue of the Madonna (Lady Diana Manners) in "The Miracle"

that my listeners would want mawkish or cheap numbers? I cannot understand why any one who is accustomed to playing good music should be willing to play any other kind when broadcasting.

"One of the best received numbers I have broadcast, is the D'Albert *Suite*—the one with the *Allemande*, *Gavotte*, and *Musette*. It is built, you know, on classical lines, very much in the style of Bach, but with the modern touch so characteristic of D'Albert who, noted first as a great pianist, can well lay claim to being, if not equally great as a composer, one that has added much to modern piano literature.

"Another number that has also been much liked by my radio audience is the *Preludium* from Grieg's *Holberger Suite*. Then I have also broadcast a Schumann *Nocturne*, Scarlatti's popular yet very classical *Pastorale*, the Liszt arrangement of Mendelssohn's "On the Wings of Song," and the "Concert Fantasie on Swedish Folk Songs," by Emil Larsen, one of Chicago's leading musicians.

"What are my feelings when playing for an invisible radio audience? Well, it is difficult to describe them because they are not essentially different from my feelings when playing for a visible audience. But I always have the feeling that there *is* an audience out there beyond—near and far—and the absolute consciousness of this is an inspiration. And I am always on my mettle, for I know that, over the radio, every wrong note, every slightest mistake, stands out with glaring distinctness. I know this from having listened so much to others. When a number is announced with which I am familiar, I listen always in the hope of learning something from the performance, and I very often do learn something, either regarding technical execution, or interpretation, and sometimes both.

"Although I play a good deal in Washington each winter at musicales and concerts, and last winter gave a number of programs with Congressman Woodrum, the 'Singing Congressman' as we call him, the enjoyment was no greater, if as great, as that I experience when playing for radio audiences. I do not know whether this feeling I have about radio listeners is shared by others who broadcast. I only know that it is the way I feel. There is always in my mind the thought that among those listeners I cannot see may be some who are thoroughly competent to criticise, and who will know from my playing just what sort of

Aldene, New York

NATHAN ABAS AND HIS PENNSYLVANIA HOTEL CONCERT ORCHESTRA

Tri-weekly features on WJZ's programs. This is the real thing, and not a jazz orchestra, which may account for the fact that it is one of the most popular organizations now broadcasting regularly. Their Sunday evening concerts, given at 7 o'clock, Eastern standard time, are especially well worth hearing

musician I am. The result is, that when before the microphone, I feel that I am playing for the most exacting yet appreciative of audiences."

Because she does not use her music as a means of livelihood, Mrs. Chindblom is not personally concerned with the question of payment for broadcasting. But she is completely in accord with the stand taken by professional musicians who depend on their music for their living, that they should be paid for radio appearances,

Praiseworthy Work of a New Broadcaster

UNSTINTED praise is due the management of WGBS [Gimbel Brothers of New York] in that they had the artistic vision to broadcast, during their opening week, Morris Gest's production of "The Miracle," which has had a long run at the Century Theater, New York, and, at this writing, is scheduled for a six weeks' run in Cleveland, Ohio, the only city outside of New York where it will be presented.

It might be thought, upon first consideration, that a performance appealing first of all to the eye could not successfully be broadcast. But "The Miracle" is an exception because the story, drawn from classic legend, is of itself so beautiful and so dramatic, and because it is given a noteworthy musical setting.

During the broadcasting of this production, Mr. Fred Eric, well-known actor and stage director, gave a graphic and sympathetic synopsis of the story as it was revealed on the stage. These descriptions were vivified by Englebert Humperdinck's music for chorus, orchestra, and organ—music of a kind all too seldom heard over the radio. Humperdinck, one of the greatest masters of orchestration among modern composers, a writer of some of the most graceful and lovely music composed during the last quarter of a century, is best known by his two fairy operas, *Hänsel und Gretel*, and *Die Königskinder*. He died a few years ago, suddenly, at Neu-Strelitz, of apoplexy. He came to this country in 1910 when *Die Königskinder* received its first production on any stage at the Metropolitan Opera house with Geraldine Farrar in the rôle of the Goose Girl. He drew largely on German folk song for the foundation of his works, using them with unexcelled finesse and effectiveness. He was a close and understanding friend of Richard Wagner and assisted him in preparations for the first production of *Parsifal* in 1880 at Bayreuth. Living a simple and unostentatious life, both as artist and as man, Humperdinck nevertheless gained world recognition during his lifetime.

Having set such a standard as the broadcasting of "The Miracle" during their opening week, it is hoped that those who are to guide the work at WGBS will live up to this standard in the future.

FROM Alice L. Nealeans, of Newport, Kentucky, comes the statement, in a letter:

"Your 'scrambled programs' raps will set makers of these 'Air Entertainments' to separating the material and keeping hours for jazz and hours for high grade music, giving certain hours to each, regularly, so that radio fans may know when to tune-in and when to tune-out."

May Miss Nealeans prove a true prophet!

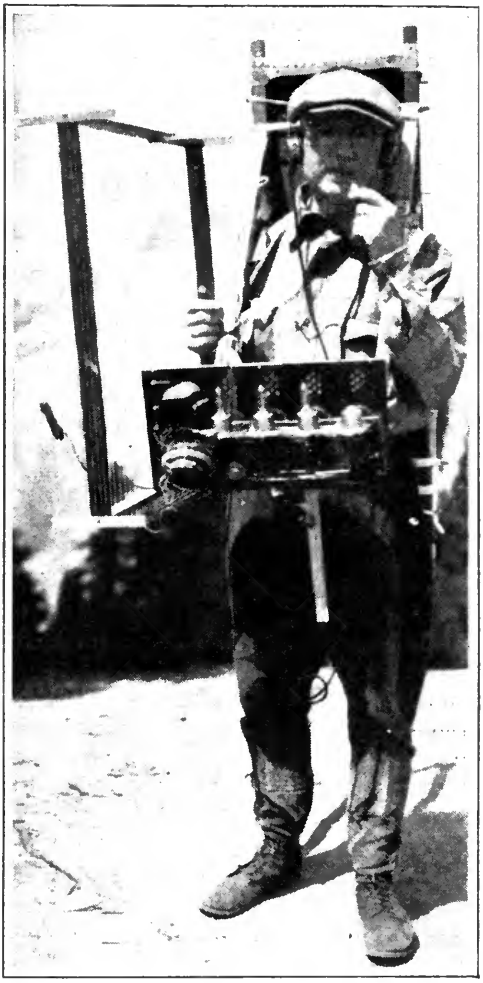
A Kit for the Radio Detective

How to Use a Sensitive, Portable Receiver to Find Interference of All Sorts —Some Radio Tests of Great Value and Interest to the Experimenter

By

ROBERT H. MARRIOTT

First President Institute of Radio Engineers



MR. MARRIOTT
With the pack loop receiver described in this article

NOT far from the point at which these paragraphs begin, the observing reader can see several photographs of a radio compass station mounted on the writer on Mount Rainier.

That is the kind of a radio compass station that can travel almost anywhere. That station is not too wide to go through doors nor too heavy for a youth. It is not too heavy for an old chap either, but of course if an old chap carries it in and around public places, it will probably be due to a lack of the dignity that usually comes with age, or due to youthful spirits, or because he wants to learn facts about interferences and the reception of radio to the extent of braving the remarks of others.

The radio compass station operator, in this case, is the means of transportation or beast of burden and, if he travels in public places, he may be referred to as a beast of burden. Somebody will surely say he is an "ass." Also, inexperienced young dogs and snappy dogs may bark at him. The wise humans and dogs will behave quite properly.

That kind of transportation for a compass station does not produce electrical disturbances to interfere with the compass readings. Also the operator is the pivot. Operator, receiver and coil turn together, which prevents changing tuning because all parts remain relatively the same.

An automobile carrying a loop cannot go up stairs and in narrow places and the ignition has to be shut off to use the radio compass. Also a coasting automobile often moves too fast to detect sources of interferences or variations in receiving ability.

Those of you who go camping in places where human transportation is the only available transportation, will recognize that thing on my back and shoulders as a special form of pack board made with braces over the shoulders instead of straps. This special pack board is just as available to carry fishing gear as to carry scientific instruments. In

another photo you can see my son wearing a regular orthodox Indian style pack board loaded with food and I am behind him with the special pack board loaded with the rest of the camp duffle, ready to go through brush and streams. Both boards are strong enough to carry fifty pounds or more. The Indian type is superior for going through brush, while the brace type can be thrown off quickly if you fall in water over your head or where you want to shed the pack quickly.

THE PACK-BOARD RADIO COMPASS

WHEN using the special pack board for radio compass work, the radio receiver is supported by the braces in front of the operator, where he can see the dials and make adjustments. Almost any kind of sensitive fairly long range receiver will do if the tubes require very little battery. The receiver in the photographs includes a regenerative detector and three stages of audio frequency, using peanut tubes that require about one volt and one fourth of an ampere each. Forty volts were used in the plate battery. That receiver was not built especially for this kind of use. It was chosen because it was convenient and light in weight.

The compass coil, as can be seen, is mounted at one side. It consists of eighteen turns of No. 23 cotton covered wire, about three eighths of an inch apart. The coil frame is of very light spruce and fitted together with screws. A folding coil would do about as well, but it might not be as strong for its weight. A clip is provided so that eight, twelve, or eighteen turns may be used. Also, the little coil in series with the loop that couples to the tickler is tapped, so altogether a range of from 200 to about 1000 meters can be covered in receiving, with the tube oscillating. An oscillating tube is sometimes better for picking up disturbances.

The batteries are carried on the back on the pack board surface. Other things may be carried on the pack board at the same time. I sometimes carry such things as electrical measuring instruments on it. In another photograph is shown the board and some voltage measuring equipment that I used on Mount Rainier. I used them to find static potentials. They are not part of the compass equipment. In traveling through brush the coil frame and receiver can be removed from the side and from the braces and packed on the back. For carrying the outfit as baggage on an automobile or in a train everything is packed on the front of the board between the braces. Blankets and clothes serve for packing material, and a tarpaulin serves for the cover of the package.

A little khaki cloth cover not shown in the photo, fits over the receiver in front and another piece of khaki over the back for damp weather. All of the wood used, which was spruce, and the khaki are waterproofed by wetting them with gasoline in which paraffine has been dissolved. The gasoline evaporates and leaves the paraffine in the pores of the wood and cloth. Waterproofing the strips that support the coil wires is necessary. Spruce is one of the best woods because it is strong for its weight, but almost any available wood will do.

WHAT GOOD SAMARITANS CAN DO WITH THIS SET

WHY have I told you about this and why am I going to say more about it farther along in the article? Because lots of people can build such arrangements as good as this or better and use them to find causes of interference, and otherwise to develop radio. Having found the causes of interference, those causes can be eliminated through the arts of diplomacy and electricity,

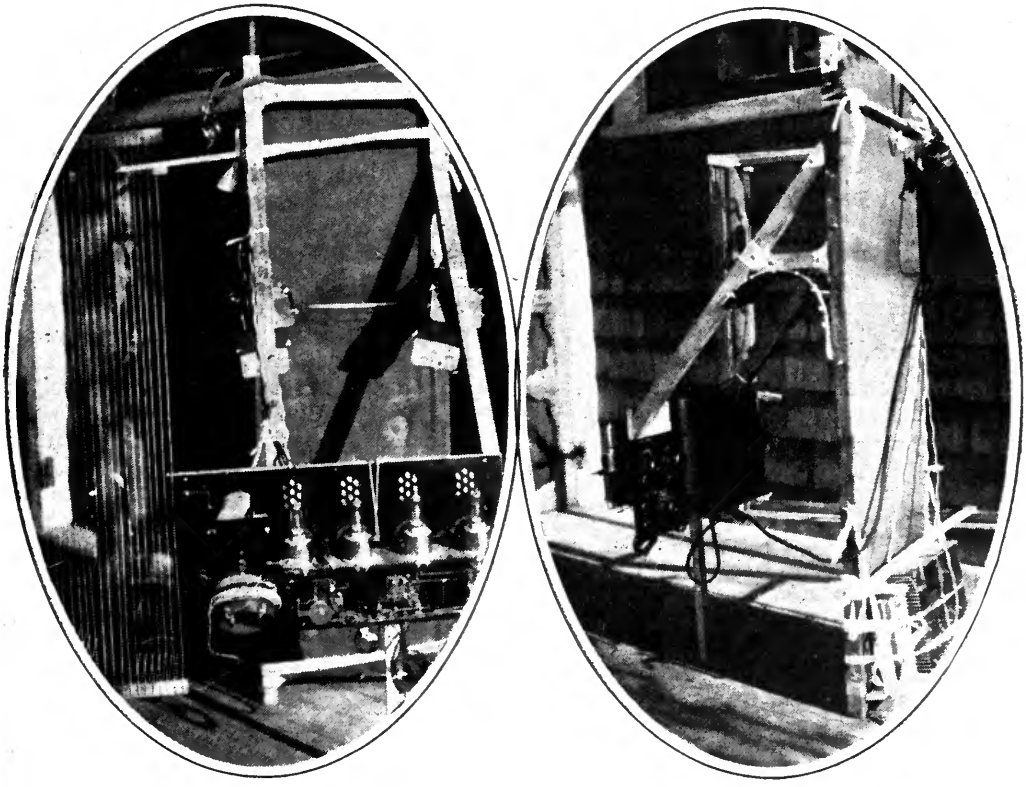
A Radio Set on Your Head

Can easily be very valuable, while at the same time, subjecting its bearer to a certain amount of ridicule. Mr. Marriott's interesting article tells how he built up a simple portable receiver, using dry cell tubes and a loop which he mounted on a pack board and used to trace interference from power lines, radiating receivers, and improperly operating domestic electrical devices. Since this magazine published a series of articles on "Man-Made Static" by A. F. Van Dyck in March, April, and May, 1924, interest in tracing and reducing unnecessary interference from these sources has grown very greatly. Other radio periodicals have since taken up the cause, and the general receiving situation is sure to be much improved, for power companies and even some of the thoughtless individuals are almost always willing to do all they can to reduce interference of all sorts, when it is brought to their attention. Local dealers can plot radio maps of their territories with a set of this kind, and radio club members wishing to perform public service can well take up this sort of thing themselves.—THE EDITOR.

and the reception of broadcasts will be improved. Cutting out interference is one of the most important things in improving local receiving. One reason why a lot of interference is not cut out is because enough people do not know what the causes are. With such arrangements as this they can find the causes.

men who would not use glittering words to attract fame or money and who, therefore, attracted little or no attention.

Another way in which radio was advanced by getting more people interested in its development was through the United States amateurs. They made radio an indoor sport.



A CLOSE-UP OF THE RADIO COMPASS RECEIVER

Showing how a simple receiving set, which can be operated on a loop can be mounted on the loop frame, which carries the dry cells to run the set

The advancing of an art and science and the correction of evils depends very largely on how many people learn the facts. For example, the apparatus for radio was invented and the idea of using it for communication was conceived and published long before Marconi made his developments. But Marconi or his associates made a lot of noise about it and that interested a lot of people who investigated the facts and started developing radio.

In their publicity, to advertise Marconi and to raise money, they brought to light information and possibilities that had previously been quietly discussed orally and in print by conservative professors and old

Still another way was the Institute of Radio Engineers which was founded and devoted entirely to disseminating information for the advancement of the radio science and art. Scientific and popular publications played a part in all those ways.

LOCAL RADIO DETECTIVES

NOW that radio receivers are located practically everywhere, there are too many possible sources of interference to cover the interference subject by articles stating where interferences may be found. Another kind of education is necessary. We have got to train a lot of local disturbance finders. Some local radio detectives with radio compasses

are needed to do the finding and spreading of information.

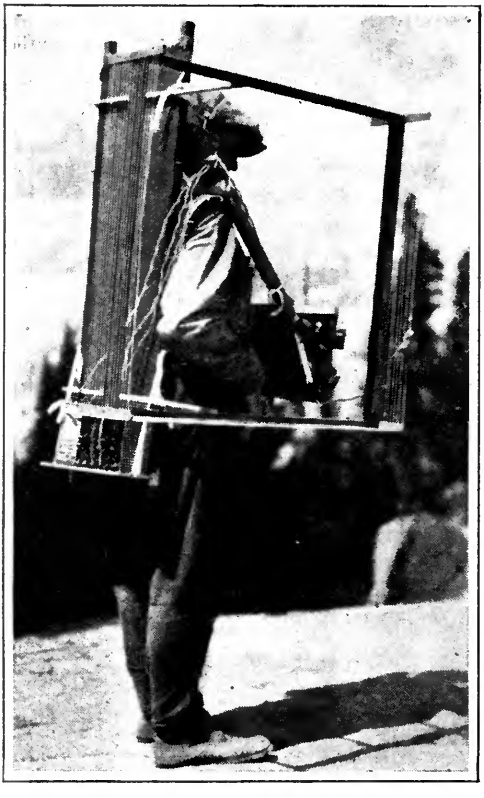
When broadcasting first started, the uninitiated blamed all interference on amateurs and static. Now in the summer time a great deal of interference is blamed on natural static that comes from defective electric lighting and power circuits. Also, winter and summer, some one short range notorious interference is blamed for what other local interferences do. A chap's own bed warmer may be causing the interference that he blames on the Blank electric light company.

To stop interferences, first, find the interference producer; second, use your best influence to have that interference cease. Power companies are glad, usually, to do their share. Individuals are almost always reasonable about such matters, once the true situation has been presented to them.

Those who take the trouble to do this radio investigating will find it decidedly interesting. They will do not a little to advance the radio art in their locality. Especially will they advance the art, if they tell others how they do it and the results they get.

There is a tendency to expect the Radio Inspectors of the Department of Commerce to find all interferences and correct them. The trouble with that idea is that there are not enough such inspectors and no Congress is going to appropriate enough money to get enough inspectors. All of the present inspectors together could not take care of the interferences in New York, and there are a lot of folks and territory west of Hoboken. If you find the interference and it is something the inspectors have jurisdiction over, they will take action.

A radio compass station made up in the form of a pack is much easier to carry than a suit case arrangement, and it leaves the hands free. One can carry about fifty pounds on a pack board as easily as one can carry twenty pounds in a suit case. And a pack board radio compass, as shown in the photos, weighs only about twenty-five pounds. By using a lighter receiver and smaller batteries, that can be reduced to ten pounds. By going to extremes and using radio-frequency amplification only it could be reduced to five pounds or less. Also all the equipment could be included in one package.



ON MOUNT RANIER

With the pack set. One attachment for the receiver allows the strength of static discharge to be measured

HOW THE PORTABLE COMPASS IS MOUNTED

IN THE accompanying photographs you can see the pack board radio compass standing alone. The back frame is of one inch by one inch spruce and consists of two uprights and a cross piece at the top and bottom fastened by dowel pins and stiffened by sheet aluminum bent around the joints and held by screws. Khaki cloth is stretched tightly over the frame and tacked fast. Stiff brass hooks in the frame serve to allow packing cords to be fastened to them. A light stick from the bar holding the receiver serves as a leg so the pack board will stand alone when the receiver is in place. Two pieces of sheet aluminum with felt on the under side are attached to the front braces and back by single screws so the aluminum tilts slightly to conform to the slope of the shoulders.

One way to put on the device is to set the pack board on the edge of a table and duck under one of the shoulder pads and rise up. Another way is to stand to one side of the pack board, say the right side, and place the left hand under the left pad and the right under the right pad and raise the pack up

and over the head and then let it down upon the shoulders.

You can probably design a better looking outfit and undoubtedly you can provide a better looking operator, packer, or beast of burden, whatever you want to call this photographed biped.

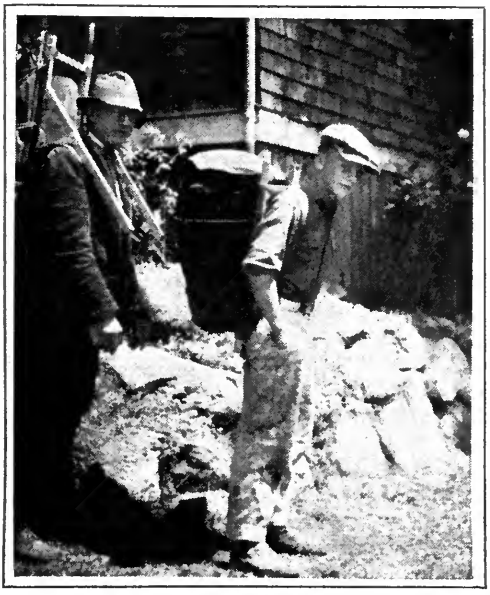
WAYS AND MEANS OF USING THIS "DETECTOR"

TO FIND the cause of a disturbance, put the pack board compass on, turn on the filament battery and tune-in the disturbance with the detector oscillating, if tuning is necessary. Then turn around until the disturbance is loudest and then till it is weakest or out. Those two positions should be at right angles and the disturbance should be in the direction of the wires in the compass coil when the disturbance is loudest, that is it should be either in front or back of you, providing it is from some place some distance away and there are no conductors in your immediate neighborhood. Then walk forward until the disturbance gets weaker or stronger. If it gets weaker, turn around again and if the direction of the wires is the same for maximum disturbance, walk in the opposite direction. If everything is ideal for compass work, you probably will walk right up to the cause of the disturbance.

If the interference comes from a neighbor with a regenerative detector and you set your radio compass so it oscillates, you probably will be able to follow the squeal right up to the neighbor's house. Then if you "squeal on" or "tell on" him to the other broadcast receiving neighbors they will probably join with you for a persuasive conference with the interfering neighbor. Of course if he is a stubborn Scotchman you may have to call on the Presbyterian preacher for aid. If he is a dealer in stubborn water called "Scotch," boycott him. If you have a drop of Scotch in your blood, please forget this. If your drop of Scotch is in a bottle, offer it to your interfering neighbor.

TO MEASURE STATIC

The pack set is arranged as shown in the photographs. The average experimenter would have no reason to use such a device, but there are some who might be interested in making such measurements



THE RADIO PACK SET READY FOR ACTION

Mr. Marriott and his son, near their home in Bremerton, Washington, ready for a journey of test and experiment with the loop receiver which the author uses for searching out interference from power lines, imperfect household electrical devices, and other sources

If the disturbance is caused by the lighting or power circuits of the public service company that you all are buying service from, the correction should be easy. Some of the power companies who have high voltage lines want to know when people hear such disturbances on their lines because such noises may mean leaking insulation which will break down some time and shut down their service.

Some of the present interfering apparatus was made or is owned by the General Electric, Westinghouse, Western Electric, and Bell Telephone companies. Those companies are also interested in broadcasting, therefore they should naturally want to prevent interference from their machines and devices, and want to know what you find.

There are a lot of effects that may make the spotting of the source difficult which, if you are not in a hurry to find a particular source, are very interesting.

If the disturbance is carried by a wire line

overhead or underground, the disturbance will be loudest when the horizontal wires are parallel to it, and the disturbance may follow the line for a considerable distance.

WHAT TO LOOK FOR IN TESTING

IF YOU have a large mass of metal in the house like a large furnace, all broadcasts and all disturbances may be loudest when the coil is pointing toward the furnace no matter which side of the furnace you may be on. That is providing you are alongside the furnace. You may get the same result from a tall iron structure or a wire coming down a tall pole.

If there are wire lines running along one side of your lot you may get a broadcast station on the other side and not at all or in a different direction on the wire line side. Generally speaking any conductor you pass close to will produce a change in apparent direction or in volume. Another interesting thing is that to get zero sound in finding directions the coil must be tilted sometimes. This is done by leaning over sidewise.

THE TESTER

May use telephones for reception, as Mr. Marriott does here, but one who wished to use a small loud speaker could create considerable interest

If you live in a part of the United States where summer thunder storms are common occurrences, it will be interesting to pick up their directions and follow them around, away, or over. When they are overhead or all of them are far away in several localities, the static will probably seem to come equally strong from all directions.

The pack board radio compass is a good device for comparing the receiving characteristics of different localities because you have the same apparatus to use in all the places instead of a different antenna and different ground connection in each place. For example: I used it at Bremerton, Washington on Puget Sound and then went up on Mount Rainier and concluded that the strength of broadcasts from KGO at Oakland was about five to ten times as strong at Bremerton than I found them in Paradise Valley on Mount Rainier.

Not only is the pack board radio compass useful for broadcast listeners and amateurs to enable them to divest their neighborhoods of interferences and to learn about radio but it is useful for merchants to learn of interferences and to chart their city and sales territory, marking the localities where receiving conditions are good, bad, and indifferent. Also if they want to have some fun and possibly make some sales they can put a light loud speaker on the pack board and tune-in broadcasts, for others to hear in passing.

PERSONAL EXPERIENCE

ONE evening, recently, I was out with the pack set checking up on the absorbing and direction changing effect of some wire lines. Going around the block I live in about dusk, I passed the Kitsap Inn. I noticed a woman on the porch, but not being so young as most radio engineers I was more interested in radio effects and did not pay any attention to her. I do not know whether she was a new comer to the neighborhood or whether she was peeved by my inattention. Anyhow she telephoned in to the Bremerton Police Department that there was a crazy man going around with a radio set on his head.

A few minutes later, a mechanic who was ambitious to become a sleuth, came along and paid attention to the lady on the porch and being informed of my conduct followed me at a safe distance.

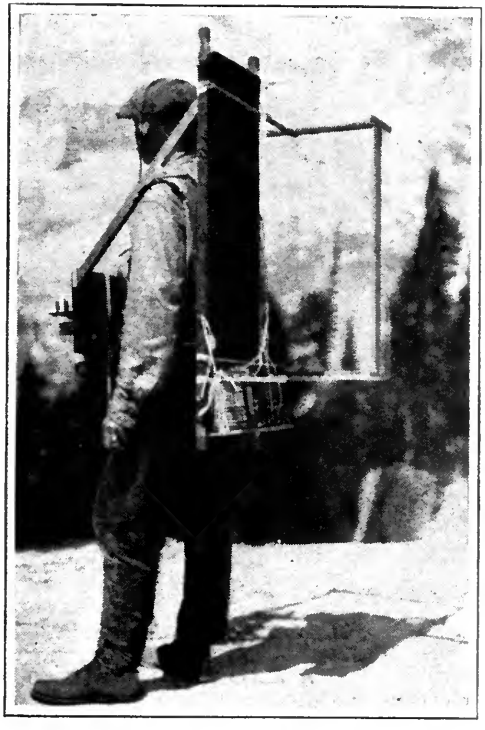
This man with the positive sleuth bias seemed to believe that I was carrying a diabolic ray apparatus which I was trying to train on the Navy Yard which is about a mile

and a quarter long. At any rate, something like that was telephoned to the Bremerton Police about the time I was passing across the street that separates Bremerton from Charleston.

After the first alarm, the Bremerton police came to look for me, after the second alarm a Charleston policeman was added to the posse. Not finding me they called out the sheriff. The neighborhood afterward told me that police were seen searching even behind garbage cans. I don't know whether any of them looked in a garbage can or not. This went on for about two hours and in the meantime I went home and set my pack compass on a table along side of a tuned antenna wire, plugged in the loud speaker and sat down.

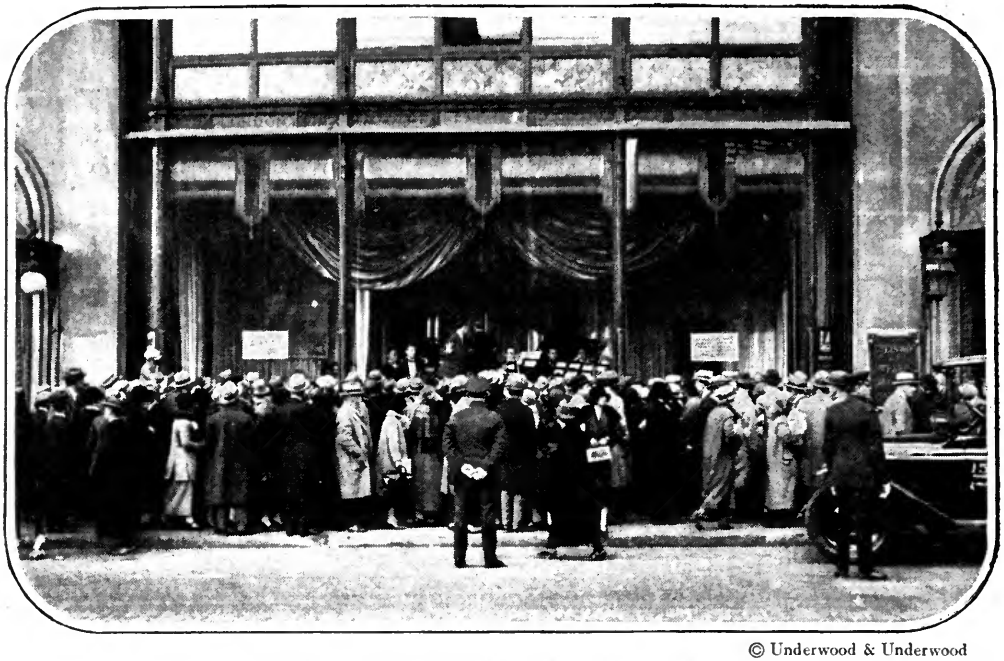
A little later an automobile full of men pulled up just below my house on the wrong side of the street and made so much noise that I thought they were full and went out on the porch and sat down on the steps to pet the dog and watch the men. About that time one of them said, "There is a fellow sitting on the porch of that house, maybe he knows something about it." Whereupon he came over and asked me if I had seen a fellow going around with a radio set on his head. I said, No, but that I had been going around with one on my back shortly before. Then he started in to ask questions about like most people ask when they meet me wearing the pack compass.

Others came up until there were eight or nine of them and the questions seemed rather unusual, which caused me to ask why all the delegation and so much interest. I didn't know they were police because they were in plain clothes. Then they told me the whole story and I invited them in and let them listen to concerts. Altogether we had a very enjoyable evening. They told my friend McCall, the mayor, and Mac told the newspaper reporters and I don't expect ever to hear the last of it.



GOOD RECEPTION AREAS

May easily be charted with a device similar to this. Local radio dealers could send several men out with a pack set and quickly make a dependable map of their territory. A direction-finding loop set used in an automobile is not always satisfactory because the interference produced by the ignition is usually quite bothersome



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A BROADCASTING STUDIO WITH A PLATE GLASS WINDOW

The studio of WJZ–WJY in New York was recently moved down to the display windows of the Aeolian Building so that passing crowds might see just how broadcasting was carried on. Amplifiers were installed so that the watching crowd could hear as well as see what was going on

THE MARCH OF RADIO

By J. H. Morecroft
Past President, Institute of Radio Engineers

What Has Happened to Important Radio Patents

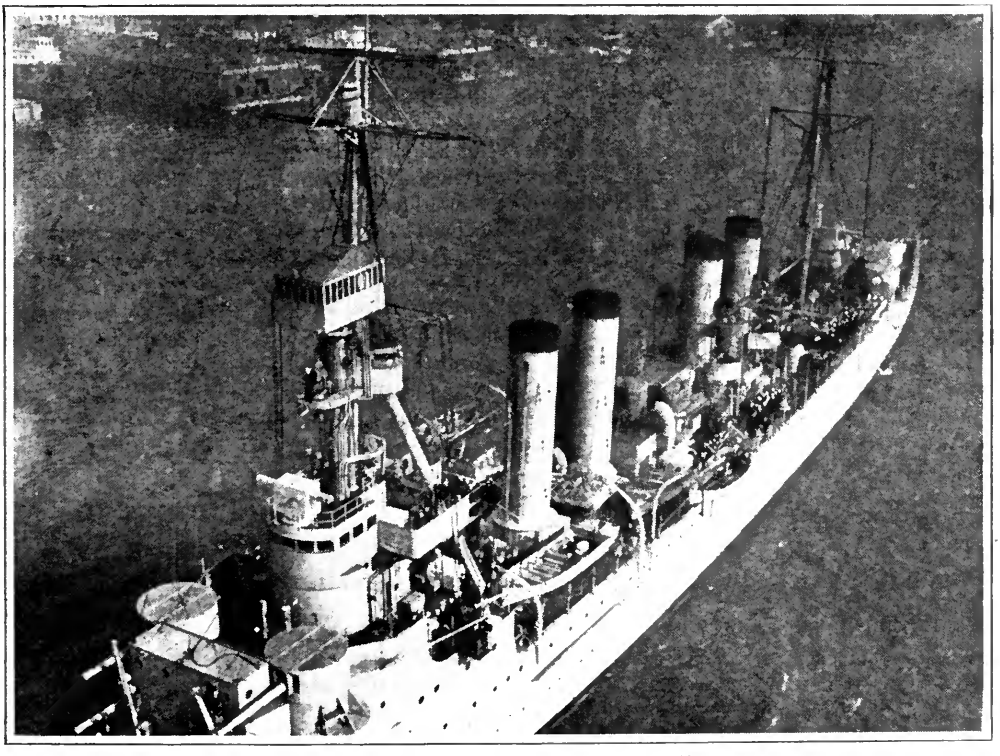
RADIO certainly has proved a boon to those who reap their livelihood by getting manufacturers into and out of legal entanglements. Patents, by the thousands, on all phases of the radio art, have been granted or applied for, and it is doubtful that a single piece of radio apparatus could be manufactured in such quantity as to bring in worthwhile returns without some dozen attorneys being able to arrange damage suits on some count or other. Some men whose names stand reasonably high in the estimation of the lay public have adopted what may be termed "steam-roller" methods of patenting radio devices. Hiring one or more attorneys, they draw up claims for anything they can conceive of whether they have made it work or not. Such men expect to make money on the "nuisance value" of their patents. We recollect seeing one man's name so often in the patent office records that he certainly must have at least 200 patents, possibly more. Such a man is trying to use the radio art purely as a money-making proposition. It is questionable if a single really original valuable contribution will be found in his whole pile of patents.

With a few such men in the game, and a

few hundred others who are more conservative in the amount of work they turn in to the patent office clerks, it is small wonder that we continually hear of patent suits. During the past month, several very important suits were either started or decided, temporarily. We say temporarily, because apparently no one but a lawyer, familiar with the various successive processes by which a suit can be continued, knows when a question is decided and when it is not.

Through various transfers of patent rights, some exclusive and some not, the Radio Corporation of America attorneys were of the opinion that they could hold the De Forest Company to carry out sales according to their desires and policies, that is, the R. C. A. could tell the De Forest Company where and how they must stick these little tags we have all seen so many times telling us that these devices are "sold for amateur and experimental use only." Early in 1923 the R. C. A. did obtain an injunction against the De Forest Company under which the selling policies of the De Forest Company were controlled by R. C. A. After thoroughly reviewing the case, vice-chancellor V. M. Lewis of Trenton, New Jersey has just handed down a decision which frees the De Forest Company from the restraining hand of the Radio Corporation. The legal arguments used are too intricate for a layman of our calibre to follow, but agreements between the De Forest Company and Western Electric Company; and then between the latter company and the American Telephone and Telegraph Company; and then with the Radio Corporation sometimes "for pay" and sometimes not, apparently convinced Chancellor Lewis that De Forest should be allowed to be free to compete with the Radio Corporation in the sale of tubes and apparatus.

In another suit, a small firm selling a few parts for a super-heterodyne has been sued by the Radio Corporation for infringement. The expert for the R. C. A. claimed that the five or more pieces collected in a box constituted the makings of a "super," although we had previously been informed that there were more than 4000 parts in the super as



THE NEW U.S.S "MARBLEHEAD"

The newest of the Navy's cruisers. The extensive use every naval vessel makes of radio is partially shown by the elaborate antenna installation aboard the *Marblehead*. This photograph was taken in the East River, New York

JACK BINNS AND HANS LADWIG

Meeting at New York shortly after the trans-atlantic flight of the ZR–3 was concluded. Ladwig was radio operator aboard the Zeppelin and Binns is famous as the first wireless operator to take part in a rescue at sea

constructed by the Radio Corporation and that, according to Armstrong himself, even though we were furnished with a diagram of connections and given the actual constants of the various coils, condensers, resistances, and what not, none of us could build a super-heterodyne that would work. It seems that one's ideas as to what constitute a super-heterodyne depends upon what one wants to prove.

During the War, someone thought of using an antenna under water as a receiver of radio signals. Under-water antennas were used to some extent for reception during the War. The principal use of such a device, however, is evidently on a submarine which needs to get radio signals when she is submerged. Dr. J. H. Rogers applied for a patent on a submerged antenna as did other inventors, some of them in government employ at the Bureau of Standards. The specific type of submarine antenna described by Dr. Rogers in his patent was an insulated wire connected to the bow of the submarine, running to the conning tower, down through the receiving apparatus, back to the conning tower, and thence to the stern of the submarine where it was attached. The hull of the submarine thus constituted a part of a one-turn loop antenna. Messrs. Willoughby and Lowell of the Bureau of Standards tried to have Dr. Rogers's patent annulled on the ground that they were the real inventors, but the Court of Appeals of the District of Columbia has, after five years litigation, declared Dr. Rogers the real inventor.

The De Forest Company has started suit against the Government to recover damages for the use of three-electrode tubes purchased for the government through the General Electric Company and others. Apparently, the De Forest attorneys think there is a possibility of showing that the General Electric Company had no legal right to sell tubes to the Government. Two million dollars is named by the De Forest Company as its estimate of the damages suffered.

Now, Attorney-General Stone has just handed down a decision which will probably prove to be extremely valuable to some of the American radio manufacturers. Some of the German patents seized by our government during the War may now be leased by the navy to American manufacturers. The Attorney-General held that there appeared to be no inhibition against the issuance of non-exclusive licenses to manufacture under the patent, but that the patent could not be sold. Use of the patents seized by the Government, several hundred in number, has heretofore been denied. Among the patents so leased is one of Schloemilch and Van Bronck covering the reflexing of radio circuits. We shall probably see a lot more reflex sets on the market in the next year or two, unless the alternating current tube should appear on the market within that time. Reflexing is a scheme for saving maintenance cost, but when an alternating current tube is available, the maintenance of a set will fall so low that the use of reflexing will not then be as general as it is now.

Radio Helps the Air Pioneers

LAST month we called attention to the help radio nowadays extends to the Arctic explorer. Now, the explorer, instead of disappearing from the face of the earth for a year or two is in daily communication with those of us who prefer the humdrum life in a more equable climate.

As we read of the transatlantic flight of the *ZR*-3, we couldn't help but think of how modestly and almost unheeded radio was making possible the record-breaking trip. A dirigible like the *ZR*-3 hasn't a great deal of fuel reserve and can make only about 70 miles an hour without excessive gasoline

consumption. If she meets a head wind of much strength, she would actually be almost standing still, and a day or two of such standing still with full fuel consumption would probably spell disaster for the trip.

The *ZR-3* however, ran no chance of getting into such difficulty; she was constantly in radio touch with one continent or the other, and with dozens of ships in various parts of the ocean, to give her weather reports, and so was able to lay her course to avoid bad weather conditions. This feat without radio, would have been entirely impossible. We can expect radio to play a rôle of ever increasing importance in pioneering of the kind our new dirigible accomplished.

What "Low Loss" Means

THE progress in any art is necessarily made in a series of steps, an improvement of existing methods here, a new idea and invention there, and perhaps improvement in material and design of apparatus elsewhere. The change of communication scheme from code signals to the spoken word at one step increased the possible users of radio from hundreds to hundreds of thousands. The advent of the inventions of De Forest, Armstrong, Heising and others increased the range of the broadcast channels from tens of miles to thousands of miles. The increase in efficiency of apparatus brought about by the thoroughgoing methods of the research engineers of the large electrical companies, and other smaller ones, such as the General Radio Company, has given us more reliable sets, easier to adjust and operate, consuming less and less battery power.

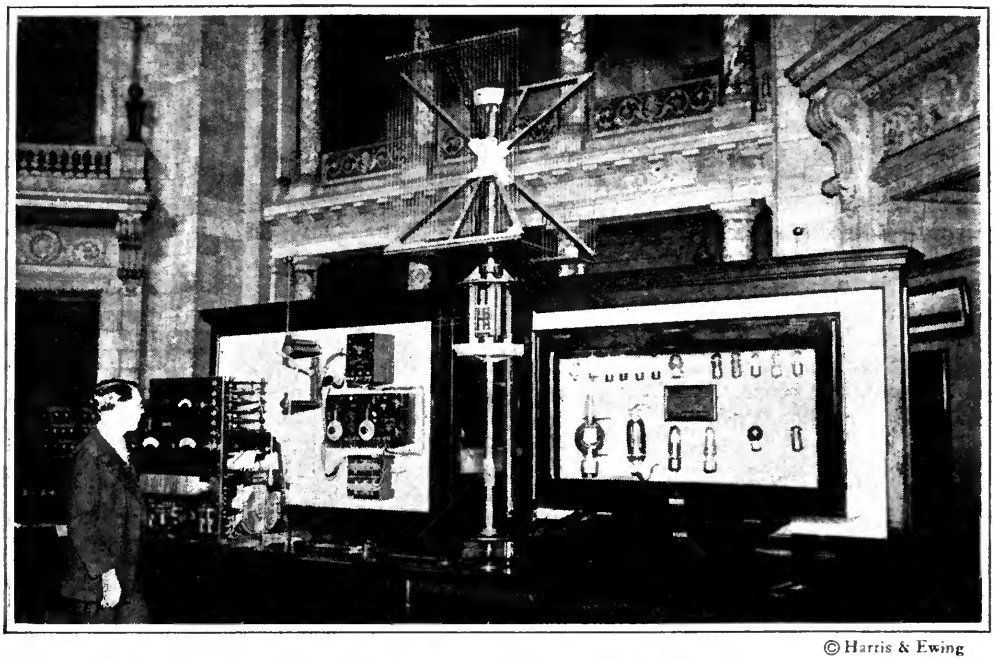
In the latter class of radio progress we have had such ideas as the unicontrol, the dry battery tube, the non-radiating set, etc., successively holding the stage in technical discussion and advertising. Of late the "Low Loss Condenser" has been the slogan of dozens of manufacturers regardless actually of whether the losses of their condensers were low or not. It seems likely that many of the "Low Loss" advertisements are based on conjecture rather than fact.

So much has the low loss idea been emphasized lately by radio manufacturers that it is likely the non-technical broadcast listener has, by the sheer repetition of this attractive phrase, become convinced that extremely low losses in a condenser are essential to satisfactory operation of his set. A condenser having a phase angle difference of one minute is thought to be twice as good as one having two minutes of angle. We have tested many of the better class variable condensers and do find that some of them have only one-half or one-third the losses of others, but this fact, striking as it may seem, should have but little consideration in the choice of a condenser. The operation of a radio set depends on many other items than the tuning condenser. Some of these are the losses in the coil with which a condenser is always associated. Now the losses in the average coil are about fifty times as much as the losses in the average good condenser. So small, in fact, are the condenser losses compared to coil losses that when any one of a dozen of the better class tuning condensers is substituted for another, no appreciable difference in the behavior of the set is discernible, even with reasonably good measuring instruments.

The lower losses a condenser has, the better it is, judged on this item alone, but the questions of permanence of adjustment, reliability of contacts, smoothness of control, etc. should be considered by the condenser pur-

MUCH EASIER THAN ORGAN GRINDING

Is the life of travelling radio music man in Germany. A number of enterprising Teutons have equipped themselves with loop receivers and a loud speaker and go about the cities vending music. The state of the musician's uniform seems to indicate that the business is reasonably profitable



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RADIO IN THE WASHINGTON NATIONAL MUSEUM

A corner of this new museum is devoted to radio. The display at the left has a complete submarine installation. A half-kilowatt quenched spark transmitter, complete with its motor generator is directly in front of the figure. Mounted on the white panel is a lightning switch and a Navy type receiver. The other displays are the standard Navy radio compass loop, and a progressive exhibit of vacuum tubes from the early De Forest audion at the left to the modern transmitting tubes below

chaser of at least as much importance as the losses.

The Meaning of Super-Power

ESPECIALLY since the recent Hoover conference, has there been much talk of super-power broadcasting stations. The word super-power station is not used in the sense that ordinary stations will be blanketed by its outpouring of radio energy, but rather that sufficient power will be sent out from the station so that static and other interfering signals will sink into insignificance when compared with the station's signals. Of course this is true now for even a 500-watt station, in respect to those listeners who are only a few miles distant from it, but evidently those who contemplate super-power stations believe that their signals will be clear and distinct for all listeners within, perhaps, a 300 mile radius. At present, this range is obtained by the present stations only with much extraneous noise. By sending out ten to fifty times as much power, the signals will reach out hundreds of miles before they drop in strength below that of competing electrical disturbances.

Many listeners are opposed to the idea of these high-powered stations, but we believe such stations are destined to come in the normal march of radio. Just as our stations went from 50 watts to 500 watts, they will go from 500 to 10,000 watts, and for the same reason, namely, to give more satisfactory communication to a larger number of people. Those who live near these coming super-power stations will, of course, be subject to more interference than are neighbors of the present stations, but the convenience of the few can never be allowed to impede a movement which is in the interest of the many. To give as little trouble as possible, the high-powered stations must be situated several miles from a large city. They will be controlled from the city studio by wire connection.

Better programs and better technical operation will come with the larger stations, and these spell progress for the broadcast art. The licenses issued to such stations will, of course, be provisional only, so that if a large share of the radio audience find the super-power idea objectionable, a return to the present low-powered stations may be readily brought about.

Antennas Are Not a Lightning Menace

WHEN radio receiving first started on its phenomenal career of popularity, many of the more cautious pseudo-scientists predicted a corresponding increase in the number of fires started by lightning. These bootless prophets averred that the radio antenna would serve as a convenient channel for the lightning bolt to enter the home. We dared to combat this view, for we thought that the increase in lightning hazard would be almost nothing, because of the general disposition of the ordinary receiving antenna.

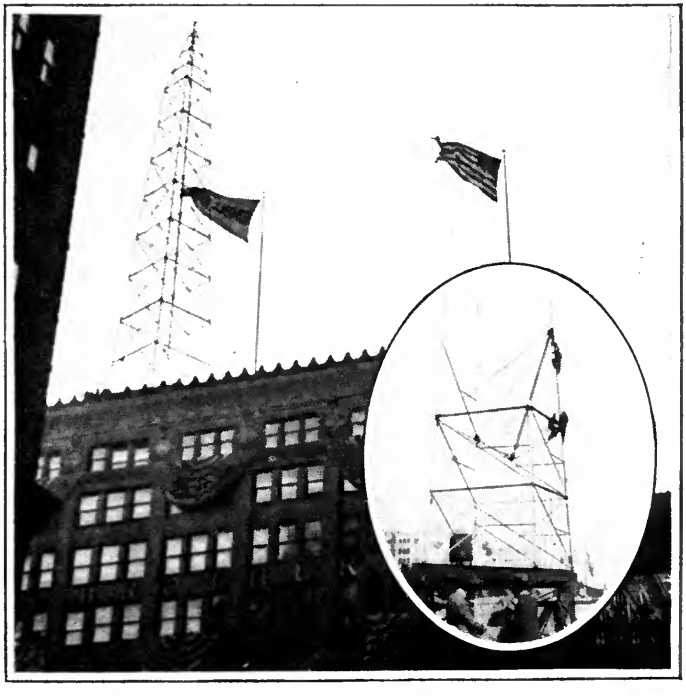
A recent bulletin of the Bureau of Standards confirms our original opinion. Whereas the radio antenna cannot be regarded as a very efficiently installed lightning rod, it need not be considered as an inviter of lightning, either. The Bureau puts an antenna in the same category, insofar as danger from lightning is concerned, as rain gutters, downleads, wire clothes lines, and metal roofs. This should be useful information for the insurance companies which have frequently in the past regarded the radio receiving set as an increased lightning risk.

Municipal Broadcasting Stations

A MUNICIPAL station such as WNYC in New York City is a very questionable benefit to those citizens whose tax contributions pay for its erection and maintenance. Especially is this true when the calibre of the municipal office holders is as low as is the case even in many of our largest cities.

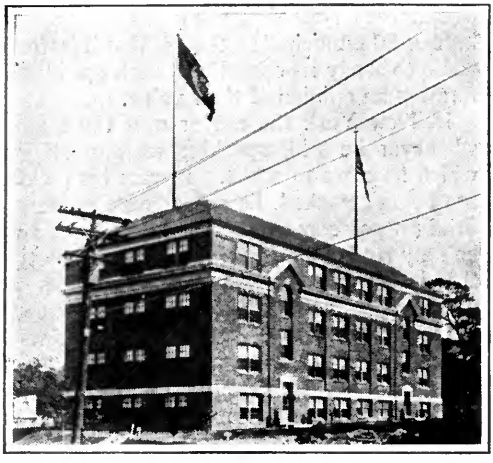
Evidently a municipal station must be largely under the thumb of the mayor or his appointees. It may be used for propaganda of the most biased sort, for unanswerable attacks on those servants of the public who happen to be of political faith different from that of the city's temporary ruler. Is this use of a city-owned station to be permitted? New York's is probably the most influential municipal station, so that it is worth while to study its operations, with the idea of forming an opinion of their value.

In New York the mayor uses the station whenever he will, speaking on any subject which he cares to select. In case his policies are being attacked, he can at once prepare a brief (or pay someone else to prepare one that he may read) showing that he is "supporting the interests of the people," whereas all others represent the "interests" and are seeking to rob the public. If his opponents want to combat his, perhaps, unreliable statements, they may do so through the city's radio station, but their remarks must be written, they must stick to their written notes, and these must be sent to the mayor's office for censoring before the speech is delivered! Others must stick exactly to the material which has been thus censored, whereas if the mayor himself is scheduled to speak on the city's budget, for example, he may forget all about the budget and spend his time vilifying some public servant who has dared to question the soundness of some of his doctrines. Surely here is a situation in the broadcasting field



STATION WGBS, NEW YORK

Recently put on the air. This station is a companion to WIP, operated by the same firm at Philadelphia. The insert shows one of the towers in the process of construction



FOR RADIO RESEARCH

This entire building, recently erected by the Radio Corporation of America in New York City, houses the technical and test staff of the organization, under the leadership of Dr. Alfred N. Goldsmith, chief broadcast engineer

which should be heralded from the housetops, so that stations of this sort may send out their messages to receivers which are all tuned to some other channel.

Is this condition morally and legally sound? Broadcasting has been put in the same class as newspapers, insofar as responsibility to the public is concerned. Is a mayor privileged to run a paper, of which he is the censor, to espouse the virtues of his régime? Certainly, it is done in many cases. But here is a different question. Is a mayor privileged to spend the city's money, collected equally from his followers and from those differing with his ideas, to purchase a newspaper for his own use? Isn't that what this municipal broadcasting station amounts to?

More ARA Public Service

THE American Radio Association is still carrying on its good work. Instead of making vague complaints about interference and other troubles, it picks out a definite point of attack and makes admirable constructive criticism. Instead of writing reams about the decrements of spark stations and the impossibility of tuning-out such signals, a letter is sent to the Postmaster-General stating that a Postal mail-boat, doing very heavy radio traffic around New York harbor, is using an antiquated spark system which is seriously interfering with broadcasting channels. Their complaint says further, "if the Post Office Department cannot afford to provide a modern transmitting apparatus for this mail-boat, several broadcast listeners stand ready to contribute to a fund to purchase the equipment and thus save the programs from the bombarding interference caused by this obsolete transmitter."

What is Happening on Short Waves

AS SOON as short-wave channels had been shown feasible for distances much greater than was ordinarily thought possible for them, all the commercial companies started experimentation in this field, and to-day a large number of stations are carrying on such work. The Radio Corporation station at Tuckerton, designed primarily for transatlantic work, with a 15,900 meter wavelength, has had its license changed so that it can use in addition 103, 100, 97, and 93 meters. KDKA is carrying on its pioneer work in this field and WGY has several short waves in use, one as low as 15 meters. POZ in Germany and UFT in France have been talking to Argentina (LPZ) on 77 meters. Two Italian stations, IDO and IHT, have been working with each other on 106 and 117 meters. The Navy reports that successful experiments have been conducted with wavelengths as low as 54 meters. It will be remembered that Marconi recently sent a 92-meter wave from Poldhu, England to Buenos Aires with a small fraction of the power ordinarily used to span a 6000 mile separation. In these tests he used Hertz's scheme of parabolic reflectors.

From the calibre of the experimenters now working in this field we can soon expect to have reliable data on short wave channels, how much fading occurs compared to longer waves, whether short period fading is sufficiently aggravated to make these frequencies of thousands of kilocycles unsuitable for telephone channels or not, and other information of equal importance.

Recent Distance Records

AS THE winter months approached, the distance-breaking contest started in earnest. Not only is the absorption of the radio signal much less in winter time than in summer, but, of far greater importance, the noises from static disturbances are only a small fraction of the summer-time values. The latter effect is undoubtedly the one which accounts for the long-distance communication records in winter time.

We have always thought that airship transmission could only be carried on over short distances. It would be remarkable enough if an airship could keep in touch with its base even by land-station relaying, but if the performance of the *Shenandoah* is to be regarded as other than freak, such relaying may not be necessary. The dirigible, anchored at her mast in San Diego, was using a 50-watt set adjusted to radiate on 90 meters. Her signals were picked up by one of the navy boats while cruising in the Pacific 4400 miles away. At the same time the naval air station near Washington was in almost daily communication with the *Shenandoah*, separated from Washington by the whole span of our continent.

Two British amateurs, one in England and one in New Zealand, with home-made equipment, have been able to communicate with each other, although half the earth's circumference intervened. Remarkable as this may sound, we shall probably hear of such feats more and more regularly. An American amateur, H. Johnson, at Short Beach, Connecticut, reports that he held two-way communication with a New Zealand amateur, the distance between them being 9000 miles.

But all these transmissions must still be regarded as freaks by any honest observer.

The Artist, Not the Broadcaster Must Pay Radio Royalties

A DOUBLE bomb shell landed in the camp of the American Society of Composers, Authors, and Publishers when Federal Judge Knox handed down his remarkable decision recently on the question of royalties and broadcasting. The owner of the copyright of a piece of music had asked the judge to stop the unauthorized broadcasting of the music. The judge's decision if it is allowed to stand as the law, will do much to prevent the coffers of the above-mentioned society from bursting with the radio harvest they had hoped for.

The first part of the judge's decision states that the artist is the one giving out the program, not the broadcasting station. The station, in other words, cannot be held responsible for royalties, no matter what the copyright situation may be. Royalties, if any, must be sought from the one sending out the program, namely, the performer. Secondly,

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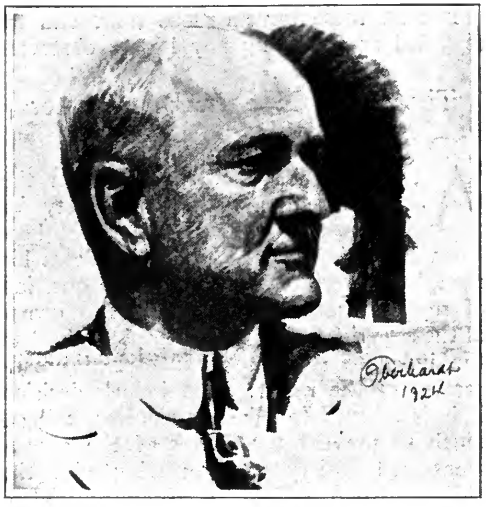
A CORNER IN THE LONDON RADIO SHOW

At Albert Hall. Some of the more enthusiastic of the visitors are testing several of the latest models of British receivers at close range. The inlay work in the radio cabinets is quite elaborate



GENERAL JAMES G. HARBORD
New York, President Radio Corporation of America

"Let me invite your attention to the developments in radio photography. Great strides in this direction have been made in the past year. It is not too much to say that we are in the eve of developments whereby it will be in the realm of possibility to transmit a complete newspaper page from London to New York by means of radio and in a fraction of the time it would take to transmit the entire text of the page either by radio or cable telegraph signals.

"Transoceanic broadcasting for purposes of entertainment is not yet in regular operation, but proposals for increasing the power of sending stations so that the programs from London and Paris and Berlin may be easily heard in America are carefully being considered.

"At present, transoceanic as well as marine radio messages are dispatched by means of telegraph code signals, but the transoceanic radio telephone, now under development through the American Telephone and Telegraph Company and the Radio Corporation, bids us to expect that before many years it will be possible and convenient for any one of us to pick up his telephone and in a short time be connected with his party in Europe, or with his stateroom, on some liner on the ocean."

that the performer, if entitled by license or otherwise to use the copyrighted music at all, can use it for broadcasting without additional payment of royalties. In other words, if the performer has acquired the right to sing to an audience of ten people, he may, at no additional expense, sing it to 10,000 people over the radio channel.

This decision, if allowed to stand as the law of the land, is the most important that has been handed down since broadcasting began, insofar as the general broadcast listener is concerned. It undoubtedly makes the royalty collecting agencies moan with anguish, but the millions of radio listeners will no doubt agree that it is a wise and proper decision.

Some of the New York *Times* correspondents have been acrimonious about an editorial which appeared in that paper commending Judge Knox's solution of the question: "People who get their music over the radio do not buy it." "Broadcasting is a sort of bonus to promote the sale of radio sets." "This profit is partly due to the fact that the broadcaster steals the music"; After much of such baseless argument, this writer winds up with a statement which shows he is at least as human as the rest of us. "However, it (Judge Knox's decision) will probably not undermine respect for the law except in a comparatively small class of artists. Nearly everybody is in favor of a law which confiscates the other fellow's property."

Interesting Things Interestingly Said

L. A. NIXON (New York; Secretary, Radio Trade Association, in a report on present broadcasting plans): "It seems to this committee that the true regulation of the power of a broadcasting station should be based on the listener; on the ability of the listener to discard the program offered by the high powered station and select another program in its place.

"Restrictions should be placed on the interference caused by the transmitting station in the receiving set, rather than the power generated. By such a plan, it would be possible that a twenty-five KW station located in some places in the country might cause less interference than a fifty-watt station located in densely populated centers and poorly tuned."

JAMES C. EGBERT (New York City; Director, Columbia University Extension Service): "About a thousand persons took the Columbia radio extension courses last year, and a great many more merely listened-in. This use of radio for education is as yet in an uncertain stage, so that it is impossible to say yet just what the results will be. We have had definite courses of instruction and have issued syllabuses which served as guides for the lectures. We shall now issue syllabuses and give opportunity for the radio student to send answers to questions given by the instructor. These will be criticised and returned to the student. In this way, we shall test the efficacy of this new method of popular education."

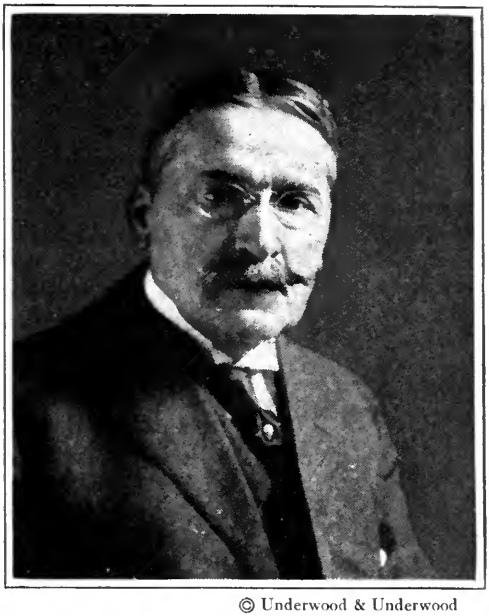
GUGLIELMO MARCONI (London; In a statement opening the New York Radio World's Fair): "Since last year, great strides have been made in the art of broadcasting, both in the United States and England. There have been some important developments in simultaneous broadcasting from several stations, and I believe that on certain occasions in the United States, vast audiences of no fewer than 25,000,000 people have listened to a broadcast address. I anticipate that in the not far distant future, this great achievement will be surpassed and the broadcasting of messages throughout the world will become a matter of everyday occurrence. We on this side of the Atlantic are looking forward to the day when we can listen to American speakers on subjects of common interest."

GIMBEL BROTHERS (New York City; in an advertisement announcing the opening of their new broadcasting station WGBS): "Broadcasting, as we see it, is a limitless force in the hands of a limited number. With some comprehension, we believe, of the invaluable possibilities of radio, and with a deep sense of the responsibility assumed by the broadcasters, WGBS begins its broadcasting experiment with the desire to employ itself in the development of programs in keeping with, and worthy of a force of such power. WGBS wishes to be a public servant in the full sense of the word."

THE NEW YORK *SUN* (New York; in an editorial about broadcasting and politics): "With the tremendous volume of political talking that has been broadcast, there has necessarily been a great deal of listening. Of course, nobody can measure it. But this is certain: only the listener chronically and bitterly opposed to politics has escaped hearing more about the campaign than he would otherwise have heard. Probably a great number of the voters at the polls this year went because of a quickened interest caused by radio.

"This is as much as any believer in radio could ask. Radio is only a mechanical device. If it gives the politician an opportunity, that is all he can ask of it."

DEPARTMENT OF COMMERCE News Service; Washington: "The activity in amateur radio work and in broadcasting is still greater in the United States than in any other nation, the past year has brought about marked changes in the situation in many foreign countries. Naturally, the development has had its greatest growth in Europe. In the British Isles, France, Germany, Sweden, Switzerland, Holland, Belgium, Denmark, and Czechoslovakia, the broadcasting of programs of entertainment and news is on a regular basis. In Italy, Finland, Spain, and Austria, programs are sent out at irregular periods. There is a decided likelihood of regular schedules being adopted in the near future. In South America, Argentina stands out as having made the greatest progress in the dissemination of music and other entertainment by radio telephony. Chile also maintains a regular broadcasting service."



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PROFESSOR MICHAEL I. PUPIN

Department of Electromechanics Columbia University

"The weakest point in democracy has always been lack of appreciation of expert knowledge. Railroads, telegraphy, telephony, radio broadcasting, electrical lighting, and electrical transmission of power are certainly public utilities, but the intelligent people of the United States will never consent that these things, requiring an enormous amount of intelligent expert knowledge be placed under government ownership. The machinery of our government, or any other government known to man to-day is utterly incapable of handling technical problems which require the highest type of training applied to the highest type of intelligence.

"All of these public utilities are full of complex technical problems which cannot and never were intended to be handled by any government. In Europe, we see where there is government ownership, the utilities are being run at very heavy deficits."

E. F. MC DONALD, JR. (Chicago; President, National Association of Broadcasters): "There is an effort afoot to change the name broadcasting to radiocasting. I wish to go on record as voicing a strenuous objection. Without explanation, ask one hundred people on the street what radiocast means, and the chances are if they answer at all, it will be a guess that the word has something to do with a radio receiving instrument. Ask the same group what broadcasting means, and they will tell you correctly. There is nothing to be gained by making the change. Why have this new word when the vernacular already offers an adequate term?"

For the Love of Mike

By A. COOPER ALLEN

Drawings by George C. Williamson

IT was the night before Christmas and all through the house there was a subdued air of expectancy. The light from the shaded reading lamp cast its mellow rays upon the big padded arm chair before the cheerful grate fire and crept partially up the four walls, leaving the ceiling in semi-darkness. The atmosphere of the room was warm and redolent of peace and piquant odor of cedar.

Curled in a heap in the deep padding of the big chair was the boy, his eyes glued to the pages of a book. Occasionally he stirred, turned the pages, muttered below his breath and continued to read. The curly haired dog —the boy's sole companion—lay comfortably dreaming on his rug at one end of the davenport, all unconscious of the joyous Christmastide.

Over against the wall in the dining room was dimly outlined a long table which gave back a glitter of silver, cut-glass, and the gaudy colors and tinsel of a small ornamented tree. Here and there about the two rooms were wreaths of Oregon grape, holly, and the red, red, berries of the madrone—for this was a home in a little Oregon valley.

The silence was absolute until there suddenly came a half uttered whine from the dog. It ceased almost as quickly as it came. A few more moments of silence then again the half-whining bark. The great chair creaked and the boy looked around at the quivering muscles of the dreaming dog. For a moment he regarded the animal intently as the peculiar barking increased and the dog's legs moved spasmodically as if in a labored run.

"Aw, cut it out!" growled the boy. "If you want to ride that nighthorse, hike into the kitchen."

The dog slowly opened his eyes, blinked a few times and promptly resumed his interrupted nap. With a yawn the boy slumped again into the chair and flipped a page of the book.

Dead silence again. Only the tick-tock of the clock was heard. The boy's head drooped over the pages and then a faint tinkle, tinkle, as of bells came on the air. Santa Claus! The youthful eyes opened, the head raised and he listened. Plainly it came—tinkle, tinkle, tinkle.

The big chair creaked, the boy slid out and stood listening. Again came the tinkle. The boy moved to the back part of the house and a sleepy voice broke the silence.

"Bobbie, is that you?"

"Yas'm."

"What are you doing?"

"Lookin' for Santa Claus—whadayu s'pose? I heard his bells."

"Bells?" came the female voice with a rising inflection. "What *are* you talking about?"

"Well, I heard sleigh bells out back and came to investigate," retorted Bobbie.

"Find out?"

"Sure."

"Sleigh bells?"

"Yah-h-h," he drawled. "Bunk. It's rainin'—droppin' from the roof on tin cans. Never have snow here. I wish——"

"I've told you to carry those cans away," interrupted the voice, "and you had better—"

"Uh-huh," grunted the boy and the door slammed as he returned to the chair.

Silence again, and then a stealthy noise at the front of the house. The dog pricked up his ears, jerked his tail a couple of times, and closed his eyes again—the figure in the chair did not move.

A SLIGHT scratching at the door then the knob slowly turned and the figure of a man with dripping hat and coat came through the opening. Furtively he looked about then entered bearing a long, oblong, bundle under his arm. Silently he crept across the room toward the Christmas tree on the table.

He was undoubtedly Santa Claus but clothed in the conventional garb of the average business man. The only possible method of identification of the merry elf was his mysterious, stealthy, entrance. It was evident he feared discovery as he cautiously moved across the floor. He passed the high back of the big chair and glanced at the dying embers of the fire. Then he halted suddenly, arrested by a voice from the padded depths of the chair.

"'Low Sandy Claus. Whatcha got?"

"Bobbie! What are you doing up, at this time of night?"

"Readin'."

"Reading? What is so interesting to keep you up this late?"

"Gulliver's Travels—book review—school—all bunk," and Bobbie squirmed and yawned.

"Well, you hop to bed—right now. How do you expect Santa Claus to come if you sit up all night? It's Christmas right now."

"All right, Dad—I'm goin'," and Bobbie uncurled his six feet of seventeen year old sinew and sauntered out.

"Merry Christmas, Dad! Call me early!"

Dad grinned and continued his journey across the room, planted the long package carefully upon the table and swept the polished silver tableware ruthlessly to one side. Then he removed his dripping hat and coat, hung them carefully in a pile on the Davenport and again opened the front door. Here he picked up sundry mysterious bundles, placed them on the table by the diminutive tree, muttering to himself "A battery, B's, horn." Seating himself at his desk he sought for and found a card and wrote rapidly upon it, placed it upon the large package and, snapping out the light, sought his room.

AGAIN the cheerful fire upon the hearth, the peaceful quiet room, now flooded with light. In the big chair was Dad, a brand-new pair of slippers upon his feet, a new smoking-jacket about his shoulders, and a pair of horn rimmed glasses upon his nose. In his hand a magazine, the page before his eyes lined with many names and strange hieroglyphics such as PAQ, KXY, WBG, etc.

On the table in the corner stood an oblong, mysterious looking, box with strange dials on its black face and beside it a queer black horn turned its mouth toward the room. Before this strange box sat Bobbie, the expression on his face denoting highly concentrated thought while his fingers manipulated sundry wires leading in from the window. From back in the kitchen now and then came the rattle of dishes and snatches of song where Ma was busy putting away the remains of the Christmas dinner.

Bobbie tightened a wire to a series of small, red-topped, boxes studded with brass taps, leaned back, and the concentrated attention changed to one of pleased expectancy.

"HE WAS UNDOUBTEDLY SANTA CLAUS
But clothed in the conventional garb of the average business man"

"Got her hooked up," he announced.

Dad grunted and looked around in his chair, his eyes peering over the horn bows. Of course Dad had no great interest in the affair, for he was not very much impressed with radio.

"Turn her on," he suggested after a wait.

"Well, I have, haven't I?" grunted Bobbie.

"Can't hear anything," apologetically.

"Give her time, can't you?"

Dad subsided, but, though the magazine was held before his eyes he saw nothing—but his ears were twisted to the rear like a mule's.

Silence—dead silence. Bobbie turned the dials backward and forward. Silence.

Bobbie lifted the cover. Inside, five tubes glowed with mellow light midst mystic combinations of wire and strange apparatus.

"It says here——" began Dad, but was suddenly stopped.

"I don't care what it says—I'm doing this."

"W-e-l-l," drawled Dad, "you are evidently doing it wrong. I told you——"

"I got it," broke in Bobbie. "Got my A battery poles reversed. Now . . . . ."

A slight sound issued from the horn, Bobbie twisted the tails of the dials. The hissing turned to a frying sound.

"You've got the kitchen," ventured Dad facetiously. "I can hear bacon frying."

"For gosh sakes! Can't you keep still? I'm gettin' 'em, if——"

Dad left his chair and stood before the yawning mouth of the horn. Strange murmurs, crackles, and the sound of frying came forth. They listened in strained attention as the dials slowly turned. Suddenly there was a squawk and a whistle—then only buzzing.

"Nearly got 'em that time," Bobbie exulted.

"You bet," Dad agreed heartily. "I heard him whistling for his dog."

"THAT CONTRIVANCE PROMISES TO DRIVE US ALL OUT"

BOBBIE'S hands dropped from the dials and he sank back in his chair as his gaze rested upon his father's face in utter disgust. Dad subsided and sought sanctuary in his chair. Bobbie returned to the dials—there were three big ones with some kind of scale marked on them, and there were a couple of other knobs. Bobbie was busy and his neck was stretched to the limit trying to get his ear nearer the horn. Faint sounds as of distant music and voices seemed to come from a hundred miles back in the black throat of the horn. Bobbie strained his ears and Dad held his breath in wrapt attention. Then a door at the back of the house slammed, dishes rattled and a woman's voice rolled through the room warbling snatches of a Christmas carol. A muttered explosion was half smothered in the throat of the boy as he impatiently thrust back his chair and made for the sound—Dad only gasped.

Bobbie returned and left silence behind him—Dad grinned.

Again the slow, deliberate, turning of the dials without result. Then the voice from the chair:

"Jones just turns one dial and gets 'em right away and——"

"Y-a-h-h-h-h!" came scornfully from the young hopeful. "Single-tube regenerative—cheap—this is different. Ah-ha!"

This time it was unmistakable. Far back back in the foothills of the machine could be heard a woman's voice—high soprano. Dad slid out of his chair and stole silently up behind the absorbed operator. Back and forth Bobbie moved the dials and the illusive sound died away or returned, according to the manipulation of the dials. He placed his

hand upon a knob and began to turn. The volume increased and suddenly burst forth in all its glory and power: "*Zitty-zit-zit-zit. Zitty-zit-zit-zit.*"

Dad snorted. "It's a Zulu lullaby," he laughed.

"*For the love of Mike*!" shouted Bobby in high dudgeon. "If you can't keep quiet, get out! I was just about to get 'em——"

"Seems to me you got a whole beehive that time."

"Gosh darn it—that's just like you. You don't know the telegraph code when you hear it and—and—oh, heck!" What's the use!" Bobbie threw a switch, the sounds ceased and he pushed back his chair.

Ma, in the kitchen, saw the door open slowly and Dad appear looking over his glasses in a quizzical way.

"What's the matter?" she demanded, realizing there was something in the wind.

"I beat it," explained Dad. "He got a Zulu band or a hive of bees or something buzzing around in the horn and——"

"I suppose you had some smart remarks to make about it?" she broke in accusingly.

"I only joked him a little," he acknowledged and his tones implied guilt.

"Well, you leave the boy alone. I," with emphasis, "think he is doing just fine—it isn't every boy his age, and never having had a radio before, could do as well. He——"

"He hasn't got a thing yet. Cost nearly two hundred bucks—I told him they are just in the experimental stage—never heard anyone get anything but whistles and howls and noise."

"But this is different," Ma stoutly defended her idol, "this is a—a—well, it's some kind of a dyne and *it* won't make those noises."

"It's already making them. If you don't believe it, go listen to it."

"Then it's all your fault. You allowed yourself to be cheated." positively declared Ma. "You know I told you to be careful."

"I got the one he picked out."

"It was probably a bargain—you always opposed the idea so you just picked any old thing and——"

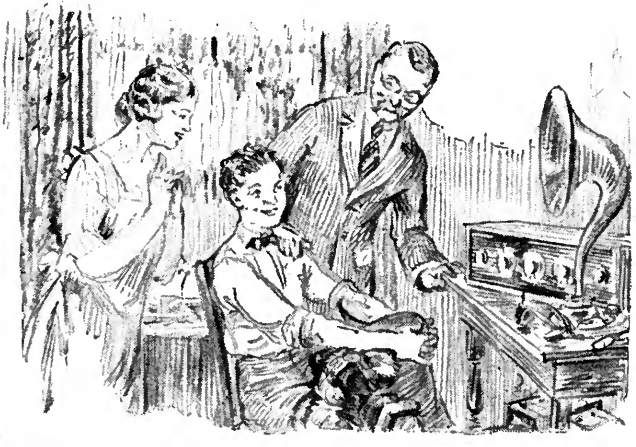
But Dad had fled. As he wasn't ready to go to bed and he wouldn't go out he could only return to the "studio." He was completely bluffed so he sneaked in on tip toes, for Bobbie was once more at the machine. He made about four steps when Bobbie whirled.

"For the love of Mike! Can't you keep still? Your shoes squeak so I can't hear a thing."

"I got to move, don't I?" Dad defended himself and sneaked toward his chair. The slippers were new and Dad was not conscious there was a very mild, weak, little squeak in them. He halted with his back to the fire watching his son who had again turned to the dials, then, after several minutes, sat down in his chair, wriggled into a comfortable position and opened the evening paper. Instantly the storm broke.

FOR the love of Mike! Just as I had 'em you——"

"Dad-burn it, do you expect me to sit here and twiddle my thumbs all evening?" Dad began to grow a bit irritable. He had opposed the installation of the "infernal thing" on the grounds of cost. He thought this business too "purely experimental." He had not expected to hear anything very much out of the set and, from self defense, had gone the limit and purchased what they had thought was the best and newest on the market, thereby hoping to get a slight return for his money. He was prepared to swallow his loss and expected failure, but he had not counted upon his peaceful home being rent and turned into a domestic battlefield. The flames of combat began to burn and, as Bobbie had much of his own disposition, the fur promised to fly.



EVERY NOTE CAME THROUGH CLEARLY

"Well, you can listen, can't you? That's what it is for."

A stinging retort was on the tip of his tongue when a movement in the shadows of the next room caught his eye and Ma beckoned to him. He arose and, with bristles standing straight up, stamped into the kitchen.

"Now, Dad," she began when she had closed the door behind him, "remember, this is Christmas and there should be peace——"

"Peace!" he shouted. "Ha, ha, ha! Ever since that blamed thing was turned on there has been nothing but growls and snarls. Why can't you all be good natured and tolerant like I am? This *is* Christmas but, all you two do is to try and brow-beat me and——"

There was a sound at the door and Dad opened it. The dog sneaked into the room with tail between his legs and sought a secluded corner beneath the kitchen table, for he had indulged in an ardent flea scratching bee just when Bobbie had again "nearly got 'em."

"See! See!" Dad exulted. "Even the dog had to beat it. That contrivance promises to drive us all——"

"*Dad! Dad!*" came excited cries from the front room and, forgetting all his troubles, Dad answered the call with Ma following close behind. Bobbie was sitting back, his face wreathed in a happy smile, as there came floating from the horn, and filling all the rooms, the clear, sweet, notes of an orchestra. There was no doubt of it, for every note came distinctly and without distortion. Dad and Ma halted on either side of the happy boy—Ma supremely blissful and tears of pride in the eyes of Dad as he rested one hand upon Bobbie's shoulder.

"Who is it?" whispered Dad in awed tones.

"Don't know yet—listen!"

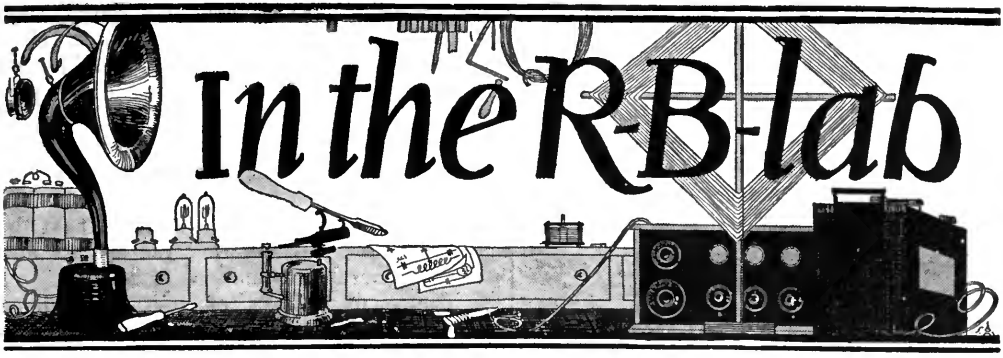
The sweet strains died away. There followed a moment of silence, then a clear voice distinctly announced the call letters and the name of the city.

"Pittsburgh!" exulted Bobbie.

"Pittsburg, and this is Oregon!" echoed Ma in an awed whisper.

"Pittsburgh!" proudly exclaimed Dad. "For the love of Mike!"

E. F. W. ALEXANDERSON
Chief consulting engineer of the Radio Corporation of America examining the automatic receiving apparatus at Radio Central, Riverhead, Long Island



STANDARD THREE-CIRCUIT COILS AND THE ROBERTS RECEIVER

THE principal difficulty encountered in the construction of the several Roberts receivers described in recent issues of RADIO BROADCAST is the obtaining or construction of the designated spider-web coils, and the mechanical arrangement of the variable tickler. Spider-webs have been recommended by the various authors, regardless of the possible inconvenience, probably because such inductances were specified in the original article by Mr. Roberts, and because, as experience has shown, it is not an over easy matter to design other inductances for this receiver.

The spider-web is not a particularly efficient type of inductance (which again dispels one of radio's pet illusions), several engineers having found it inferior to the conventional single layer coil (the solenoid) for a given value of inductance.

After several months of experiment, this department has found the several problems of the Roberts inductances solved for the average builder by adapting the standard three-circuit tuner to the requirements of the more efficient Roberts circuit. These coils are widely purchased under a variety of trade names—such as "The Ambassador Coil," "The Trans-Continental Tuning Coil," "The Uncle Sam"—etc., all of which are characterized by three windings, primary,(antenna coil), secondary (grid coil) and the rotating tickler (plate coil). There is little electrical difference between the various makes of these coils, and any one of them, with the addition of a few turns of wire, may be substituted for the usual spider-web, radio-frequency transformer and tickler in the Roberts set (T2, Fig. 2).

First count the number of primary turns—of which there will generally be from fourteen to sixteen. Place a layer of tape over the primary winding, and connect one end of a sufficient length of No. 22 wire to *the binding post which represents the primary terminal nearest the end of the tube.* Wind over the tape exactly as if you were winding a second layer of the primary over the first layer, winding to one turn less than the original primary. You will now have a *transformer* primary, and a neutralizing coil with one terminal common. In wiring the receiver, the common post leads to the plus B battery, the two remaining terminals running, indiscri-

In the R. B. Lab This Month

SHORT ARTICLES ON—

—Three-circuit tuner coils for the Roberts set.

—A one-stage resistance-coupled power amplifier.

—Loop sets on outdoor antennas—Why this is inadvisable and how it should be done when necessary.

—A one-tube receiver that works on a loop accomplished by radio frequency and regeneration.

"Building your own lab"—The slide rule and how it can help you in your work.

—and short lab notes that may mean a lot to you.

We are endeavoring to make "In the R. B. Lab" the most valuable single department to you in RADIO BROADCAST. *Tell us what you would like to see in it—some particular experiment or test that has been puzzling you.*

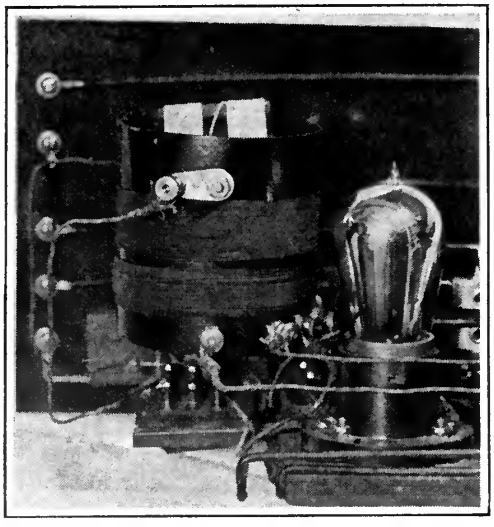


FIG. 1

The three-circuit tuner in an experimental Roberts set. The extra winding can be seen on the lower portion of the coil

minately, to the neutralizing condenser and plate of the radio-frequency tube. (This is exactly as directed in the articles describing in detail the construction of the Roberts receiver). Fig. 1 shows the arrangement connected in the R. B. Lab.

Fig. 2 shows the circuit in which the modified coupler was used as T2. P1 and P2 refer to the primary and neutralizing windings, S to the secondary, and "tickler" to the rotating coil, the last two windings being connected as in the usual three-circuit arrangement. T1 is the antenna coupler, the secondary of which consists of forty turns of wire on a three-and-a-half-inch form. The primary is wound alongside of the secondary with fourteen turns of wire. This forms a semi-tuned primary, the ground side of which is connected to the filament lighting battery. The usual type of tapped primary can be used if desired.

For further details and operating data, the reader is referred to any one of the numerous articles on the Roberts set appearing in the August, September, and October, 1924, numbers of Radio Broadcast.

A ONE-STAGE RESISTANCE-COUPLED POWER AMPLIFIER

AS WAS demonstrated in this department last month, the tendency of a receiving system toward instability increases more or less directly with the number of tubes. For this reason, the addition to a multi-tube receiver of still more tubes, such as a single stage of power amplification for use on distant stations and dance purposes, must be effected with unusual method and care. In many cases an extra stage of transformer-coupled power amplification to a many tube reflex or super-heterodyne receiver proves to be the straw that breaks the camel's back, precipitating the system into almost incurable oscillations or squeals.

The characteristics of resistance-coupled amplification, which made effective the attempts at stabilizing the three-tube reflex receiver as described in the R. B. Lab. for December, recommend this method of amplification as a final stage of power intensification free from the complications attending a similar step of transformer coupling. (Resistance coupling and its particular qualifications in final amplifying stages, has also been described in greater length in "How To Make A Knock-Out Amplifier" featured in the same issue of Radio Broadcast.)

Figs. 3, 4, and 5 are descriptive of a single stage of resistance-coupled power amplification, for use as an external and auxiliary amplifier. Fig. 3 illustrates the amplifier built up on a base board for experimental and lab work, while Fig. 4 suggests a more finished cabinet model, designed to conform in appearance and for use with the Haynes super-heterodyne receivers described in several numbers of Radio Broadcast. The circuit is shown in Fig. 5.

The coupling resistor, R1, is generally a one hundred thousand-ohm resistor, though this value often varies in either direction, following a stage of transformer-coupled intensification. A one hundred thousand-ohm resistor, when using one hundred and fifty volts or less on the plates, may be a Daven special coupling resistance, which will clip into the Daven resisto-coupler shown in the photograph. However, if higher voltages are used on a one hundred thousand ohms or lower resistance, a Crescent Lavite is recommended. On resistances above one hundred thousand, the Daven unit may be employed almost regardless of plate potential.

The coupling condenser, C1 is a .006 mfd., Micadon.

A power tube, such as the W. E. 216-A is recommended, with a gridleak of 100,000 ohms.

The input of the single stage resistance-coupled amplifier is coupled to the output of the preceding amplifier in the usual manner

—i.e., substituting the input connections for the loud speaker. The lead from the upper end of the resistor, however, must run to the plate of the preceding bulb.

USING LOOP SETS ON ANTENNAS

PROBABLY the best way of disposing of this question would be to state emphatically that it should never be done. There are two excellent reasons why engineers and reputable magazines frown upon this procedure. In the first place the arrangement is deliberately inefficient. Apparatus designed for loop reception is ultra-sensitive—it is made receptive to the comparatively weak impulses supplied to it from the coil antenna by the rather prodigal use of extra radio frequency stages that are not merely unnecessary but actually undesirable on antenna reception. Less theoretically, it is possible to design a three-tube antenna receiver (the Roberts for instance, plus one stage of transformer-coupled audio amplification) that will do everything that a seven-tube super-heterodyne will accomplish working on a loop.

The second consideration dispels the rather prevalent misconception that if a receiver works well on a loop, it must necessarily function many times better on an open antenna. Such is far from being the case, particularly with a receiver primarily designed for loop reception. Connecting such a set to the antenna merely raises the noise level. There is a more or less definite limit to the strength of the signal which a radio-frequency amplifier can feed to the detector tube—a limit that is occasionally reached in the case of loop reception. Hence it is obvious that on such stations, the use of the antenna will merely bring up the extraneous noises—atmospherics, arc light interference, etc. to this same limit of audibility—i.e. until these undesired sounds are quite as loud as the desired signal! Weaker signals will of course be amplified more than on the loop, but owing to the raising of the noise limit they will be anything but enjoyable if heard at all. (Incidentally, a good loop receiver will bring in most signals above the noise level, at the point of reception—that is, signals that are louder than the undesired but inevitable static and similar disturbances. Thus the effect of operating such a receiver on an antenna would be to lower the signal to the noise level.)

An additional and very weighty argument against antenna operation is found in the case of the super-heterodyne, where a continuously oscillating bulb is coupled into the antenna circuit. Such an arrangement is a radiator—one that will produce a continued squeal on stations slightly above or below the transmitter to which the "super" is tuned. Investigation has shown this receiving system (the "super" closely coupled to the antenna)

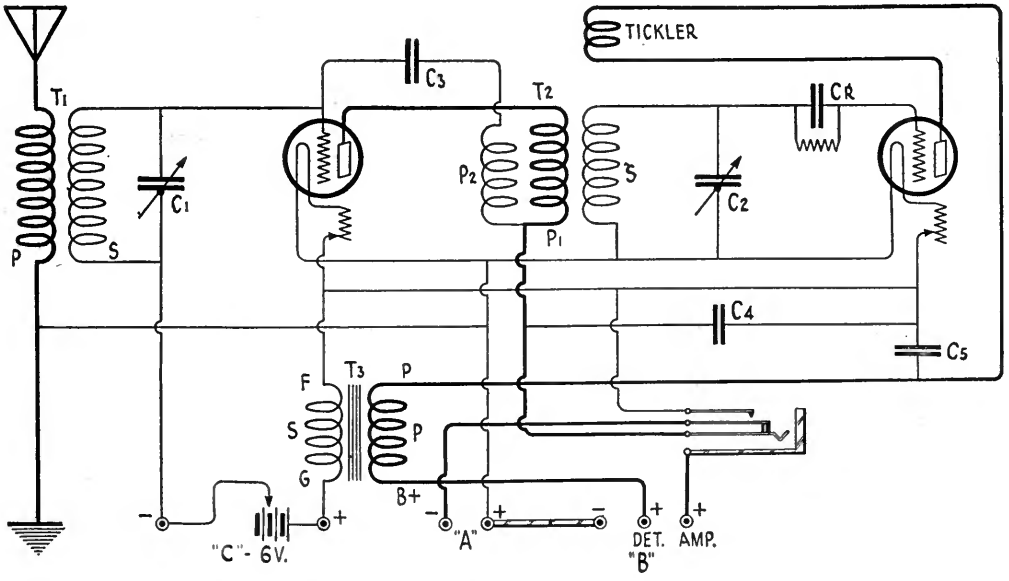


FIG. 2

The standard three-circuit tuner as adapted to the Roberts circuit, in the R. B. LAB. If the reader prefers, T, may be the usual tapped coupler

the source of many squeals usually attributed to a heterodyning distant transmitter.

Unfortunately, advising against this procedure will not solve the problem. Indeed, in some cases, such as in transoceanic reception and similar tests, the *proper* use of a loop receiver on an open antenna may be justified. However, a good bit of the justification lies in the word "proper." Coupling *should never be made* by tapping on to the loop, by the use of a tuning coil or by a standard variocoupler. In all of these cases, the coupling will be considerably too tight. Tight coupling results in two more or less obvious undesirable conditions—the raising of the noise level, and radiation in the case of the "super."

A simple and acceptable manner of experimental coupling, which will determine if yours is one of the few loop receivers that benefit from antenna operation, consists of two turns of No. 18 or any other self-supporting wire, with a diameter of about one foot, suspended a few inches from the loop connected in the usual way. One side of the additional coil is grounded and connected to the minus terminal of the filament lighting battery, the remaining terminal running to the open antenna.

A less experimental type of coupler may be built up in accordance to Figs. 6 and 7. The two coils are wound on a three-and-a-quarter to three-and-a-half-inch tube, with an inch and a half separation between primary and secondary. The ten-turn or primary winding is connected to antenna, ground, and A battery in the manner suggested for the two-turn coil, while the forty-turn inductance or secondary is substituted for the loop. No. 18 annunciator or magnet wire can be used in place of the designated wire. The completed coils are mounted in back of a seven by five inch panel. The coupler photographed has been mechanically designed for use alongside of a RADIO BROADCAST super-heterodyne described by A. J. Haynes in this magazine in January and March, 1924. Electrically, it will give equally good results on the Grimes and similar reflex circuits.

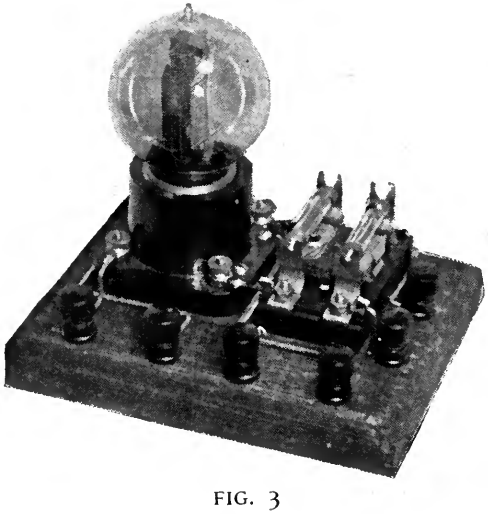


FIG. 3

The one-stage resistance-coupled power amplifier built up on a base board for lab and experimental use. One hundred and forty volts were used on the plate of the W. E. 216-A tube shown in the photograph

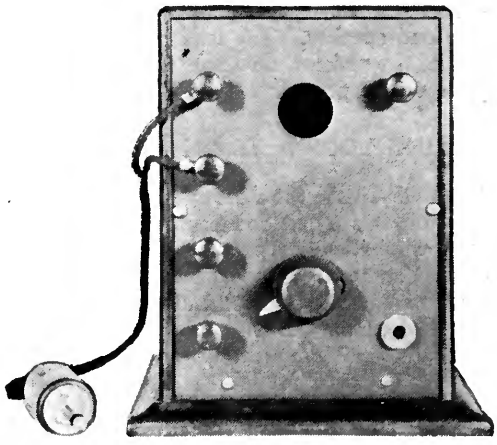


FIG. 4

A more pretentious layout of the power amplifier. It is merely plugged into the output jack of the preceding amplifier or receiving set

The use of the antenna will seldom increase signal strength on local and semi-local stations, and while better reception of distance may be effected, this can only be accomplished by also bringing up the noise level.

THE ONE-TUBE KNOCKOUT ON A LOOP

IT IS theoretically possible to operate any circuit from a coil antenna, merely by substituting the loop for the customary input coil to the detector or radio-frequency tube. Unfortunately, the effectiveness of a receiving system designed for antenna operation is generally seriously impaired when such a receiver is switched to loop operation. However, in the RADIO BROADCAST Knock-out single-tube receiver, a slight revision of the circuit develops into a receiver that makes loop reception on the head phones quite practical —the usual losses, being somewhat compen-

sated for by the circuit changes. The possibilities of such a receiver were first suggested to this laboratory by a reader, R. S. Ryan, and the resulting circuit is shown in Fig. 8.

Other than the substitution of the coil antenna for the secondary of the usual radio-frequency transformer, T1, the changes of the circuit consist of a liberal distribution of bypass condensers and the two hundred-ohm potentiometer, which contribute controlled regeneration that is doubtless responsible for the effectiveness of the single-tube loop receiver.

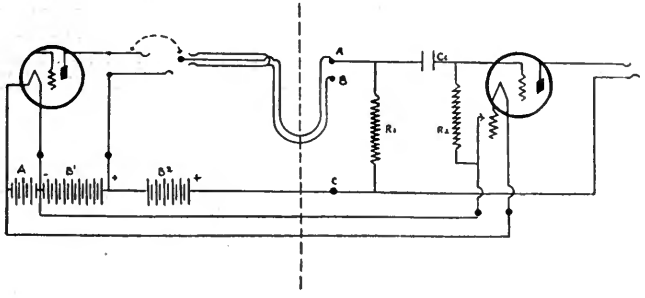


FIG. 5

The circuit, connected to the last tube in the super-heterodyne designed by A. J. Haynes. If the extra battery B2 is not used (when B1 is above 100 volts) B may be connected to C

T2 corresponds to the original specifications for this transformer, 63 turns being wound on a two and a half inch winding form, functioning as the secondary, followed by a layer or two of paper and the primary of thirty-six turns. Any convenient magnet wire, between No. 22 and No. 26 may be used. In the R. B. Lab. (Fig. 9) the Ballantine Varioformer has been found particularly effective in this one-tube loop receiver, the regeneration that is more or less objectionable when operated on an open antenna, adding considerably to the audibility and range of the loop set. When using the Varioformer, the condenser across the secondary T2 is, of course, eliminated.

The audio-frequency transformer T3 may be any reliable make—this laboratory recommending a medium high ratio—such as five to one—in which case the bypass condenser across the secondary is best dispensed with.

Under some conditions, it will be found advisable to use a ground connection, running to the minus side of the filament lighting battery.

A fixed crystal may be used with this receiver, though an adjustable detector, which can be operated on a comparatively high resistance spot, will permit greater regeneration. Try reversing connections to the crystal. A loop of standard dimensions will operate successfully with the receiver, though as usual signal response will vary directly with the size of the loop.

Though this laboratory has not been able to duplicate Mr. Ryan's reception record of 1000 miles, the results indicate that such a range, while perhaps not consistent, is quite possible. Local tations (within 25 miles) come in with enjoyable ear-phone volume, and when amplified with the Knock-out amplifier, described in the December number of Radio Broadcast, gives a signal of splendid volume and quality.

BUILDING YOUR OWN LAB

OUR suggestion this month is addressed in particular to the more serious fan—the experimenter—the embryo engineer, whose interest and inclinations prompt him to original and studied design. Our recommendation is a slide rule—preferably a Keuffel and Esser, ten inch polyphase rule. Such a rule, with leather case, retails at eight dollars, and is shown in Fig. 10.

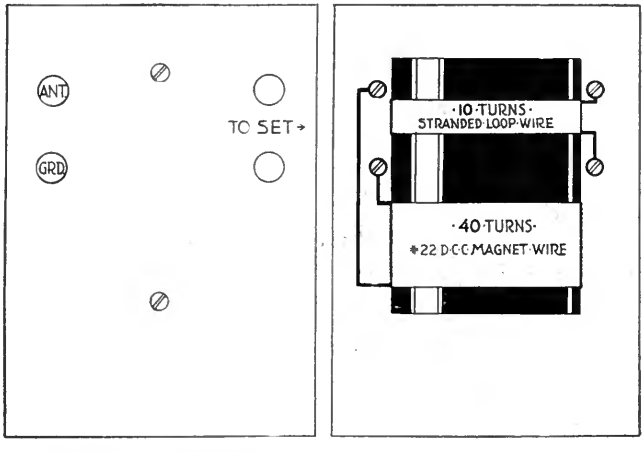


FIG. 6

Suggested layout for the antenna coupler

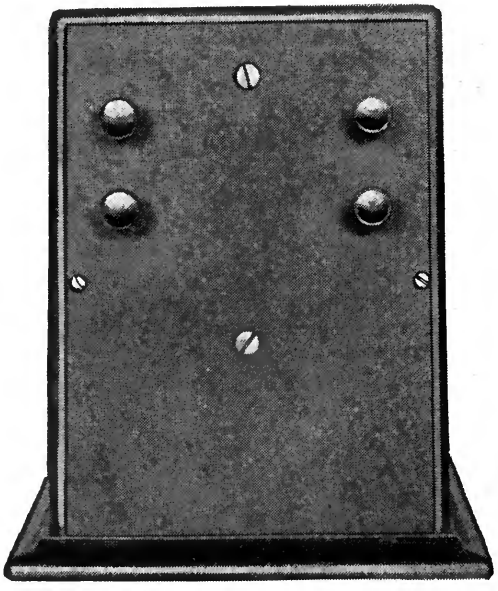


FIG. 7
The finished coupler

This wonderfully ingenious arrangement is equally a most capable assistant at desk and lab bench. The rule consists of a set of scales which, through their logarithmic interrelations make possible multiplication, division, squaring, cubing, the extraction of square and cube roots, the solution of ratios and proportions, the determining of logarithms, and the juggling of trigonometric functions practically without mental effort and in a small fraction of the time required to accomplish the same calculations in the usual way. The radio experimenter will find the slide rule particularly applicable to the solution of problems involving Ohm's law, and to the design of transformers where, given one winding additional voltages and windings are solved almost instantaneously, the changing of wavelengths to kilocycles, and in the thousand and one calculations to which lab work invariably gives rise. Tube curves and similar characteristics may be plotted with the slide rule in a tenth of the time required for arithmetic derivations.

Though the slide rule is generally associated with the more serious experimental endeavors, the fan with only the slightest inclination toward the design and engineering side of electricity and wireless will profit by possession and a working knowledge of the rule. The fascination of its ingenious possibilities is a powerful stimulant leading to a more comprehending appreciation of this science-art of ours.

LABORATORY HINTS

AN INVALUABLE assistant to the lab worker is a good manual of electrical engineering. Such a manual should cost five dollars or more. The experimenter will find arranged in it in a logical system, all the formulas, data and miscellaneous information that he has run across in his more or less haphazard reading and to which it is so often difficult to return.

THE modern vacuum tube (the De Forest DV-2, the Cunningham C-301-A and the Radio Corporation UV-201-A) is not at all critical in respect to detector plate potential, and in many cases requires higher voltage for most efficient operation than the older soft tubes. This is particularly noticeable in the super-heterodyne, when it may be found advisable to increase the detector plate voltage to ninety.

MOST loud speakers must be connected in the right direction in respect to polarity. If the direction of current is reversed the permanent magnets are weakened, and the efficiency of the speaker ultimately impaired. It is often difficult to locate the plus battery lead to a jack or plug. However, in the case of adjustable diaphragm speakers, it is easy to determine when the instrument is connected correctly, by noticing at what adjustment the "rattle-spot" occurs. When the adjuster is turned all the way to one side, the diaphragm of the speaker is generally in contact with

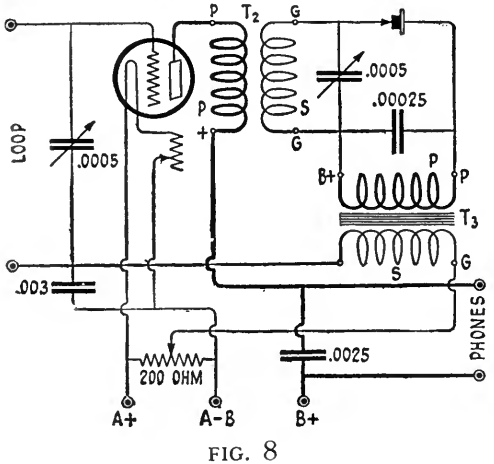


FIG. 8

The one-tube loop hook-up—the first cousin to our old friend the single-tube knock-out. If the Ballantine Varioformer is substituted for T2, the condenser across the secondary is eliminated

the magnets, or so near to it that it rattles badly on a signal. As the adjuster is turned away from this dead or inoperative side, the diaphragm is raised until it generally "plops" free. When the speaker is connected correctly, it will be necessary to turn the adjuster farther than on the incorrect polarity, to free the diaphragm and achieve distortionless reproduction.

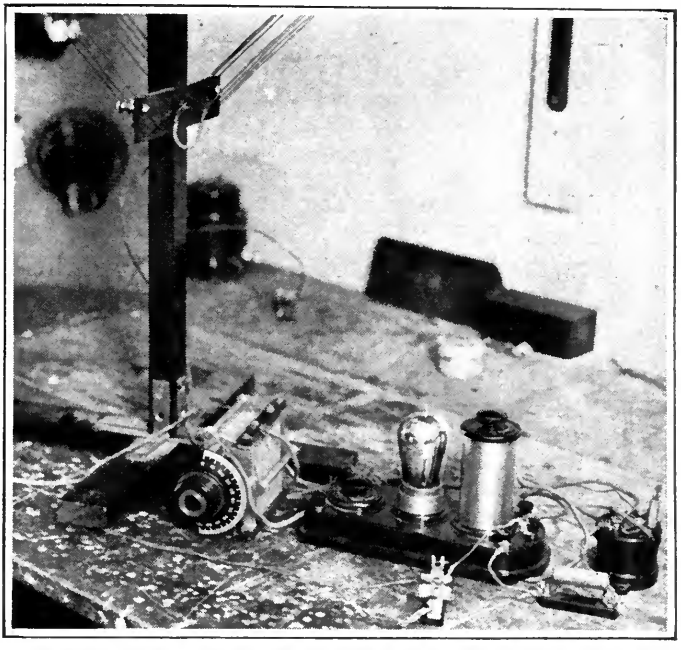


FIG. 9

Testing the one-tube loop receiver in the R. B. Lab. Regeneration is quite pronounced with the Ballantine Varioformer

NEVER overload your loud speaker. The suspicion of a rattle should be avoided. Even momentary overloads lower the power capacity of the talker (in respect to satisfactory reproduction) and a loud speaker that has been occasionally strained will distort and blast on much lower powers than before the initial stress. This fact was ably demonstrated in a series of amplification experiments carried on in the R. B. Lab in which volume was a primary consideration.

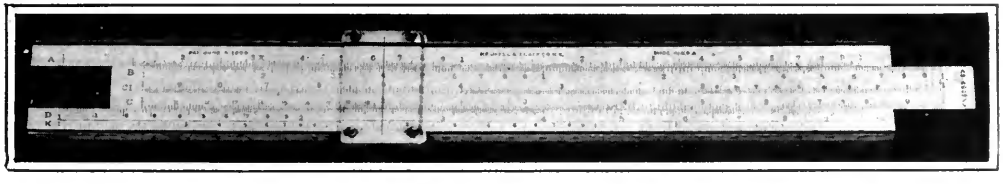


FIG. 10

The ten inch poly-phase slide rule or "slip stick,"—our laboratory suggestion for January

IN THE R. B. LAB SOON

The R. B. LAB is preparing data on low loss coils in the Roberts receiver, in both the broadcast set and the record-making short-wave receiver. This material will appear in an early number.

Pioneering With De Forest in Florida

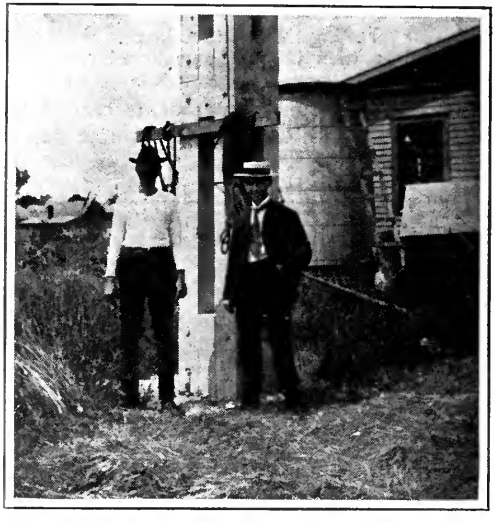
High Adventure with Temperamental Wireless When Forty Feet of Sand Brought Failure Close—Despair, Expense, Trouble, and Final Success—How the Pensacola and Key West Navy Wireless Stations Were Built

By FRANK E. BUTLER
Former Chief Assistant to Dr. Lee De Forest

THE erection of five high-powered wireless stations in the South guaranteed to give perfect communication over a distance of one thousand miles was the flattering contract offered Dr. Lee De Forest by the United States Government after he had made his sensational success at the St. Louis World's Fair. Naturally, he was elated at such unqualified endorsement of this success coming from so high a source. And I, having worked with him during every hour of that long and desperate struggle, and having shared with him the final triumph, was equally elated.

The stations were to be built at Pensacola and Key West, Florida; at Guantanamo, Cuba; San Juan, Porto Rico; and Colon, Panama.

They were to be the first wireless stations ever erected in the tropics. They were to work over a distance two thirds greater than wireless communication had before carried. But what of it? Had we not smashed the world's record at St. Louis? As a preliminary to this stupendous achievement had we not conquered all installation troubles? This Southern job was going to be an easy matter now that we had the St. Louis experience back of us! There was nothing to worry about, even though this time we were working for the Government.



TOWER BASE AT THE PENSACOLA STATION
The masts were two hundred feet high. Each timber in the base is eight by eight

This was the way we felt the day we started for the South. But, alas!

That Southern trip, begun in 1905, lasted close to two years. In the exercise of patience and the development of skill it made those gruelling days at St. Louis seem as no more than a preliminary bout before the battle royal.

It was a battle from the very start. All nature seemed in revolt at our intrusion. She fought us with static overhead. It was fierce, relentless static such as was never heard before with the crude tuning devices at hand. She baffled us by "ground conditions" underneath that taxed to the utmost our perseverance and ingenuity in the effort to conquer them. She pestered us day and night with insects so vicious we grew to think of the mosquito as a friend. But we stuck. And we stuck until we conquered.

SCENE OF OUR FLORIDA STRUGGLES

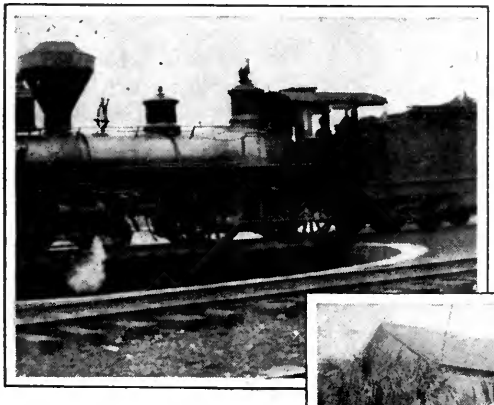
MY FIRST stop was at the Warrington Navy Yard, Pensacola, where I was to have charge of the erection of a two-masted station with a fan antenna. This station was to be of 10 KW capacity, and although very similar to the St. Louis Fair installation, excelled it in refinements of apparatus and wiring. I had a special letter from Mr. Breckenridge Long, then Secretary of the Navy (under

President Roosevelt), requesting all navy officers to assist us as much as possible in our work, but it was not necessary for me to use it because the navy officers at this yard were always exceedingly courteous and helpful to us in every way.

For a time I lived at the hotel in Pensacola. But only for a time. As our troubles multiplied I found it necessary to be right on the spot day and night. So I moved down to the wireless station where I slept on a bunk and ate my meals with the "Jack Tars" in their mess hall. It was here among these happy fellows that I learned many things which have proved most helpful to me ever since. They patiently taught me the knack of tying knots and of rope splicing, accomplishments I afterward found most useful in making proper antenna construction. I was allowed access at all times to their machine shop and electrical department, and I had the advantage of their experience with heavy construction work, wind stresses, mathematical formulas, etc. And so, for weeks, all concerned in the erection of the station worked happily, undaunted by nature's enmity, worked with the persistent energy that comes from a surety of ultimate success.

When the installation was finally completed it had all the aspects of a beautiful job.

As the day arrived for the initial test, the stage was all set to begin the test signals at 8 P.M. Dr. De Forest was located at Key West, about 400 miles distant. He was notified to listen-in at the appointed time when we were to send out the accustomed "D" test signals. All of the reading instruments on the operating table registered perfectly, the spark across the spark gap was fast and powerful, and there was every indication of a perfect inauguration of service without delay.



MUNICIPAL PROGRESS AT KEY WEST IN 1905

The lower cut shows the transportation system of the city. One car, one mule, one street. To board car, proceed to center of street. The mule then stops, turns head around, and will not start until passenger is aboard. The conductor at rear of car gives the mule "motorman" the bell twice and on you go until the "motorman" stops of his own accord at the other side of the next street. At the left, the diamond stack wood-burning locomotive that was still in use on the Florida railroads when Mr. Butler went from Pensacola to meet De Forest at Key West in 1905

"WE SHOULD WORRY"

They seem to be saying, even though they are away down in Pensacola. Mr. Butler, third from the left, of this group of "Jolly Tars" is helping the boys form the lucky combination of "four eleven, forty four"

IT WOULDN'T WORK

THE battleship *Brooklyn* was anchored in the harbor about two miles distant. The wireless operator aboard had been a daily visitor at the station and was interested in the test, so he planned to listen-in that evening. It seemed ridiculous to us that he should listen in on a 10 KW station located only two miles away, but he did.

As I started the test I was positive of its success. I sent "D's" for hours, waiting

anxiously for a telegram from De Forest at Key West. Nothing came.

However, at eleven o'clock, the *Brooklyn* operator came ashore in a launch and reported at the station. He inquired as to why we had not been sending, and added that he "had not heard a peep" from us.

The following morning a message was received from Dr. De Forest stating that he had not heard our signals.

Every item of the installation was carefully checked over and not a flaw found. A slight change in adjustment was made and the test resumed that evening with the same result. This testing continued week after week with relentless patience and continual changes. Even the large spread fan antenna was taken down, closely inspected and replaced.

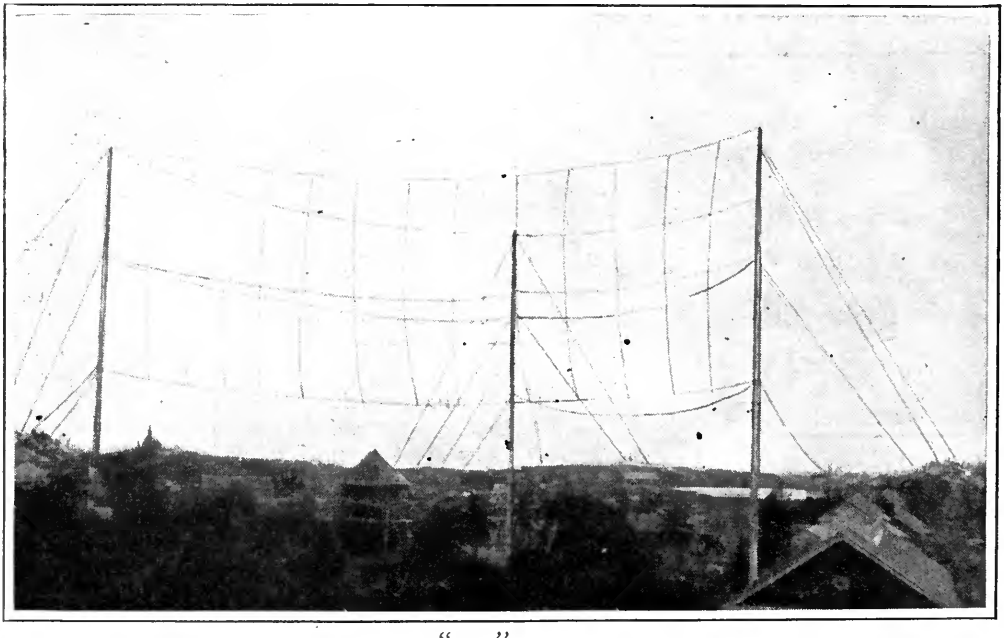
What Dr. De Forest Said of the Author

"Mr. Butler, is in fact the only surviving member of the "old guard" who is still interested in wireless and who is in a position to lay before the public, in a graphic and interesting manner, a gripping story of those old days and the subsequent development of radio under the De Forest banner. He has just read me the first three installments of a most graphic story of his early days in wireless, recalling a thousand interesting facts which I had forgotten, and in which every radio fan must be intensely interested."

The "ground" was an item of suspicion.

This "ground" had been considered a good one for the reason that it was made of heavy sheet copper one hundred feet square and buried five feet underground two feet under water, and connected to the spark gap by a four-inch copper bus bar.

To make sure the ground was all right, we dug up the plate and prepared to sink it deeper into the sea water. To do this it was necessary to construct a cofferdam, and while a force of men shoveled out the sand another crew on each corner operated force pumps to keep out the water so the digging gang could work. It was slow, stubborn work. When a depth of eleven feet had been reached, we were compelled to stop further excavation on account of the increased rush of the incoming



"KW"

The De Forest station at Key West, erected in 1905 for the United States Navy. This spark set had a capacity of twenty kilowatts. The radio scenery at Key West now looks vastly different, what with the tall steel masts of the present modern Navy station now there

water. Then we dropped a new one hundred square feet of copper and buried it, feeling certain it would solve our ground difficulties. That evening we sent "D's" energetically and with renewed confidence in our success.

It was a staggering blow to receive the following morning the old accustomed telegram from Dr. De Forest, "Heard nothing." This was followed by some suggestions of another change and an admonition to keep up courage.

That day, when the clouds of despair were at their darkest, an incident occurred which, trivial in itself, was the turning point in our apparently hopeless battle with an unknown trouble.

It was a drink of water that brought about the idea that solved the Pensacola problem.

A DRINK OF WATER SOLVED THE PROBLEM

WITHIN a few rods of the wireless station was a well from which we obtained our clear, cool drinking water. As I strolled over to the pump to get a drink on this day I met a Navy officer who reached the spot at the same time I did. After the usual greeting, I said:

"This is fine drinking water. Wonder if it's a drilled well."

To which he replied:

"It is. I know because I drilled it."

"How deep?" I asked, and little realized the tremendous importance of the question.

"Fifty feet," came the answer. "But," went on the officer, "if I had stopped at forty feet or gone down to sixty feet, I would have had nothing but salt water."

"How's that?"

"Well, you see it's this way. This white sand around these parts is about forty feet deep, and below that is a stratum of clay and stone twenty feet thick, and beyond that is an indefinite reach of sand."

"Ah, I see," was my rather inane comment. But I was too stunned by the idea that had flashed into my mind to carry on the conversation further.

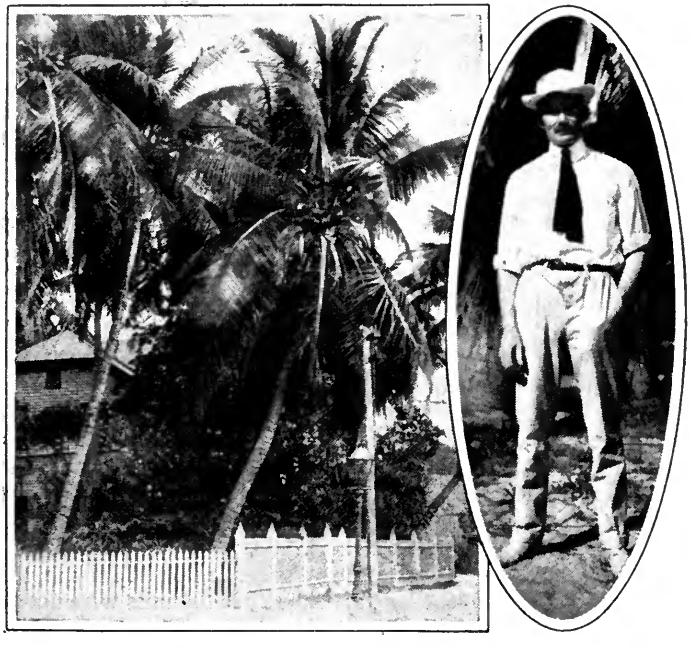
The idea was that perhaps that white silica sand, the body of which was greater than the thin film of seawater that seeped around it, offered too much resistance or formed a dielectric which prevented a good ground.

I spent the rest of the day absorbed with this idea. It still had full possession of me when, in the evening, I went to the Western Union office to send a telegram. Before I left I asked the operator what kind of a ground he had. He replied that the ground they used consisted of an iron pipe driven down forty feet, and that using any less than that produced no electrical results whatever.

That settled it. I was sure the solution of our baffling problem was at hand.

The following day I bought about six hundred feet of four-inch pipe and engaged men to drive twelve iron pipes each forty-five feet long into the loose, moist sand. These were grouped in a small circle about two feet apart. The twelve tops were joined together with heavy copper cable and a large bus bar run into the spark-gap.

The evening after this was finished we started sending "D's" promptly at 8 o'clock, and scarcely before I could realize it, the joyful news was received from Dr. De Forest that he had heard the first signals we sent out. To have success so suddenly thrust upon us after weeks of discouraging failures, was indeed a



PALMS AND WIRELESS AT KEY WEST

The palms hid the masts, but the station and its buildings took up an entire block. The insert at the right shows Dr. De Forest as he looked when he was doing the installation at Key West

keen pleasure and relief. You radio fans who enjoy making your own sets and revel in the thrill of "hearing results" for the first time, can perhaps appreciate to a degree the sensation that was ours that evening.

From this time on "PN" worked perfectly, and it was not long before we were heard by distant Northern stations.

KEY WEST GETS A STATION

COURAGE soared. It was time for another "forward march!"

Leaving the Pensacola station in charge of the Navy wireless operators, I departed for Key West, overland, by way of Tampa, and thence by steamer. Even if I had not taken a snapshot of it, I should still be able to visualize the primitive engine that went ambling leisurely from Pensacola to Tampa, an engine of the "diamond stack" wood burning type. About every twenty-five miles cords of three foot stove wood were loaded on the tender, to be consumed during the next twenty-five miles with much belching of smoke that, compared to coal smoke, was a grateful odor.

Arriving at the Tampa docks just before noon, I had lunch, after which I found my finances reduced to exactly five cents. My boat ticket included meals, but the boat was not to leave until evening. There was nothing but a railroad yard at the Tampa docks, and the city itself was ten miles distant. So, with insufficient carfare to "go to town" there was nothing to do during the long afternoon but to watch the fish from the dock. It did not occur to me to mourn over being broke, for, during those early days of wireless, being broke was the usual condition with all of us, and being flush meant knowing where next month's rent was coming from. And it was worth it, the fight, the privation, the anxiety. And even if any of us had had it in us to weaken, it would have been impossible with De Forest always at the helm, an inspiring leader.

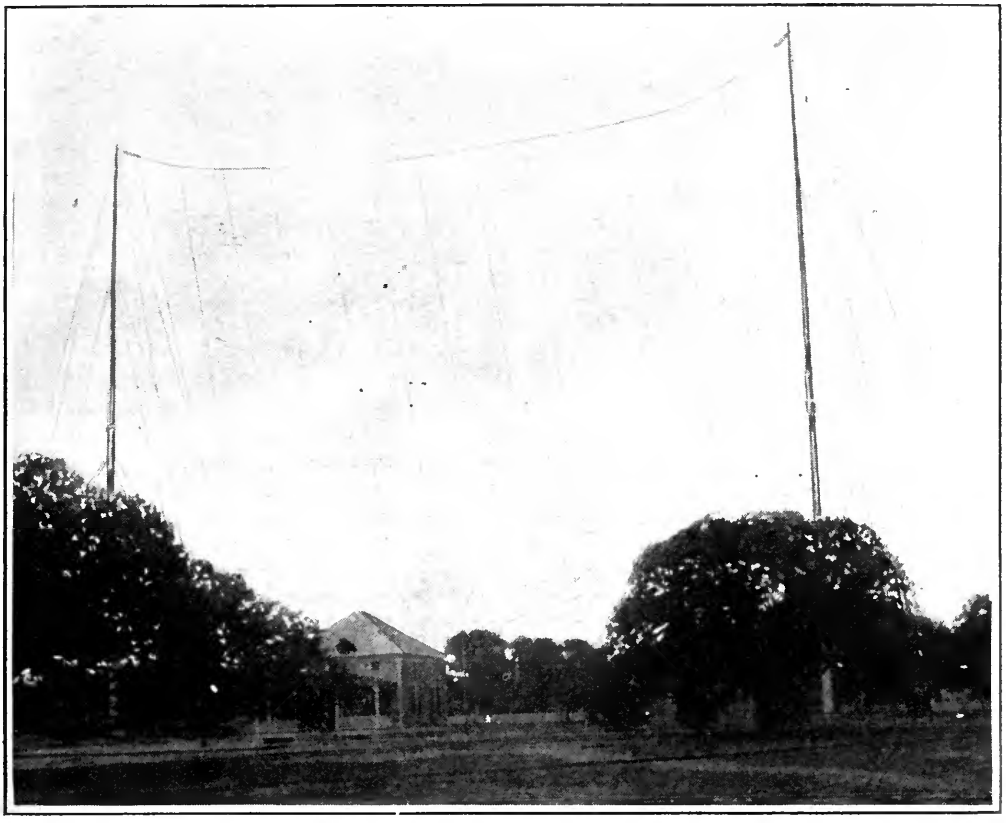
ALL IN THE DAY'S WORK

Here are the laborers pumping out water from the "ground excavation" at Pensacola to enable the diggers to get at their job of making a place for the large copper ground plate and below, the gang of diggers shovelling sand for the "ground" excavation at Pensacola. Some of them had to work waist deep in the cofferdam. The peculiar character of the ground connection here led to some unusual and very discouraging difficulties

I found him at Key West in his wireless station set in the midst of a picturesque tropical grove. Cocoanut, banana, and palm trees completely surrounded the station and the living quarters of the wireless crew. So far as climate and scenery were concerned, this island was an ideal place in which to live. But the restaurants were exceedingly poor. The only appetizing food was rice and hard rolls. Although fish was abundant, no one seemed to know how to cook it. When our work was going fairly well (comparatively speaking) we felt rather disturbed about this inadequate food supply. But when trying to solve seemingly unsoluble problems, we scarcely knew whether we ate or not.

Spread majestically over the trees of the grove that surrounded the station was the huge triangular cage antenna consisting of 45,000 feet of wire, suspended from three equi-distant masts, two hundred feet high. The radio fan who has used seven stranded phosphor bronze wire for antenna purposes knows how stubborn and kinky it is and how difficult to handle. Think, then, of the difficulty of this antenna installation owing to the density of the tree foliage and the prevalence of high winds.

Many improvements in the wireless apparatus were noted at this station, and the quality of the spark at "KW" (as it was then called) was better than hitherto heard. Most notable of these changes were new ideas in receiving tuning devices. We made a definite endeavor to overcome the incessant static.



STATION PN
The De Forest Station at the Warrington Navy Yard, Pensacola, Florida

In my diary, under date of April 16, 1905, I find a notation of an experiment we carried on at this Key West station with an *incandescent lamp for the purpose of eliminating static.* In these tests we used bulbs of various voltages and watts in conjunction with coils and condensers. The results were unique but not definite.

This was two years *before* the famous "audion" bulb was invented by Dr. De Forest. Little did we know how closely we were stumbling at the door of the "wonder lamp" that was destined to revolutionize wireless and make radio broadcasting possible. Had we gone a degree or two farther we might have a different story to tell here.

Evidently the doctor had become tired of "pump handling" "D" signals as was done at St. Louis, day after day, because here he had devised a mechanical contrivance operated by clockwork, which sent out the "dash-dot-dot" "D" signals incessantly, without manual effort.

My stay at Key West was short, as it was now time to begin operation at Guantanamo Cuba, where the third station of the group was to be erected. Again, I started forth with high hopes, believing that the worst of my experiences with wireless were behind me. As it turned out I was going straight into a work that called for wholly unforeseen and difficult engineering feats and the most crucial physical endurance test of the entire contract.

How success was finally accomplished after eleven months of hardships and disappointments is a story in itself which will follow.

(The next article in this series will deal with the experience of these radio pioneers in Cuba)

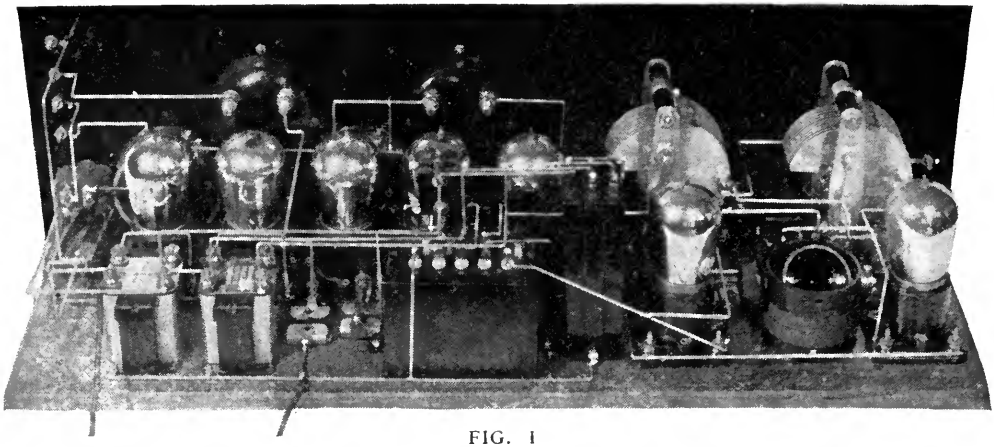


FIG. 1

The rear view of the seven-tube "super". The photograph shows what an excellent layout can be secured using a standard 7 by 24-inch panel. The small balancing condenser is shown between the two variable condensers

Revamping the Silver Super-Heterodyne

Complete Instructions and Discussion on Changes Necessary to Adapt a Dry-Cell Straight "Super" for Storage Battery Tubes—A Complete How-to-Build-it Article Describing a Super-Heterodyne Which Produces Remarkable Results

BY McMURDO SILVER

IN THE October, 1924, RADIO BROADCAST an article appeared by Mr. Silver, describing a super-heterodyne that operated on 199's, had remarkable selectivity, and could be assembled from standard and easily procurable parts. In this article, Mr. Silver has answered a demand for a super-heterodyne of the same qualifications to operate with storage battery tubes. Experienced constructors, and those not so experienced will readily appreciate that this "super" is well worth the time necessary to build it.—THE EDITOR.

SINCE the publication in the October RADIO BROADCAST of the description of the portable super-heterodyne receiver using dry-cell tubes and self-contained batteries, the writer has been swamped with letters from fans asking all manner of questions, and reporting results far in excess of what they had expected from the set.

Reports have come in from all sides, telling of phenomenal DX reception with this set and its exceptional selectivity and quality of reproduction, both from seasoned experimenters and from builders who had no previous constructional experience. One log made by a man totally unfamiliar with radio who had built the set, listed thirty-three stations heard in one night, with loud speaker volume on an 18-inch loop. This was the second evening he had operated the set in his home, in a thickly populated Chicago residential district, surrounded by steel frame buildings. Another report came from a man who had built seven different super-heterodynes in an endeavor to get selectivity and DX reception in his home, located, within a radius of five miles of a number of powerful broadcasting stations. Suffice to say, that he finally found what he had been hunting

for as he was able to report during the first week of operation three Pacific Coast stations received with loud-speaker volume.

Several of the sets, located within five blocks of WQJ and WEBH in Chicago, have tuned-out these two stations and brought in WGY in Schenectady and WOS in Jefferson City, with loud-speaker volume on a small loop. The separation between WGY and WEBH is ten meters, and between WQJ and WOS, seven meters. It is also possible to work through WLS on 345 meters to WBZ in Springfield on 337 meters. Some builders have reported five Pacific Coast stations in one night, through the locals. An experimenter in Delhi, New York, reported loud-speaker reception from KGO in Oakland, California, several times in one week, as well as stations all over the country.

Last but not least, Captain Irwin of the RADIO BROADCAST COVERED WAGON reported from Las Vegas, New Mexico, hearing both east and west coast stations with loud-speaker volume, operating the set right in the COVERED WAGON. He advised that dead spots did not seem to exist when the set was in operation, and that it was the most selective outfit he had ever operated. This will be realized when it is understood that a one half degree movement of both dials will tune from WSAI, Cincinnati, to KGO, Oakland, with a silent spot between them.

Practically all of the letters received about this set have asked questions which might be summed up as follows:

1. How can storage battery tubes be used?
2. How can the set be enlarged to make an easier wiring and assembly job?
3. Can resistance-coupled audio amplification be used?
4. How can a stage of tuned radio-frequency amplification be placed ahead of the first detector?
5. How can voltmeters be incorporated for A and B battery voltages?

THE NEW MODEL

IN RESPONSE to these many questions a larger model of the portable "super" was designed, which for ease of reference, will be called the laboratory model. This set is 24 inches long and fits in a 7 x 7 inch cabinet. It may be used with any type of tube now on the market, or various combinations of types, and will permit of as many refinements in the way of extra high grade material as the builder may desire to incorporate.

The portable set has already proved to be one of the most thoroughly satisfactory and fool-proof "super" designs ever presented to the public, and the larger laboratory model is even superior to it in the matter of volume when 201-A or DV-2 tubes are employed. This model retains all the desirable features of the portable, but because it is spread out more it is somewhat simpler to construct and is recommended to the fan who is not interested in building a small, self-contained outfit.

The results to be expected will be somewhat better than those experienced with the portable set. In the suburbs of Chicago the laboratory model will bring in the east or west coast broadcasting stations on a small 18-inch loop with slightly greater loud speaker volume than the portable. On locals the use of the larger tubes gives considerably more volume. As for selectivity, stations such as WHN, WGY, WBZ, WFFA, WOAW, KGO, and many others could be brought through while

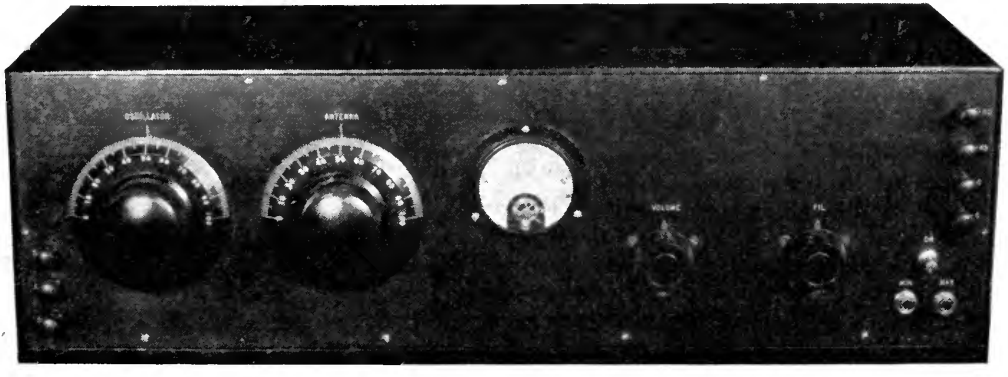


FIG. 2

Shows the front panel view of the storage battery-operated super-heterodyne. The small balancing condenser used in the receiver is not shown in the photograph

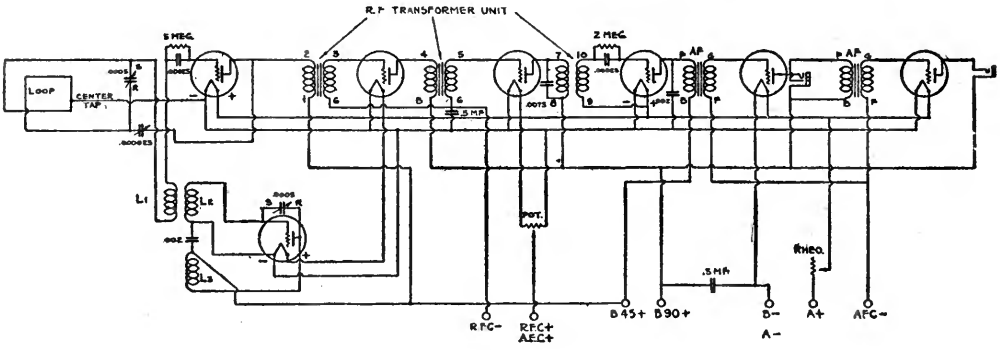


FIG. 3
Schematic circuit of the seven-tube super-heterodyne

four or more of the powerful local stations were operating within a radius of twenty miles. The tuning of the set is so sharp that a fraction of a degree will throw out out-of-town stations, and a movement of two or three degrees on both dials will throw out locals completely.

ANY TYPE OF TUBE MAY BE USED

THIS laboratory model may be built for use with any tubes on the market and if the builder already possesses WD-11's or WD-12's, which heretofore have been considered unsuitable for "super" use, they may be used in this design satisfactorily. The tube combination may employ either WD-11's, WD-12's, UV-199's, DV-3's, UV-201-A's or DV-2's either throughout the entire set, or as detectors, oscillator or intermediate amplifiers. In any case the use of 201-A's for audio amplification is advisable in order that full advantage may be taken of the volume developed by the set. If volume enough for home use is all that is desired, 201-A's need not be used, however.

A front view of the laboratory model is given in Fig. 2, which, however, does not show the small balancing condenser brought out to the panel. Meters are not absolutely necessary, but if the constructor desires to add them they are very convenient for checking up the battery voltages. Fig. 1 is a rear view of the set, showing the placing of the instruments and the general lay-out. Figs. 3 and 4 give the circuits, both pictorial and schematic, and it will be seen that they are practically the same as for the portable. The panel lay-out is in Fig. 5.

Certain refinements have been added in this larger model, such as the addition of battery binding posts, a filament switch, the location of the balancing condenser on the panel, and the voltmeter, which need not be employed unless desired.

Below is a list of parts used:

2 Silver .0005 Low Loss Condensers.
2 4" Moulded Dials—Tapered Knobs, preferably vernier type such as Apex or National.
1 Howard 7-Ohm Rheostat.
1 Howard 200-Ohm Potentiometer.
7 Insulated Top Binding Posts, Eby or similar.
1 Single circuit-closed Carter 102-A Jack
1 Open circuit Carter 101 Jack.
1 Silver R. F. Transformer Unit No. 401.
1 Silver Oscillator Coupler, No. 101.
7 Benjamin Spring Sockets.
2 Thordarson 3 ½ : 1 Audio Transformers.
1 On-off Switch.
3 .5 mfd. By-pass Condensers.
2 .00025 mfd. mica Condensers with Leak Clips.
2 .002 mfd. mica Condensers.
1 .0075 mfd. mica Condensers.
1 .000045 mfd. balancing Condensers.
1 .5 Megohm grid leak.
1 1Megohm grid leak.
7 x 24 inch Panel.
7 x 23 x ½ inch Oak Base Board.
Bus-Bar, Spaghetti, Screws, Nuts, Solder, Lugs, etc.

ACCESSORIES:

1 Loop with Center Tap.
7 Tubes
2 4½-volt C Batteries.
A Battery—6 volt.
B Battery—90 volt.
Phones, or Loud Speaker, and Plug.
1 7 x 24 x 7 Mahogany Cabinet.
Tools needed: screw driver, pliers, soldering iron and hand-drill with drills and counter-sink.

Other parts may be substituted for those recommended in the list, but the constructor should be very careful to see that they are of first class manufacture and in every respect of as good quality as those recommended.

If UV-201-A, DV-2, UV-199, or DV-3 tubes are used, the Benjamin spring sockets will work in very nicely. These sockets absorb all vibration and eliminate almost entirely the ringing noise often experienced with such tubes. In addition, these sockets are excellent from an electrical and mechanical standpoint.

If standard 4-inch dials are used on the condensers, they can be tuned satisfactorily either by means of a pencil with an eraser rotated against the edge of the dial and the panel, or by tuning the dial with the fingers on the outside edge instead of on the knob. If vernier dials are used, the Apex, which is geared about 10 to 1, is extremely satisfactory and is to be recommended. The Eztoon is also a good dial, except that the vernier action covers only a few degrees, after which the entire dial must be rotated and the vernier re-adjusted. Any other good standard vernier dial without "back-lash" or play in it will be satisfactory.

Jefferson No. 41 transformers may be used in the set although Thordarson $3\frac{1}{2}$ to 1 transformers seem fully as satisfactory as the Jefferson.

The Thordarsons may be used in either $3\frac{1}{2}$ to 1 for both stages or if a very great volume is anticipated a $3\frac{1}{2}$ to 1 in the second stage and a 2 to 1 of the new type in the third stage.

For details of the construction of the set. the reader is referred to the unusually complete construction article on the portable set in RADIO BROADCAST for October, 1924. Methods of construction in both sets are quite similar.

HINTS ON ASSEMBLY

ALL PARTS are placed on the baseboard and panel, and should be located according to the photographs. After the panel has been prepared, the proper parts should be placed on it and the sub-base screwed in position. The parts to go on the sub-base should be placed in their proper positions, and their locations marked, care being taken to see that they are so situated that the wiring will be easy and that tubes will not strike meters, etc. or the location of any parts on the sub-base conflict with parts on the panel.

All wiring that it is possible to do on the panel should be done before the panel is attached to the sub-base on which the sockets,

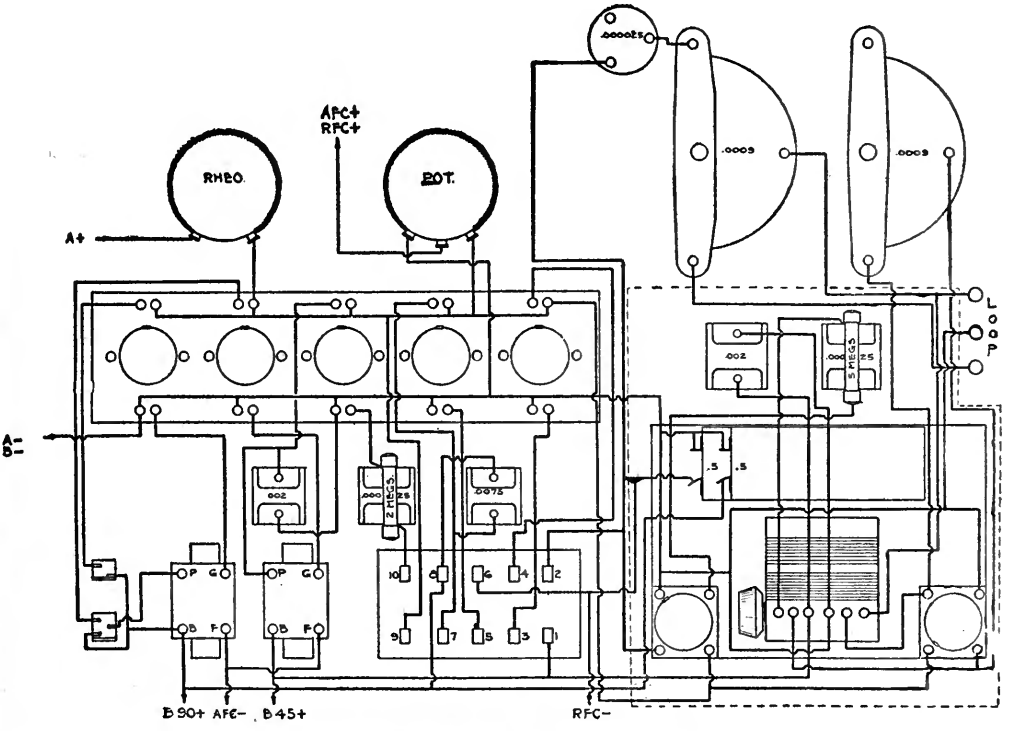


FIG. 4
A placement diagram of the units in the receiver

transformers, etc. have been mounted. Likewise, all possible wiring should be put in place on the sub-base before it is finally screwed to the panel. If this is done, only a few leads will have to be run from the panel to the baseboard and the wiring will be found quite simple and easy. The wiring may be done with bus-bar, straightened, bent at angles and soldered to lugs fastened to the instrument binding posts, or it may be done with flexible magnet wire covered with spaghetti, as described in the October article.

A C battery is used on the intermediate amplifier tubes as well as on the audio amplifier tubes. For UV-201-A's this C battery will vary between 3 and 4½ volts. The same values will hold for UV-199 or DV-3 tubes, while the C battery value for WD-11's, or WD-12's will range from 1½ to 4½ volts. In each case the C battery is connected with its negative terminal to terminal 6 of the radio-frequency transformer unit and its positive lead to the center contact, or arm of the potentiometer. The audio amplifier C battery is connected with its negative lead to the F terminals of the audio transformers and with its positive lead to the minus side of the filament line. The C batteries may be located on the right hand corner of the base board inside the cabinet. If a high value of C battery is used on the intermediate amplifier, the potentiometer will have no effect on the volume of the set and a low enough voltage to permit of the potentiometer volume control should be used.

It will be noticed in Fig. 3 that three by-pass condensers are used, each of ½ mfd. One is connected across the 90-volt B battery, one across the 45-volt B battery section and one from terminal 6 of the radio-frequency transformer unit to the minus side of the filament. The cans of these condensers are soldered together, and with the cans of the audio transformers and the radio frequency transformer unit, are grounded to the negative side of the filament. This is very important; instability of the set may be due to the failure to ground all of these cans.

If meters are to be used in the set, a voltmeter with a maximum scale reading of from 6 to 10 volts may be connected directly across the A battery terminals of the set to indicate the A battery voltage, or across the filament terminals of one of the tube sockets to read the filament operating voltage. This latter is the preferable position as it will permit operating the tubes at their best point, and resetting of the rheostat to the same value each time the set is used. A milliameter in the plate circuits of the tubes is of little value; a B battery voltmeter would be preferable. The B battery voltmeter may be connected directly across the B battery or it may have its negative terminal connected to the negative B terminal of the set and its positive post brought through the resistor to the center arm of a small single-pole double-throw switch. If one contact of the switch is led to the 45-volt B post and the other contact to the 90-volt B post it will be possible, by means of this switch, to throw the meter across either the 45- or 90-volt battery sections at will. If a double range voltmeter is employed, a small switch can be used to throw it from the A to the B battery. The details of these circuits are given in Fig. 6.

The advantage of bringing out the balancing condenser to the panel is that it permits maximum sensitivity to be obtained at every wavelength. If the balancing condenser is set at one fixed value, it will have to be at a point where the first detector tube will not oscillate at the shortest wavelength to be received. At the longer wavelengths the value of balancing condenser may be increased slightly with resultant strengthening of

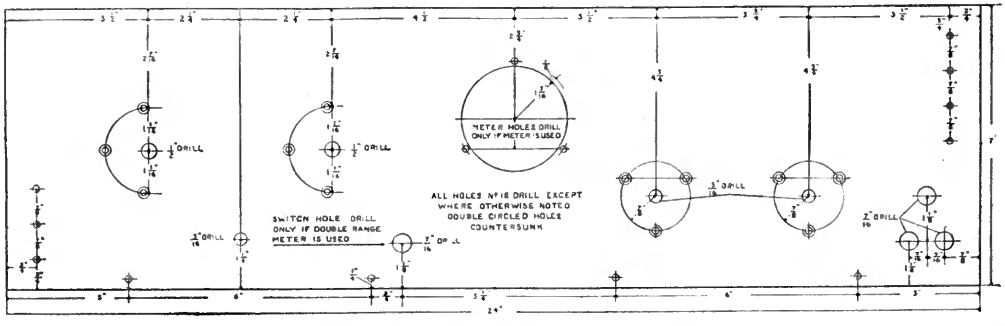


FIG. 5
The panel layout

signals. This control is not critical except that if too high a value of condenser is used the first detector tube will oscillate and become unstable. The condenser may be located above and between the two tuning condensers on the portable model also, if it is desired to take advantage of the full amplification possibilities of the set by means of this one additional, but fairly non-critical adjustment.

Binding posts may be located on small bakelite strips on the sub-base so that they will not appear on the panel. This will add somewhat to the appearance of the set if it is to be used in a permanent installation.

WIDE LATITUDE IN ASSEMBLY

THE assembly can be changed to meet any individual conditions of height, depth, or length, such as might be imposed by a phonograph cabinet. The amplifier assembly should not be changed, but the oscillator coupler and first two tubes may be moved up against the panel between the two condensers, which will have to be located farther apart. The entire amplifier section may then be shifted behind this portion of the set, which will make an assembly 12 to 15 inches long and 8 to 10 inches deep. (See Figs. 6, 7, and 8 of the article on the portable receiver.) It is also possible to locate the amplifier section above the condensers and first two tubes. The size would then be approximately 10 to 11 inches high, 12 to 15 inches long, and 6 to 7 inches deep. These variations are only suggested where the constructor wishes to meet particular space requirements, and feels confident that he will be able to work out the changes satisfactorily.

TESTING AND TROUBLE SHOOTING

Filter Condenser: The value of the condenser across the RF unit terminals 7 and 8 will vary between .0075 and .01. It is best to start with .0075 and then build up to .01 by adding .0005 and .001 condensers in parallel with the .0075 condenser. The best value will be where the oscillator dial reading is sharpest on a comparatively strong local signal. The proper number of condensers may be bolted together with machine screws and nuts and soldered in position on the wiring.

Grid Leaks: For 201-A tubes the grid leaks should be from $\frac{1}{2}$ to 2 megohms for the second detector. One megohm is satisfactory. A grid leak from 2 to 5 megohms should be used for the first detector. The higher value is preferable. Grid leak values for 199 tubes are given in the October, 1924, article and the same values are correct for DV-3's. For WD-11's or WD-12's they will be approximately the same as for 201-A's.

Filament Returns: In the portable receiver, the first detector grid return, or center tap of the loop is shown going back to the negative side of the filament, and for the second detector, terminal 9 of the can leads to the plus side

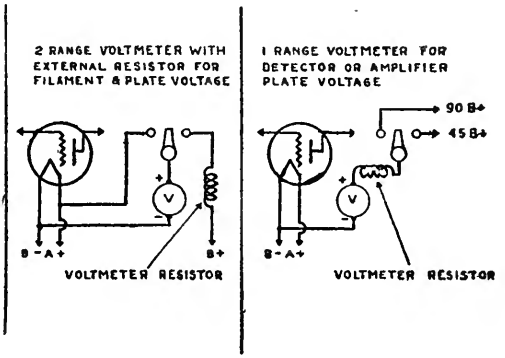


FIG. 6

Wiring details of voltmeter which can be used with advantage in the super-heterodyne

of the filament. In the laboratory model both these returns are shown to the negative side of the filament. It is not of very great importance which connections are followed out, although it would be advisable to keep all returns, including those of by-pass condensers, on the negative side of the filament line.

Overloading: Due to the extreme amplification, about 55 per stage (voltage) with 201-A or DV-2 tubes, developed in the intermediate amplifier it is sometimes possible to overload the set on strong local signals. This may be overcome by some of the suggestions offered in regard to the portable super-heterodyne or by connecting grid leaks of $\frac{1}{10}$ to $\frac{1}{4}$ megohms across the radio-frequency amplifier tubes from grid to plus or minus filament.

Potentiometer Control: In the case of 201-A, DV-2, UV-199, or DV-3 tubes, the potentiometer control will probably be satisfactory in that the volume of stations may be reduced by retarding its arm toward the positive side. If this is not possible, decreasing the value of C battery on the RF tubes will remedy matters. On WD-11's or WD-12's, good control will be difficult to obtain and the C battery will have to be set at the lowest value commensurate with good

signal strength in order to obtain any volume control at all on the potentiometer. This is because in the case of 201-A's, the voltage variation across the potentiometer is from 3 to 5 volts and with 199's from $2\frac{1}{2}$ to 3 volts, whereas with WD-12's, the variation is only about 1 volt.

Filament Rheostat: If one type of tube is used throughout the set, a single rheostat for all tubes is sufficient. This should be from 6 to 7 ohms for any of the standard tubes. If 201-A's are used only in the audio stages, their positive filament leads will have to be brought out independently, when other types of tubes are used up to the audio stages The filament adjustment on the 201-A audio tubes may be made by means of an extra rheostat or by means of a small resistance unit placed inside the set and adjusted once. The filament current of the audio tubes is not critical and when once adjusted may be left fixed. If the 199's are to be operated as the first five tubes in the set in conjunction with 201-A's on a 6-volt battery, the rheostat resistance for these five tubes will be from 15 to 20 ohms. If WD-11's or 12's are used for the first five tubes, they should be operated either on a 6-ohm rheostat lead out to a separate A-plus binding post and then to a 2-volt tap on the storage battery or to a separate A battery. If they are to be operated directly from a storage battery supplying the 201-A's, the rheostat resistance will be about 10 ohms. In both the case of the 199's and WD-12's, run directly from the storage battery, the rheostat used with them should be just barely turned on, as if it is cut all out the full 6 volts will be applied directly to these tubes with disastrous results.

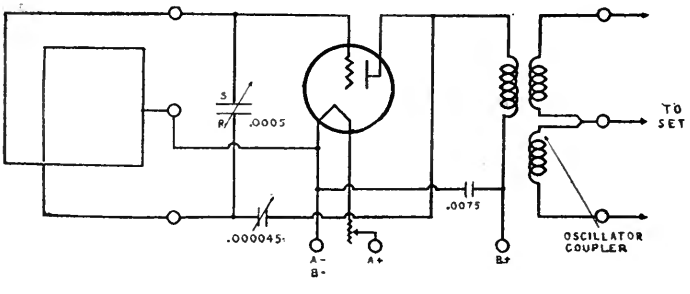


FIG. 7

How to add an additional stage of radio-frequency amplification to the "super". Another oscillator coupler, tube, socket, rheostat, and variable condenser is necessary for the construction of this separate unit, which should not be attempted except by the radio constructor who is expert at tuning the super-heterodyne because the additional radio stage sharpens the tuning greatly

Volume Control: The volume of the set may be controlled by the potentiometer, operated in conjunction with the rheostat. The potentiometer might be entirely omitted and the volume controlled by the rheostat only. It will be found that if the full amplification of the set is used on local signals, a slight amount of distortion may be evident. With volume enough to be heard all over a 40 foot square room no distortion will be experienced. In any event it may be controlled by proper rheostat and potentiometer adjustments. It has been found possible to operate 201-A tubes with as little as $3\frac{1}{2}$ volts on the filaments with perfectly satisfactory results.

Location of Rheostat: Tube manufacturers recommend that rheostats be placed in the positive filament lead of the detector tube and in the negative lead of an amplifier. The reason for this change is that in the circuits shown in the tube data sheets an endeavor is made to use the voltage drop across the rheostat for grid biasing purposes. If a separate C battery is used and no endeavor is made to utilize this voltage drop across the rheostat, it is of absolutely no importance which filament lead the rheostat is connected in. It is always advisable, however, to keep it out of the lead which is a common B battery return. The common point in these sets is the negative. For these and other reasons it is shown in the positive filament lead, while the on-off switch is in the negative lead.

Plate Voltage: The set will operate satisfactorily with as little as 45 volts on all tubes, but the C batteries will have to be readjusted if this voltage is used. Varying the detector and oscillator plate voltage from 22 to 45 may sometimes improve reception slightly, and decrease consumption a small amount. The current consumption using 201-A's on 90 volts is twenty milliamperes or less, and in using 199's from 14 to 15 milliamperes.

If it is desired to add resistance-coupled amplification to the set instead of transformer-coupled audio it may be done by using the amplifier circuit given in Fig. 8. This shows two stages, which will give not quite the

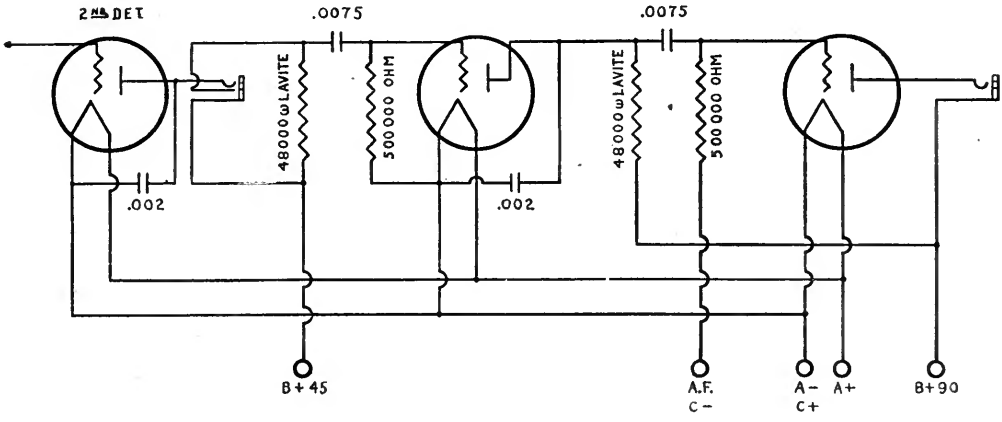


FIG. 8

Two additional stages of resistance-coupled amplification may be connected in place of the ordinary audio-frequency amplifier specified in the circuit

volume of two transformer-coupled stages. This is of no very great importance, however, since the volume obtained from the set is in practically all cases, very much more than will be needed for good loud-speaker operation.

It is suggested that lavite resistances of about 48,000 ohms be used as the plate-coupling resistances with grid leaks of from $\frac{1}{4}$ to 1 megohms. It will be advisable in this case to leave out the jacks in this amplifier and use either the detector output or the full two-stage amplifier output, as is shown in the figure. In this case, a C battery will be necessary only on the last audio stage, where it should be of approximately $4\frac{1}{2}$ volts. This is because the effective plate voltage on the first stage is only about 30 to 40 volts, whereas the effective plate voltage on the last stage is very nearly up to the full 90 of the B battery. This will be made clearer when it is realized that a 48,000 ohm resistance is in the plate circuit of the first audio stage which cuts the B voltage to approximately $\frac{1}{3}$ that of the full plate potential. Only a loud-speaker or a pair of phones is in the plate circuit of the last audio stage with the result that practically all the B battery voltage is applied directly to the tube.

SHORT WAVE RECEPTION

THERE is a growing interest in a really sensitive receiver for operation on the new low broadcasting wavelengths in the neighborhood of 100 meters.

The wavelength range of the oscillator used is about 150 to 550 meters, which is more than ample for the entire broadcasting wavelength band. This oscillator range will permit reception over a range of from slightly below 150 meters to about 600, by using the lower heterodyne point at the upper end of the range, and the upper points at the lower end of the range.

It is also possible to use a harmonic of the oscillator to perform the heterodyne function. If the first harmonic, or half the wavelength of the oscillator is used, it means that the range of the oscillator, using this harmonic, would be from below 75 meters to nearly 300 meters. If it is desired to receive a 100 meter signal, the oscillator dial may be set at either of its points where a 200 meter station may have been heard. Then the harmonic will bear the proper relation to the 100 meter signal to create the necessary beat with it. This, of course, is general, but it indicates how the set would be operated.

The loop circuit would have to be changed for this work, the loop being cut to about four turns. It may be rather difficult to employ the split loop feature at these waves also. If an antenna is used, the coil to replace the loop may consist of about 20 turns of No. 16 or No. 18 DCC wire, on a three or four-inch form. The antenna coil should contain three to eight turns, depending upon individual conditions.

If a set is to be built for short wave work only, the oscillator coils could be wound with fifteen turns each in L2 and L3, and about six or seven turns of heavy wire in L1.

SHORT WAVE R. F. AMPLIFIER

UNDER certain conditions the experienced fan may find it desirable to add additional R. F. amplification to either of the receivers. A condition which would

justify this would be where the atmospheric noise was not very great and where it was desired to obtain the very limit that could be gotten from a receiving system. Or, it might be that the receivers were poorly located, so far as collecting sufficient energy for their operation is concerned, yet the noise level might be very low. In either of these cases it would be possible to add a stage of R. F. amplification before the first detector tube, which would involve but one additional tuning adjustment. This adjustment would be comparatively sharp and the addition of this amplification is not recommended until the builder has operated his set for some time and is entirely familiar with its operating characteristics. This is because with three tuning dials the set would be so sharp that it would be extremely difficult to tune it without knowing where at least two of the dials should be set for a given wavelength.

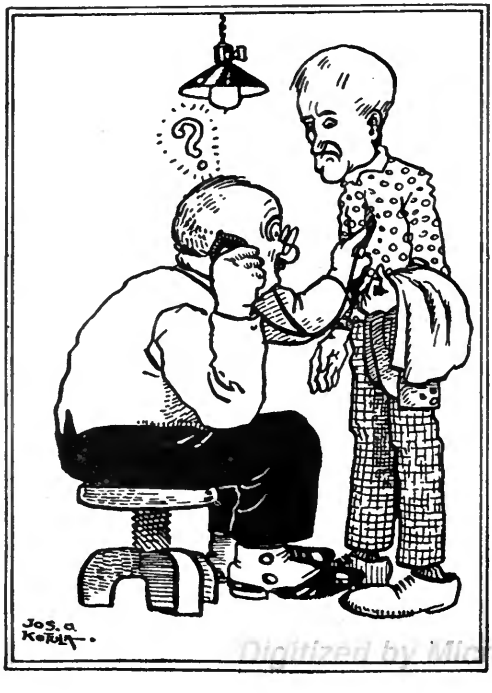
The circuit for this amplification is given in Fig. 7 and the only additional equipment necessary to construct it would be an oscillator coupler, as described in the previous section, the tube with its socket and rheostat, the tuning condenser, and a balancing condenser.

The entire amplifier could be housed in a small box which would go at the loop end of the set with three binding posts to connect it to the set and three binding posts for the loop. It would also be necessary to bring out posts for the A and B batteries as shown in the drawing.

It will be seen that this circuit is practically the same as that of the first detector, except that the grid condenser and leak and oscillator coupling coil have been omitted.

In the plate circuit of this R. F. tube, the coupling coil of an oscillator coupler is connected. The stator windings of the coupler are brought to three binding posts on the panel of this unit and are in turn connected to the three binding posts intended for the loop on the set itself. The oscillator coupler then performs the function of the R. F. transformer. Its two stator coils with their center leads joined, form the secondary circuit, the coupling coil acting as the primary. The balancing condenser in this case is not critical as in the first detector circuit of the super and may be set practically all the way in without oscillation occurring in the R.F. stage. This condenser acts almost entirely as a neutralizing condenser, its purpose being to sharpen the tuning of the loop connected in the R. F. stage and to prevent oscillation.

The same batteries may be used for this unit as are used for the set itself, and any standard type of tube may be employed in the circuit.



FORCE OF RADIO HABIT

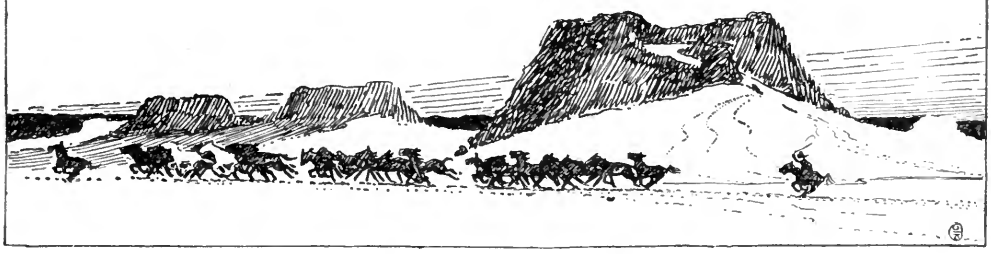
The Doctor: "H'm! that's strange, Cuba ought to be on now!"

STATIC DAYS AND NIGHTS

The Boredom of Ranch Life is Now Broken by Radio

Word and Pen Pictures of the E-Bar Ranch

By Remington Schuyler



"STATIC" describes perfectly the evenings on the old ranch in South Dakota. So *static* were our evenings that in desperation we turned in along about nine o'clock of a winter's evening, bored to death with each other.

The same old faces, stories, and magazines grew terribly dog-eared. We knew the magazines from cover to cover. We knew the advertisements with the same close intimacy. We knew every yarn of the other fellow's and every "funny story." Dynamite is "static" till you wallop it. It only needed some slight wallop to start something in the close harmony of our bunk-house. It was a desperate time. You can't forever talk horses, cattle, and women.

Living the same life, doing the same things, day after day atrophied our brains. Our conversation moved sluggishly in deeply worn channels, all too familiar and threadbare.

The nearest ranch, Isaac Battleyoun's, was fifteen miles over across the broken buttes of the Key-a-pa-ha. Ike had a wax cylinder Edison; a Steinway, a pipe organ, and a daughter who could certainly play. At times my bunkie and I would ride over and sit in on some music. It was not often, for by sundown we were dog-tired, and thirty miles, what with the drifts, was no great sport after a fourteen-hour day.

We were building up the E Bar. Our days were long and full of toil. Four A. M, when it was still dark and bitterly cold we "came alive," bustled into our frozen, board-like clothes and got out and going. There were seven of us. Six cow-hands and Bob Emory, our genial foreman. Into the frosty darkness, one of us would ride over the drifted prairies and round up the pony herd and work horses. By lantern light another chopped wood. A third pumped water for the stock and calves in the pens. The rest busied themselves pitching hay or building the board corral and branding chute. At six o'clock and barely dawn we were heartened by the familiar ring of the lustily beaten frying pan and the welcome whoop, "Come and get it." In a ravening pack we scrambled to be first into the grub house. This nine by nine end of the log cabin was also kitchen and washroom.

Hustling in the door, one slopped a dipper of icy water into the tin basin—hurriedly soaped and washed face and hands and slicked one's hair. Then on to the grabbing match at the oil cloth covered table.

At the round corral a lively scene followed. The pony herd led by the wise old bell mare had been driven in. With saddle rope dragging we stealthily stalked our horse for the day. If you were crafty enough, to mislead the horse you were after into thinking you were after some other one, then a sudden swish of the throw rope and you had your mount for the day.

Saddles were slapped on, latigoes made snug and we were off about our several businesses. Some rounded up and counted the scattered herd and threw them back on the range, then looked for strays or cattle that had "gotten down." Others set out with running gear and teams to haul logs from the "breaks"

of the Little White. The logs were needed for our bunk house which was slowly rising alongside the original ranch-house.

At noon and again at six we went through the same washing rites and ate the same grub. After supper "while we were resting" as Bob used to say, we squared and wrestled into place a few more logs on the bunk-house walls.

During the fall, the tent which "The Kid" and I slept in had been the gathering place. Now that winter was seeping down from Medicine Hat it had grown too frigid to be pleasant for gossiping.

Our new bunk-house was complete, so we gathered the clan there. Pipkin and Ambrose had one room, The Kid and I the other. Our room had more bunks and a stove. The Kid's mother had sent over some curtains and do-dads that added to the coziness.

THERE was Pipkin—an ex-cavalry man, a genial, hard riding good scout. He had come to us in the summer. "Pip" was down on his luck with a badly infected finger and arm, but with a zest for work. After he arrived we had taken turns as surgeons. A liberal use of gauze, bailing wire and tobacco quids had nursed him back to a normal use of his hand and arm, and an intense desire to work. His army stories and ditties had given us quite a few thrills and furnished entertainment. But he was running dry. We knew his Sergeant McGillicuddy tales almost perfectly.

Ambrose, nick-named "Old Nick," was a dirty, unshaven, unbathed rascal. He had a flow of language which was an undammed stream of obscene profanity. He couldn't even ask for a smoke without G——D——ing it. And yet his folks were sturdy pious New Englanders. The daguerrotypes of his parents and grandparents showed fine stock, dependable citizens. He had slipped from his earlier snubbing post and was a disgusting specimen. A bath with him consisted of squirting water on himself and scrubbing white spots with a sock. If ever his spots seemed in danger of overlapping he would quit disgustedly, muttering he was getting "too ——— particular". Then another month would add its grime and grit unmolested.

"The Kid" was young, handsome, well knit, the son of a teacher in the Indian day schools; raised on the prairies, a good cow hand and rider. But his mind dwelt constantly on new conquests to be made and the remembrance of former ones. A year as a fireman on the Missouri and Elkhorn; another with the Express Company, these were the only times he thought he had really lived. They were his only vivid experiences. He constantly pined for what he longingly called God's City—Chicago.

For my part they knew all I could tell them of my native state, Missouri. My camping experiences down in the Ozarks among the mountain people were the only bits of conversation that got by. So I would plunk my old guitar and sing Negro camp meeting songs and the latest popular hits I had learned before leaving St. Louis. "Goo Goo Eyes" "Under the Bamboo Tree" and such like.

The two Indians were just so much smoky blanketed background. They silently rolled and swiftly smoked cigarettes. Like most Indians who smoke they resembled an engine starting up. A series of short sharp puffs, then a pause. Another series and then that cigarette was about done.

Often I tried to draw them into the conversation. But "The Kid" and Ambrose thought only of them as "damned Injuns," and barely tolerated them in our circle.

Eagle Horn Dog was a noted singer of the Sioux. That is, he made new songs and knew all the old ones. He had a fine voice and loved to sing. Sometimes I could get him to favor us. It was stirring to listen as he thumped the bunk edge with a quirt and sang "Sitting Bull's Defiance" or "Go You to War?" or "Horses I am Seeking." Last year when I broadcast my western experiences from WEAF, I sang some of the songs which I had learned from Eagle Horn. Eagle Horn is gone to the Happy Hunting Grounds. Enlisting immediately when we entered the World War, he

went across with the First Division. He was among the first to fall.

Except for an occasional grunt, "Was-Tay" (good), "Waw-wee" (the Hawk) never made himself prominent. He seemed to be glad of the warmth and the company, but otherwise was merely a blur in the smoky background.

Bob, our foreman, was our best entertainer. He had grown up in the saddle. He had known cattle and horses all his life. He had been in on the last of the buffalo running. In his youth he had drifted over many ranges. He told tales of "The Panhandle," Montana, Idaho, and the "Ute" country near Carson Sinks. The Dakotas were as familiar to him as his own quarter sections. His knowlege of cattle ways and pony tricks seemed uncanny.

When the mood was on him he could recount thrilling experiences in a stilted matter-of-fact way. He had been in Spotted Tail's tepee when Crow Dog had ridden up and shot "Old Spot" as a traitor to the tribe's best interests. A moment later, sharp knives were slicing the tepee to ribbons while stone mauls were smashing the poles down about his ears. The uproar and excitement following the slaying, he told of as if he had been but a guest at a tea party. Yet in actual fact, he barely escaped alive by jumping his horse down a cut bank and riding across a narrow swift river on a one log bridge.

SO FOR a month or two we had good entertainment. But as the snow banked up around our log houses, and blizzard and snow storm followed each other in steady procession, sweeping down on us over hundreds of miles of treeless prairie from distant Saskatchewan, we gradually got worn to a frazzle.

We tried by superhuman efforts to hold the herd from drifting too far with the blizzards, then worked them back on to our range with painful effort, almost carrying in the weakened steers. Now and then we rescued some snow-blind, snow-bound freighter. And again when a windless snowfall had buried even the ridges, we fared forth with the pony herd. All day we let them paw through to the grass and then drove them on to another pawing contest. The cattle herd followed, and once having smelled the grass exposed by the ponies they nosed out a meagre meal. At night the tired hungry ponies were given some hay and then set adrift to shift for themselves.

The prairie wind seldom ceased. All day it buffeted one. The drifts in the gullies smothered any one who got off the ridges. It was struggle and fiendish toil. Then an evening as pictured in the beginning—monotonous in its sameness.

But once a month came a rift in our clouded horizons. *The Rosebud*, a four-page newspaper, printed at the Agency School by Indians would arrive by some circuitous hand to hand route. But bedraggled and mussed though it was, it brought news from the outside world. We had new things to talk about.

In memory I can see Old Bob, leaning back in an old broken backed chair, following the text with one finger and laboriously reading and gloriously mis-pronouncing such interesting items as "John Comes-Out-Holy" has been visiting in Cut Meat with his old friend "Brings-White" or "Bill Bates and Mack Marsten have been out gunning for antelope in the Bad Lands, or "Doug" McChesney, Agency Brand: Inspector, was down near Olaf Nelson's ranch checking up on Olaf's report of too many strays from the settlers down in Nebraska, or perhaps these bits of Agency humor: "The stork has left a new Annuity Baby at Mrs. Chased-by-Bears. Louis Ribideau will have one more papoose by next Annuity Payment Day. Good luck to you Louie. We hope it will be twins."

And so the wonderful news of the outside world dribbled in to us.

Except for *The Rosebud* and an occasional

Where It Drips Boredom

Remington Schuyler, who is well known to readers of this magazine through the many excellent covers he has done for us, spent considerable time among a certain type of real Westerners to whom we all attach a great deal of "romance". And most of us have thought of the life of the cow-puncher and Indian as something resplendently virile and somehow romantic. We think most often of radio in the city or small town and on the farm, but here is a view of what radio is doing in the genuine "open spaces." The sketches accompanying this story were made some years ago by Mr. Schuyler on the ground, and our cover this month shows one of the typical ranch houses in this country with radio holding its new sway.

—THE EDITOR.

"THE KID"

drifting cowboy we had lost contact with the outside. We were thrown so much on each other that it looked like a free for all would be the only safety valve. There was no telephone. "No nawthing" as Bob used to say.

IT IS a winter's night on the old E-Bar in the year 1923. By hard riding I dropped the drifted miles behind and received a rousing welcome as I pulled up at dusk.

The supper is much the same and the old wash basin and dipper still do duty. But the bunch seems changed. Bob is there, grayer and more wrinkled, Pipkin much the same. In old Ambrose there is a marked change. He seems too ungodly meek and thoughtful. He gets through first and disappears toward the bunk house. We follow leisurely and as we come close to the door I notice for the first time a rude antenna on the roof.

"Sh-h" says Bob as I start to congratulate them. "Slip up here and have a look-see at the old cuss."

Through the small window there is Ambrose hunched down in front of a "super-het" set. Through the thin panels of the door comes a voice familiar through all the country. That tough old ex-service man, McNeary, with his grand voice and wonderful imagination telling bedtime stories—and old hard-boiled Ambrose listening-in on the loud speaker. When WOR has signed off we stomp loudly up to the door and bursting in, find Ambrose trying to get WEAF.

At last we succeed and coming over the air is Oskenonton, the Mohawk Singer singing an Indian program. His rich voice and the thump of the water drum comes clearly. At the end he sings "Sitting Bull's Defiance" and one of old Eagle Horn's plaintive melodies.

"Jest like old times ain't it Cinchbuckle?" says Bob. "Can't you jest hearn Eagle Horn a-yowling? I'll tell a man we sure got the world by the tail with a down hill pull."

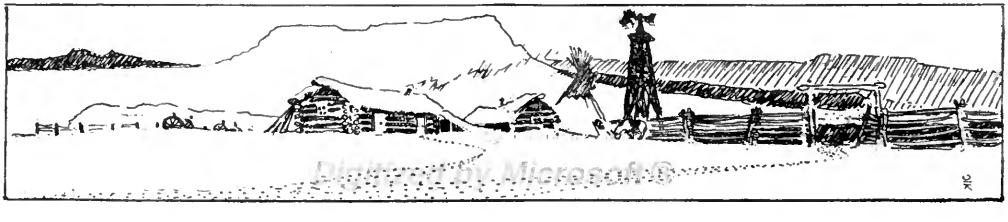
"When these here dinkuses furst came out we didn't put no stock in them," says Pipkin. "But Johnny in at the Agency got one and when we all heered it, why man alive we just cottoned to it."

"We hocked our German silver trappings and we're way behind on the pay, but I'd eat my socks if I had to to jest keep the dinkus in prime shape."

It was funny to hear their remarks about the different performers.

"Why," says Bob, "We nearly bought a vacuum cleaner, after listening to a feller who was 'loco' about it. It do beat all what you can learn."

And so each evening while I was there we had a radio banquet. Gone was the old dismal gloom of snow-bound isolation. A wider world had stalked across the frozen prairies and opened up their lives. They were *living* nowadays and happy. In an old shed they had the wreck of a flivver jacked up. It was Ambrose's job to keep her running enough to store the battery. The three old cronies Bob, Pipkin, and Ambrose still clung to the remnants of the old E Bar doing freighting carrying the mail, and Bob now and then had put in a few years as instructor to the Indians in farming. But the tie that made the old E Bar a rallying point—a home for all of them, was radio.



Notes on Neutralizing the Roberts Circuit

By JOHN B. BRENNAN

RADIO receivers, especially those using the regenerative principle, should not be allowed to radiate energy into space, causing unnecessary interference with other receivers in the vicinity.

In the Roberts circuit, radiation is prevented by the use of the coil N and the condenser connected to the grid of the first tube and the coil N. This coil N, because of its peculiar connection, prevents oscillation in the plate circuit of the first tube, and the condenser, when properly adjusted, should exactly equal the capacity between the grid and plate of the tube. (See Fig. 4). Mr. Roberts describes the theory of this action as follows:

> Whatever alternating voltage exists on the plate of the tube must be due to alternating magnetic flux linking P. But the same flux also links the similar winding N, which is connected the other way 'round, and hence, acting through C, produces an effect on the grid which is equal and opposite to that produced by P acting through the grid-plate capacity of the tube. Thus the net feed back, or tendency to regenerate is completely neutralized or balanced.

Having now determined the necessity for this neutralization, we must know how to apply this method of neutralization to the receiver.

To do that, one proceeds as follows: turn the tickler control well up against the secondary; light the filaments of the tubes and rotate both dials until the carrier wave or "squeal" of a station is located. Now adjust the dials for maximum signal strength and then lower the tickler coil to loosen the coupling between it and the secondary.

Now, by rotating the left hand dial slowly, the intensity of the squeal will be varied as the dial is moved. The intensity depends on the amount and the direction that the dial is turned.

On another page are shown two curves, which illustrate incorrect and extremes of unbalanced neutralization which are occasionally experienced in the Roberts circuit. To operate this receiver successfully without radiation, the neutralizer must be correctly adjusted. Therefore a bit of instruction on this important feature will not be amiss.

The best home-made type of neutralizer is made from a length of bus bar with spaghetti or glass insulation and a piece of copper gasoline tubing for the sliding member. Fig. 1 gives the dimensions for such a unit.

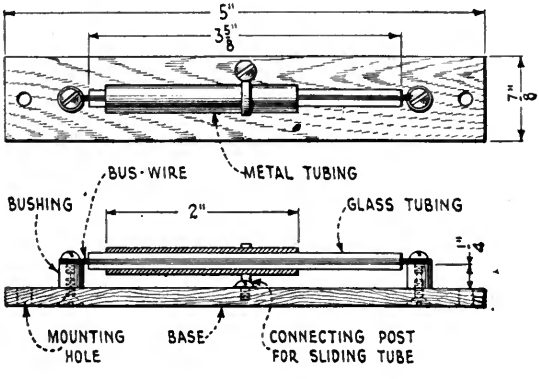


FIG. 1

How to make your own neutralizing condenser. Bakelite or formica may be substituted for the hardwood base. If it is desired, the right side mounting may be eliminated, making it possible to slide the tubing over the end. This will allow a greater range of neutralization

In determining whether or not your receiver is properly neutralized, one must visualize the rise and fall in squeal intensity.

The curves in the two graphs shown in Figs. 2 and 3 are somewhat exaggerated to make it easier to understand the action of the neutralizer.

HOW TO TEST YOUR SET FOR IMPROPER NEUTRALIZATION

BY ROTATING the dial (Fig. 2) in the direction of the arrow, we find a quiet spot X at the reading 50 and extending one or two degrees either side of it. By continuing slowly to rotate the dial, we immediately reach the full squeal intensity indicated at B. As the dial continues to rotate, the squeal intensity gradually decreases to A. On the other

side of X, rotating the dial in the opposite direction, we immediately reach the full squeal intensity as before at C, but here the decrease in intensity is very rapid ending at D.

In Fig. 3 the action is just the opposite. The quiet point X is found at 50. Rotating the dial in the direction of the arrow, the full squeal intensity is immediately reached at B and then rapidly decreases to A. On the other side of 50 we immediately reach the full squeal intensity at C which gradually diminishes to D.

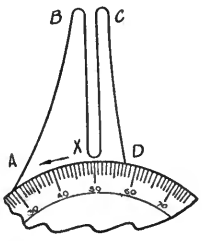


FIG. 2

An example of extremely unbalanced neutralization. Visualize your own "squeal curve" on condenser C1 in the Roberts circuit

These two examples of improperly balanced neutralization will suggest to the constructor the proper setting of the condenser. The graph showing the proper balanced squeal curve appeared in the article on the four-tube receiver.

Obviously, if your receiver produces squeals similar to those indicated in Figs. 2 or 3, the condenser tubing must be shifted until each section on either side of the quiet spot (indicated in the graph,) is equal and balanced.

It is well to remember that the same setting will not always be correct for all tubes. The Roberts receiver will operate equally well on all types of standard tubes. In the first description of the Roberts circuit appearing in the April number, two types of tubes were used, a UV-201-A and a UV-199. The only reason for this arrangement was the saving of .19 ampere in filament consumption. Naturally the neutralizer setting for these tubes would not work out efficiently if WD-12's were substituted.

In determining the location of the squeal, this characteristic noise should not be mistaken for forced or over-regeneration due to the use of high B battery voltage applied to the plate of the detector tube. However, in this operation, the tickler coil should be turned well up against the secondary. Once the squeal of a station has been located, the volume may be reduced at will by decreasing the coupling between the tickler and secondary coils.

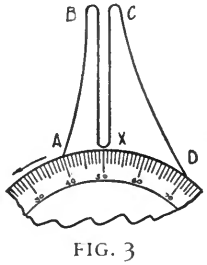


FIG. 3

Showing the other extreme of unbalanced neutralization. The correct "squeal curve" will result from a neutralizer condenser setting equal to the average of the settings in Figs. 2 and 3

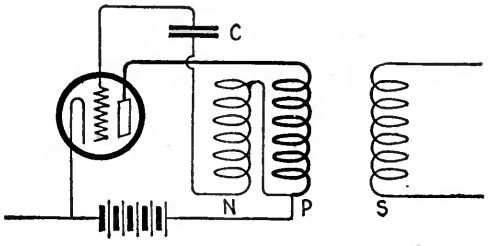


FIG. 4

The heart of the Roberts circuit. Any standard tuned radio-frequency amplifier may be neutralized by using the inductance N and the capacity C. In the Roberts circuit, S is made of 44 turns of No. 22 dcc wire wound on a spiderweb form having 13 teeth. The first turn diameter is 2⅛ inches. The outside diameter is 5 inches. S is shunted by a .0005 mfd. variable condenser, preferably a vernier. Coil N-P is wound on a similar form. A pair of wires, of different colors for ease in winding and connection, are wound for 20 turns. For this coil, use No. 26 dcc wire. The outside turn of one of the wires is connected to the plate and its other end (inside) is connected to the outside lead of the other wire. From this point, a lead is brought to the B battery or phones. The inside end of the other coil attaches to the neutralizing condenser C which is connected to the grid of the tube

To adjust the regen erative action so that there is no sudden 'plop' of the regenerative squeal, regulate the detector B voltage to its most effective value for the particular detector tube used.

ANOTHER GOOD TEST

ONE of our readers, Mr. W. A. Golden, Jr., of Santa Ana, Calif., writes us as follows:

A very easy and effective method of determining the point of neutralization can be had by the use of a good crystal detector and a pair of phones connected across the antenna and ground binding posts. First tune-in a strong station in the regular manner, allowing the detector tube to oscillate and form an audible beat note with the carrier wave of the station; then listen to the phones connected in series with the crystal detector between the antenna and ground and, if the set is not neutralized, this beat note will be heard. Now adjust the small neutralizing condenser until this beat note becomes inaudible. It is a good idea when doing this to listen to the phones in the plate circuit of the tube set once in a while so as to be sure that the detector continues to oscillate and form the audible beat note at all times while the neutralizing condenser is being adjusted. When the note can no longer be heard in the phones between the antenna and ground, the set is adjusted properly and should be left permanently in this condition.

I have found this a very simple and efficient means of performing this otherwise rather difficult task.

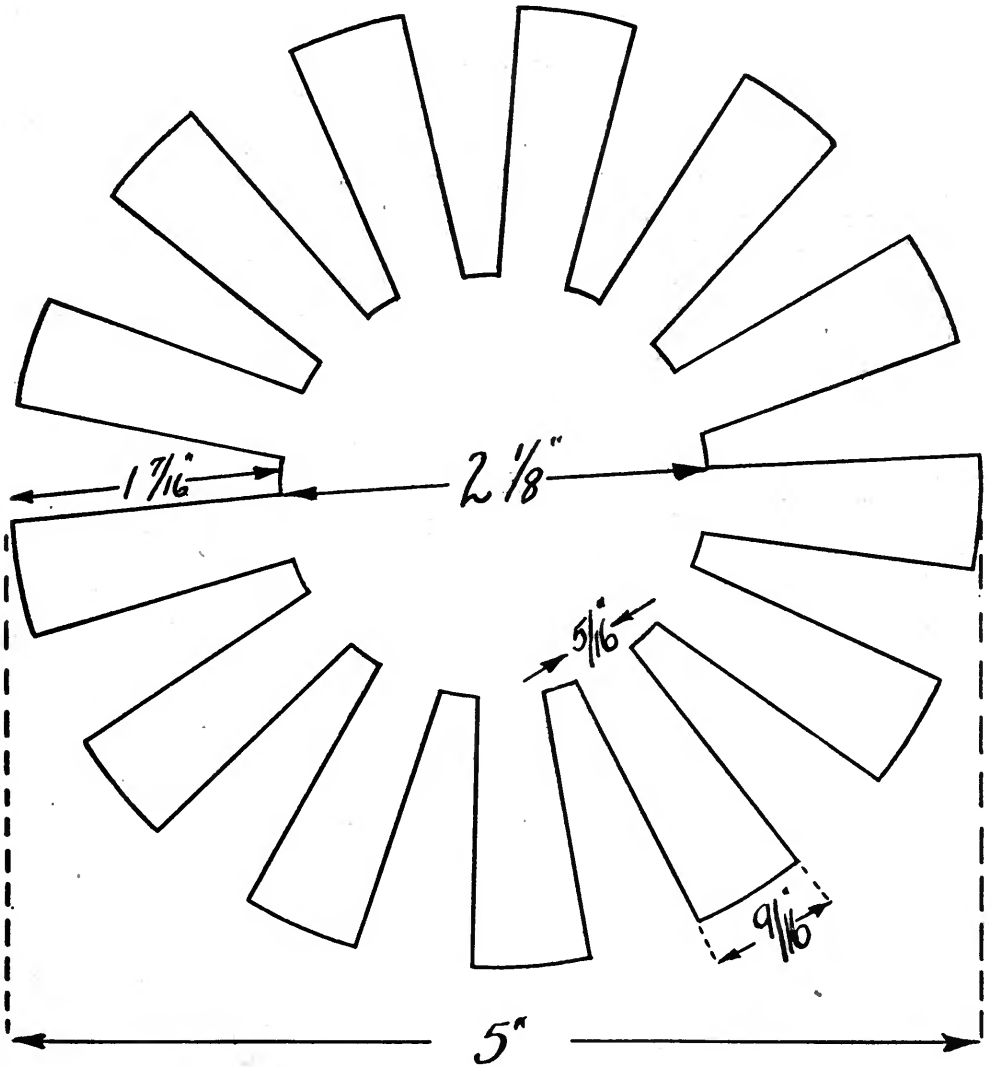
The coil winding data contained in the May RADIO BROADCAST is herewith reprinted with slight elaborations.

A WINDING FORM FOR THE ROBERTS COILS

IT IS recommended that double cotton covered wire be used instead of silk covered wire as the latter is more apt to wear away more quickly. Enamel covered wire may be used, providing the builder is sure there are no points at which the insulation has worn away.

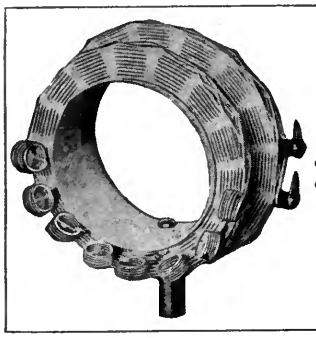
Coils A-S and T are all wound the same way, that is, over two spokes and then under two spokes of the spiderweb form. The coil N-P is wound over one, then under one spoke.

The number of coil turns for the several inductances is listed below the spiderweb template. For those who wish to experiment

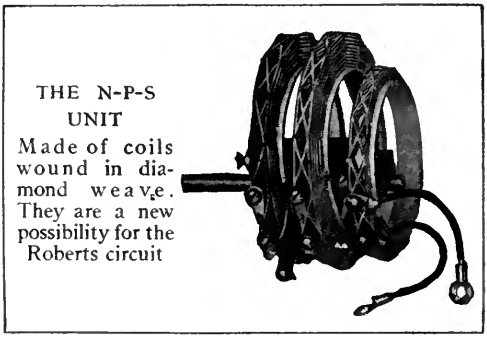


A TEMPLATE FOR THE SPIDER WEB COILS

Exact size. The winding for these coils, as used in various parts of the Roberts circuit and indicated by the letters are as follows: A: 40 turns No. 22 dcc wire tapped 1–2–5–10–20–30–40; S1: 44 turns No. 22 dcc wire; N: 20 turns No. 26 dcc wire; P: 20 turns No. 26 dcc wire (two wires of N and P are wound parallel as a pair); S2: 44 turns No. 22 dcc wire; T: 18 turns No. 22 dcc wire. Coils A, S1, S2 and T are each individually wound under two and over two spokes of the form. The NP coil is wound under one and over one spoke



A NEW TYPE of the P-S coil of the diamond weave winding



THE N-P-S UNIT
Made of coils wound in diamond weave. They are a new possibility for the Roberts circuit

with cylindrical coils, it is suggested that they use the same number of turns as specified for the spiderwebs and then increase or decrease the number of turns, as the case may be, until a satisfactory arrangement is provided.

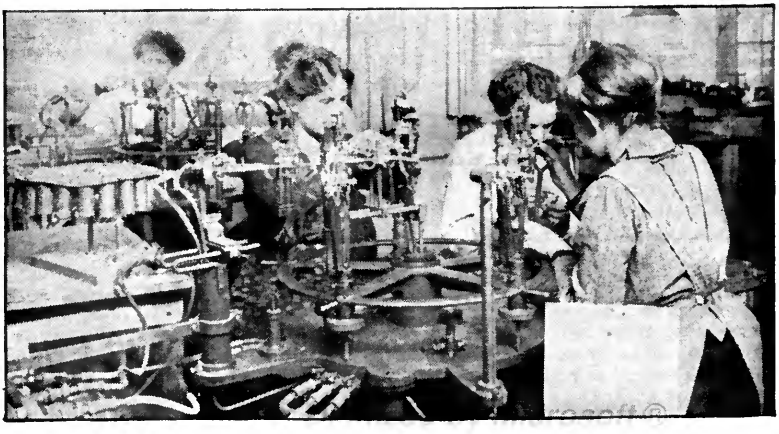
NEW COILS FOR THE TWO AND FOUR TUBE KNOCKOUT

SOME of our readers have reported some difficulties in making the two- and four-tube knockout receivers employing the Roberts circuit perform satisfactorily. We have found that in many instances this difficulty has been caused by faulty manufacture in connection with the spiderweb coils. In some of these units, the coils were wound in the wrong direction, and occasionally turns in one or more of the coils have been short-circuited.

During the past few weeks, we have experimented rather extensively with the coils illustrated here, which are made by the F. W. Sickles Company, of Springfield, Massachusetts, and have found that the difficulties referred to in the case of the spiderwebs were not encountered. With good condensers we have discovered that these coils will cover a wider band of wavelengths than was possible with the spiderwebs, permitting reception on amateur waves at the lower end and commercial stations at the upper.

The following numbers of RADIO BROADCAST have contained constructional and operating information about the Roberts circuits.

RADIO BROADCAST	for	April,	1924,	pages	456 to 460
"	"	May,	"	"	73 to 78
"	"	July,	"	"	272
"	"	August	"	"	279 to 285 and 308 to 314
"	"	September	"	"	379 to 386 and 438
"	"	October	"	"	490 to 497
"	"	November	"	"	60 to 62 and 112
"	"	December	"	"	279 to 281



A CORNER IN A GERMAN TUBE FACTORY

The German Radio Patents

The History of Certain Important Patents Seized During the War, and Now Released for General Use

ONE of the outstanding events in the radio patent field took place Oct. 30, 1924, when the Navy Department decided to issue licenses to approximately sixty independent radio manufacturers under 129 German patents seized by the Alien Property Custodian during the World War.

Early in 1923, application for the patents had been filed, but no decisive action was taken by the Washington authorities. The coöperation of Congressman Fred Britten of Chicago, the National Association of Broadcasters, and the Radio Manufacturers' Association was enlisted.

The majority of the patents and applications involved were originally owned by the Telefunken Company, a German corporation. Among their patents is the controlling patent covering tuned radio frequency amplification —the well-known Wilhelm Schloemilch and Otto von Bronk patent. Under a series of contracts, the first dated Feb. 21, 1913, substantial rights in these patents and applications were assigned by the Telefunken Company to the Atlantic Communication Company, a German corporation organized under the laws of the State of New York.

Under the provision of the Trading With the Enemy Act, as amended, the Alien Property Custodian seized all right, title, and interest in and to these letters patent and application, which remained in the Telefunken Company, and simultaneously took over the Atlantic Communication Company.

Under the provisions of the Trading With the Enemy Act, as amended, the Alien Property Custodian on Feb. 5, 1919, sold to the Secretary of the Navy, representing the United States, all right, title, and interest in and to the said patents, which had been vested in the Atlantic Communication Company and acquired by him from it. Next day the Custodian also sold to the Secretary of the Navy all right, title, and interest in and to the patents and applications which had remained in the Telefunken Company after the assignment to the Atlantic Communication Company, and which had been acquired by the Custodian.

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CONGRESSMAN FRED BRITTEN

Of Illinois, in an unconventional attitude. Mr. Britten was influential in having the radio patent situation clarified according to the recent ruling of the Attorney General

These sales were outright, without any limitations, and covered all the rights acquired by the Government. The sale expressly includes "the sole and exclusive right, license, and authority to manufacture or cause to be manufactured within the United States, its Territories and dependencies, and within the Republic of Cuba, and the right to sell and install, to use and to grant the right to use. . . ."

THE SALE IS LEGAL

THERE is no question about the legality of sales of this nature. Title to property so acquired vests in the United States. The Attorney General has so decided.

It is also established that the grant of a revocable, non-exclusive

license to use patents valuable to the manufacture of radio apparatus is well within the discretion of the Secretary of the Navy.

On Aug. 5, 1920, the Secretary of the Navy granted to the International Radio Telegraph Company a non-exclusive, irrevocable license, without royalty, to make, use, and sell for the purposes and to the extent which the department has a right to do the inventions covered by the patents.

The theory on which the independent manufacturers requested grant of license was that such grant would tend to advance the welfare of the people of the United States and would promote a healthy competition in the manufacture and sale of radio apparatus; that to withhold such license would tend to injure the public welfare by tending to promote monopoly contrary to the policy declared by the Sherman act; that the denial of the license to the applicants would make the International Radio Telegraph Company the only licensee, which would be inconsistent with governmental policy as to monopoly.

As a part consideration for granting the license, the independent radio manufacturers agreed to grant to the United States of America, represented by the Secretary of the Navy, a non-transferable, non-exclusive license under United States letters patent which they now own or may hereafter own during the term of the agreement, to make or have made for it and use for governmental purposes apparatus utilizing or embodying the inventions of their patents, but not for sale.

It is claimed that this grant of license by the Navy Department to the independent radio manufacturers will completely change the complexion of patent litigation.

One of the chief obstacles to the greatest development of the industry is thus removed. The complexities of the radio patent situation have been minimized.

A "muffler" or "blocking" tube is a vacuum tube used in a special circuit to elimate radiation from a receiving set. The patent which covers this method of preventing radiation is owned by the United States Navy Department. Proposals have been made to release the invention to the public so that American manufacturers can develop a device to stop the interference caused by radiation of receivers.

The patent was originally issued on Feb. 17, 1914, by the United States Patent Office to two Germans, Wilhelm Schloemilch and Otto von Bronk. The patent is 1,087,892 and is titled "Means for Receiving Electrical Oscillations."

Since this patent was finally granted during the World War to citizens of Germany it was seized by the Alien Property Custodian Jan. 28, 1919. It was sold by the Alien Property Custodian on Feb. 6, 1919, to the United States Government as represented by the Secretary of the Navy. The legal title now belongs to the United States Navy Department.—*New York Times.*

THE COVERED WAGON IN NEW MEXICO

Captain Irwin navigating a pass through the mountains in New Mexico on his way to California. He is now in California where great interest is being show in the WAGON and its cargo of receivers developed in the RADIO BROADCAST LABORATORY

Principles of Feed Back Circuits

Various Applications of this Method, Regeneration, to Receivers—A Simplified Explanation

WHAT MAKES THE WHEELS GO 'ROUND: IX

By WALTER VAN B. ROBERTS

IT IS particularly fitting that this installment of Mr. Roberts's interesting series of technical discussions which we have been printing since the March, 1924, RADIO BROADCAST should have to do with regeneration and the feed back principle, for the interesting application of that method is one of the features of his now famous Roberts Knock-Out circuit. Many wild claims are being made these days for various neutralizing circuits, and good radio terms are being played with fast and loose. Some of Mr. Roberts's remarks may serve to clear up misunderstandings which exaggerated claims have caused. This installment is quite worth the reading.—THE EDITOR.

BESIEGED on all sides by new circuits bearing peculiar Greekish names such as Homodyne, Neutrodyne, Pliodyne, and Superdyne, and others less mysterious-sounding but equally impressive, such as regenerative and super-regenerative, the radio enthusiast will do well to deepen his understanding of the principle of "feed back," upon which the operation of most receiving circuits depends in greater or less degree.

Fundamentally, the idea of "feed back" is quite simple: energy in the form of alternating current is picked up by the antenna and amplified by one or more vacuum tubes. Some of the amplified alternating current energy is then used to produce a voltage that is fed back to the antenna or other part of the circuit. In the simple regenerative circuit, the voltage thus fed back into the antenna increases the current in the antenna, and hence increases the strength of the signals. Figs. 58 and 59 are familiar single-circuit regenerative receivers working in this fashion. In Fig. 1, voltage is fed back into the antenna circuit by the coupling to the coil L of the coil T (the tickler) which carries the amplified alternating current.

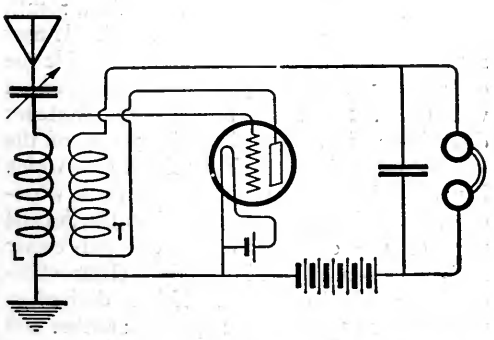


FIG. 58

74. THE TUNED PLATE CIRCUIT

IN FIG. 59, the voltage produced by the amplified current flowing through the variometer V is fed back to the antenna circuit through the capacity (shown in Fig. 59, as a small condenser drawn in dotted lines) that exists inside the tube between the grid and plate and the wires leading to them.

This latter is often called a "tuned plate circuit" regenerative receiver, but it is easy to see that the plate circuit is *not* tuned, at least not in the ordinary sense of the word, because the amount of inductance in the variometer required for regeneration is very largely determined by the filament current and B battery voltage, whereas the inductance required for tuning in the ordinary sense is determined only by the frequency of the signal.

75. RELATION OF VOLTAGE PHASE TO FEED BACK

SO FAR, only simple special cases of feed back have been considered. In general, feed back has two features:

1. The amount of voltage fed back, and
2. The *phase* of the voltage fed back.

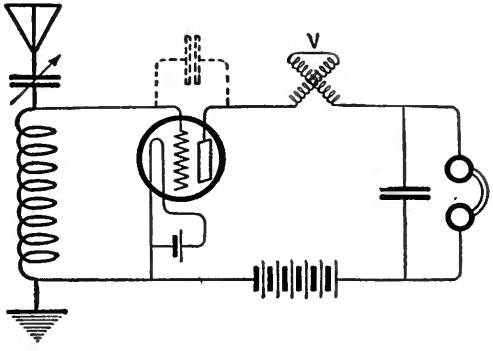


FIG. 59

While a complete explanation of the word "phase" would be too much to include here, yet those unfamiliar with it may be able to get an idea of its meaning from the following: Consider the familiar circuit of Fig. 58. Regeneration is accomplished by bringing the feed back coil T up close to the antenna coil L. Now suppose that coil T is turned around so as to present its other side to L without changing the distance between them. (Or, what is

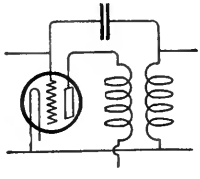


FIG. 60

the same thing, the connections to T are reversed). The *amount* of voltage fed back into the antenna circuit will be unaltered but its *phase* will be reversed, or expressed otherwise, its phase will be changed by 180 degrees. It might seem reasonable to suppose that if we turned the tickler coil only, say, a tenth of the way around we would alter the phase of the feed back by 18°. This is however not the case. In this simple circuit we can adjust the amount of feed back to whatever we want, but the only control we have over its

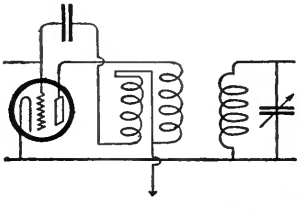


FIG. 61

phase is the choice of the two values 180° apart. If, by reversing the connections to T, we get the wrong one, the result is that instead of *re*generation we will have what might be called *de*generation, or weakening of the signals. In between these two extremes there are other possibilities. If we could manage somehow to feed back a voltage having a phase 90° different from those considered above, there would be no effect upon the signals. Feed backs having other phases cause more or less regeneration or degeneration.

76. How Correct Phase is Attained

WHENEVER feed back is desired, whether for regeneration or to neutralize some undesired feed back, it should be supplied not only in the correct amount, but also in the correct phase. In practice, a small error in phase is not serious, as the feed back can be considered to be composed of two feed backs, one having just the right phase and the other being off by 90° and hence having no effect at all. Theoretically however it would be desirable to have complete control over both the phase and amount of feed back to any part of the receiver or amplifier, and this can be obtained in a number of ways, the same general idea being behind them all.

Perhaps the most elegant method is that shown in Fig. 62. To make things definite, suppose this represents the last tube of a radio-frequency amplifier. Coils a and b are in a fixed mounting, concentric but at right angles. The condenser in series with "a" is adjusted so that the phase of the current through "a" is the same as if resistance alone were present in the lower branch. The condenser in series with "b" is adjusted so that the *reactance* of the upper branch is equal to the *resistance* of the lower branch. Thus the currents in the two coils will be equal in magnitude but 90° out of phase. As a result, a rotating magnetic field is produced. If now a small coil "c" is properly pivoted inside the other two coils, it will pick up a voltage which will be of the same amount in whatever direction it is turned, but the phase of the voltage depends upon the position into which it is turned and can be set to any value whatever. The feed back from "c" to the desired part of the circuit can be effected either magnetically as shown in Fig. 63 or electrostatically as shown in Fig. 64. If it is desired to feed back to two different points another coil "d" may be placed inside of "c" and operated

independently of "c." In Fig. 63 the amount of the feed back is controlled by the closeness of magnetic coupling to the desired part of the circuit, in Fig. 64 by the amount of capacity coupling; in both cases the phase is adjusted

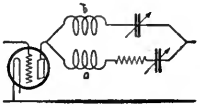


FIG. 62

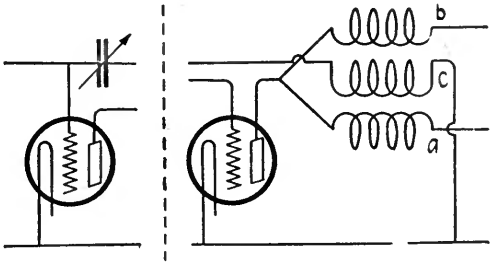


FIG. 64

by rotating coil "c." When it is desired to listen to a different station the two condensers in Fig. 62 must be readjusted, but as their adjustment is not critical they may be shafted together and the dial set to the wave length desired, the dial readings being previously calibrated in wave lengths. In actual practice a radio-frequency choke coil would have to be shunted around one of the condensers to afford a path for the direct component of plate current.

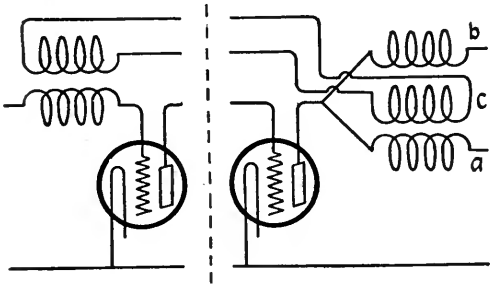


FIG. 63

The above very general type of feed back was devised about two years ago by the writer and successfully used to control the tendency to regenerate in a two-stage Radio Corporation U.V. 1714 transformer-coupled amplifier. On account of its complexity however it is by no means recommended for ordinary use. The chief thing is that it is a general method of which regeneration, the neutrodyne, and the superdyne as well as other less well known circuits are merely simplified special cases, and if its action is well understood, many queer looking new circuits can be "solved" at a glance.

The next article in this series by Mr. Roberts will discuss the superheterodyne.

The Complete Re

RADIO BROADCAST Will Publish Its Own Com
Radio Broadcast Tests Involving Two

By ARTHUR

THIS number of RADIO BROADCAST is going to press just as the International Radio Broadcast tests are at their zenith and it is impossible to get a complete story of the most interesting radio event in history into type in time to make our presses. The first two days of the tests, every telephone in the Doubleday, Page & Company plant was swamped with local and long-distance calls, and the telegraph offices in our vicinity were overwhelmed with messages from every part of the United States, reporting successful reception of foreign broadcasts.

The forecast, made in earlier numbers of this magazine, that reception from abroad would be very generally and surprisingly successful this year, in certain contrast to last year, is certainly borne out in no uncertain fashion. Thousands and thousands of listeners have reported their success to us, and that, in spite of great atmospheric difficulties the first few nights.

We are compiling the complete story of the tests for the February RADIO BROADCAST, which is as soon as we can possibly print it, and we know that every radio fan, whether or not he is a regular reader or subscriber to the magazine will be intensely interested in reading the fascinating story of events radio as they progressed at our laboratory at Garden City, at the Army Air station at Mitchel Field, in the offices of the British Broadcasting Company at London, and at the *Wireless World and Radio Review* in the same city.

OFFICIAL LISTENING POSTS

WELL known radio amateurs, newspapers, broadcasting stations, and manufacturers' engineers were all appointed as official listening posts and it is going to take some time to group their reports and to analyze their experiences. Some of the best radio locations in the New York territory were secured and special receivers installed. Stories of loud-speaker reception of the foreign stations await only the telling.

An official of the New York office of the United Press told us that the interest expressed by newspapers all over the country as shown by telegrams and telephone calls in their office was "positively phenomenal." Several men in the various news services did nothing

port in February

plete and Exclusive Story of Its International
Continents and Millions of Radio Listeners

H. LYNCH

else for several days but devote themselves to handling news matter about the tests.

The International Radio Broadcast tests are full of powerful potentialities for international betterment and a firmer basis for understanding. More than one person has agreed with us on this stand. We have the following copy of a telegram which bears out this contention and phrases the idea in most powerful fashion.

RADIO WTAS
KIMBALL BUILDING
CHICAGO

HEARD MENTION LAST EVENING OF TONIGHT'S GALA PROGRAM AND CONGRATULATE YOU THEREON STOP THIS WEEK IS CERTAINLY A GALA EVENT IN RADIO BUT PEOPLE SEEMINGLY REGARD INTERNATIONAL BROADCASTS AS JUST INTERESTING FEATS STOP MOMENT'S THOUGHT WILL REVEAL AMAZING POTENTIALITIES FOR BENEFIT MANKIND IN FREE EXCHANGE OPINIONS BETWEEN NATIONS STOP IF ANYTHING WILL PUT ALL BATTLESHIPS AT BOTTOM OF OCEAN WHERE THEY BELONG UNDER A REAL CIVILIZATION RADIO'S INFLUENCE IN PROMOTING BETTER UNDERSTANDING AND MORE INTELLIGENT PUBLIC OPINION AMONG THE NATIONS WILL BE THAT FACTOR

ERIC H PALMER BROOKLYN NEW YORK
24 NOVEMBER 1924

We shall make an effort to print the names of all those whose reception of the foreign programs has been verified, but the number may grow too large by the end of the test, in which case other arrangements will have to be made.

All the American broadcasters showed unanimously that they appreciated the importance and interest attaching to this test and were good enough almost unanimously to keep off the air during the foreign transmission periods. It was almost without exception that the American stations kept off the air and used every means within their power to see that the American air was free for listeners on this side. This involved considerable sacrifice on the part of some of the stations who had contracts with various organizations.

The official detailed story complete with exclusive photographs will appear in February.

QUESTIONS AND ANSWERS

WHEN YOU WRITE THE GRID . . .

Don't fail to enclose a stamped, self-addressed envelope with your inquiry if you expect a personal reply.

Don't be impatient if you do not receive an immediate answer. Every letter is answered in the order of its receipt. Do not send a second letter asking about the first.

Look over your files of RADIO BROADCAST *before asking a question which might have been covered in a previous issue.*

Don't ask for a comparison between manufactured apparatus. The addresses of manufacturers of articles used in the construction of apparatus described in RADIO BROADCAST *will be given on request.*

Don't include questions on subscription orders or inquiries to other departments of Doubleday, Page & Co. Address a separate inquiry to The Grid.

Don't send us a fee for answering your questions. The Grid Department is maintained for the aid and convenience of readers of RADIO BROADCAST *and there is no charge for the service.*

QUERIES ANSWERED

HOW MAY I ADD AN R. F. AMPLIFIER TO MY HAYNES SUPER'?

W. H.—Baldwin, L. I.

HOW CAN I INSERT A JACK IN MY CIRCUIT FOR LOOP USE?

E. J. B.—Lansing, Mich.

WHAT IS A COUNTERPOISE AND HOW IS IT USED?

L. W. A.—Chicago, Illinois.

CAN YOU GIVE ME A FEW POINTS ON TROUBLE-SHOOTING IN THE KNOCKOUT CRYSTAL REFLEX CIRCUIT?

W. E. D.—Peru, Indiana.

MY ROBERTS RECEIVER DOES NOT OPERATE CORRECTLY. HOW CAN I TEST IT FOR DEFECTS, ETC.?

C. J. F.—Chicago, Illinois.

CAN CYLINDRICAL COILS BE USED IN THE ROBERTS CIRCUIT?

M. J. M.—Atlanta, Georgia.

WILL YOU PUBLISH A BUZZER CIRCUIT FOR THE PRACTISE OF CODE?

A. W. M.—Bronx, New York City.

WHAT RHEOSTATS SHOULD BE USED WITH 201-A TUBES?

R. N. R., Memphis, Tennessee.

MAKING THE "SUPER" MORE SENSITIVE

FOR those who, like Mr. W. H., wish to make their Haynes super-heterodyne more sensitive to weak signals emanating from great distances, the information contained herewith should be helpful.

The circuit in Fig. 1-A shows the use of an antenna and an extra stage of neutralized radio-frequency amplification placed before the first detector tube of the "super" receiver. It is quite necessary that this stage of amplification be neutralized, especially when the antenna is used, so that radiation does not occur. Ordinarily a good super does not require the use of an antenna as a collective agency and its use is poor practise. In Fig. 1

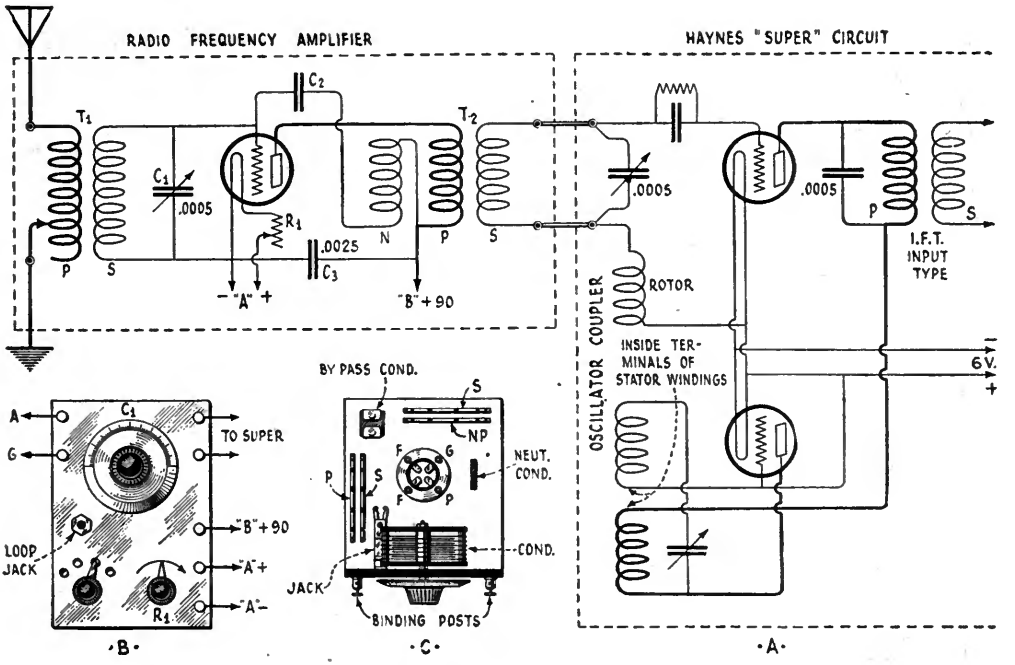


FIG. 1

its use is indicated for general purposes when the R. F. amplifier is connected with other circuits. The method for plugging in a loop is shown in Fig. 2.

Explaining the circuit in Fig. 1-A, no changes or alterations are necessary in the Haynes circuit. The amplifier may be constructed so as to be entirely contained in its own cabinet as a separate unit. See Fig. 1-B and C. For the sake of compactness P and S of T1 and N P-S of T2 may be wound on spiderweb forms similar to those used in the Knock-out Roberts receivers. The number of turns for each coil is as follows:

T1-P 40 turns No. 22 dcc wire—S 44 turns No. 22 dcc wire. T2-N 20 turns No. 24 dcc wire—P 20 turns No. 24 dcc wire—S 44 turns No. 22 dcc wire.

If it is desired, P of T1 may be wound with about ten turns to make the antenna circuit a periodic or untuned. C2, the neutralizing capacity may be made by connecting a 4" piece of bus bar to the grid post of the tube. A piece of spaghetti insulating tubing is slipped over it and on top of this is wound two or three inches of bare wire with the turns soldered together making it one continuous piece of wire tubing. C1 is a .0005 mfd. variable condenser preferably of a vernier type.

Coils N and P are wound as a parallel pair of wires. In this instance two spools of No. 24 dcc wire may be used for simultaneously winding both turns together. A panel and base layout are shown for use primarily as a guide, not as an actual definite placement for the parts. This type of amplifier will fit in nicely as an addition to any type of receiver. See articles in the March and May, 1924, RADIO BROADCAST for additional details.

DOUBLE CIRCUIT JACK FOR CHANGE-OVER PURPOSES

IN THE multi-tube radio frequency receivers, super-heterodynes, and neutrodynes, a double circuit jack may be included to change automatically from loop to antenna by merely inserting a plug to which the loop has been connected, in the jack. This feature will also apply especially to those who are inclined to experiment with couplers of various designs, antennas, loops, etc. The circuit in Fig. 2 shows how the adaption is made. The secondary of an additional coupler may be connected to the inserted plug which is of the Weston or other "instant change" type.

USE AND VALUE OF A COUNTERPOISE

MANY operators of receivers are troubled by broad tuning or by their peculiarity of picking up local disturbances caused by telephone ringers, house-lighting circuits, vacuum cleaners, elevators etc. Usually these defects may be attributed to faulty ground systems to which many of the above named apparatus are connected. A counterpoise, very similar to an ordinary flat top antenna, excepting that it is mounted just above the earth or in the cellar of one's home, may be advantageously employed to eliminate these forms of disturbances. In Fig. 3, several forms of counterpoise are shown with their constructional details and method of use. It is only necessary to remember that to be efficient they should be well insulated from near-by objects. Any type of wire, insulated or bare, may be used. Porcelain cleats may be economically used as insulators. The counter-

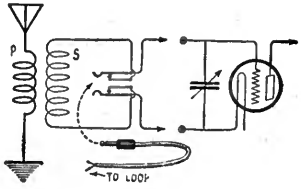


FIG. 2

poise is connected to the radio receiver in place of the ordinary ground connection.

USING STANDARD PARTS FOR THE ROBERTS CIRCUIT

IN THE matter of substitute coils to replace the spiderwebs used in the RADIO BROADCAST Knock-out circuit, it is well to understand from the start that endeavors along these lines so far have been experimental in nature. Many experimenters are working on the problem, and in a short while no doubt the needs of all will be satisfied in this particular connection.

RADIO BROADCAST has experimented with various forms and herewith is presented a few guiding facts which may prove helpful to those who wish to experiment of their own accord.

In most instances those couplers now on the market such as Ambassador, Shamrock, Fischer, Eastern pickle-bottle, and others of a similar constructional nature may be advantageously experimented with by merely adding to, or rewinding the primary coil constituting the N-P winding of the Roberts circuit. The turn ratio between primary and secondary will vary according to the coupler used and no definite value can be given. In general it is well to use the same number of turns as specified for the spiderwebs, then vary for satisfactory operation. Instead of a double wound primary a coil of twice the number of turns as specified may be used taking off a center tap as shown in Fig. 5 and 6. In most instances the placement of the primary N-P coil will have a very decided effect upon the operation of the receiver. The usual practice is to rewind the primary N-P coil directly over the secondary with cambric cloth insulation between the two.

Standard neutroformers offer an opportunity for interesting experiment. The present primaries may be removed and double-wound coils substituted. In this case the N-P coil would consist of as many turns per coil as the removed primary. A variometer in the plate circuit of the detector tube will provide regeneration.

Mr. Roberts, in his original article describing the two-tube receiver, mentioned the fact that the two wires constituting the N-P winding should be wound physically as close together as is possible. From Mr. Roger Whitman, Associate Editor of *Country Life*, comes the suggestion of cutting two pieces of wire long enough to provide 20 turns each for the N-P coil and twist them together. Mr. Whitman has found that with about 3 to 5 twists to the inch this arrangement provided more stable, sharper operation. Figs. 4 and 5 are illustrations of the various points explained herein. Fig. 6 shows the circuit diagram for the connection of the coupler with the split primary illustrated in Fig. 5

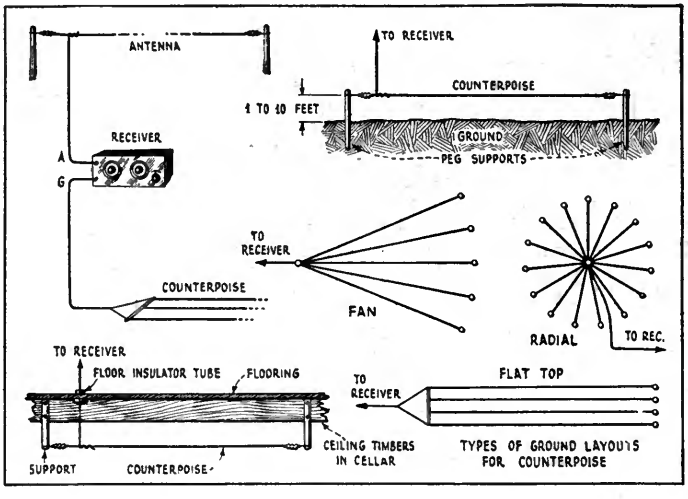
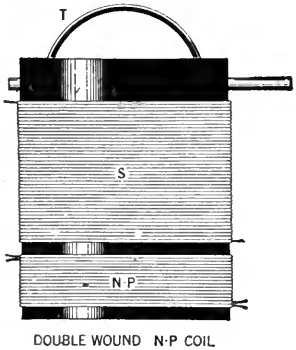


FIG. 5



DOUBLE WOUND N-P COIL PLACED ON SAME PLANE WITH SECONDARY

FIG. 4

GENERAL POINTERS ON THE ROBERTS CIRCUIT

MR. C. J. F'S. question is similar to a number of others received by THE GRID. The following general pointers will serve as an aid in locating and eliminating the troubles sometimes found in the RADIO BROADCAST Knock-out Roberts receivers.

1. Check over all the parts to be used, before assembling, with a view to preventing the use of defective parts. A pair of phones and a C battery, used as a testing circuit, will uncover any open circuits in the various coils, transformers etc., and any possible short circuits in the several condensers to be used.

2. Tubes offer one of the greatest hindrances to proper, efficient operation. This is

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THE new Magnavox Receiver (with or without built-in Magnavox Reproducer) is an entirely new development of tuned radio frequency.

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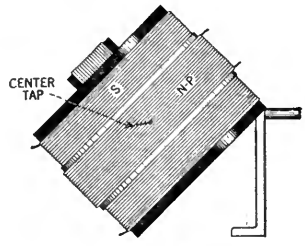
especially true in the case of the detector tube. Change around the tubes until their best operating position is found.

3. Manufactured and home-made coils may be so mounted that the direction of winding in several of the coils is found to be opposite. Check over the coil assembly and be sure that



THE N-P COIL PLACED OVER THE SECONDARY

FIG. 5

all the coils are mounted so that the winding direction in all the coils is the same.

4. When regeneration does not occur, it is an indication that the tickler coil is reversed. Also, the B battery voltage on the detector tube may be too low. On the other hand, if regeneration is too pronounced, the circuit going in and out of oscillation with a decided "plop," it is quite evident that excessive detector plate voltage is being applied and must be reduced for more stable operation.

5. Howling may be due to (a) an interaction or feedback between the several circuits; (b) Reversed leads to the primary of the audio reflex transformer. (c) Incorrect values of C battery. In some cases it will be found necessary to ground the negative side of the A battery to obtain stability.

6. Grid leaks clear up, to a marked degree, the volume and tone quality delivered by the receiver. Try various values of leak and grid condenser.

7. The spiderweb coils, as designed, will cover the entire broadcasting wavelength when the secondaries are shunted by .0005 mfd. variable condensers. When the sensitivity of the receiver varies for different wavelengths, that is to say, when signals received are louder on the lower wavelengths than on the higher wavelengths, the receiver is then in a condition where the step-up of energy is not the same over the entire wavelength scale. To overcome this, the primaries and secondaries of the two couplers must be made semi-variable so that resonance may be obtained at all the wavelengths. Variation of the turn-ratio between primary and secondary will also serve to eliminate this trouble.

8. The use of a by-pass condenser shunted across the C battery and secondary of the audio reflex transformer as outlined in the November GRID is not a general cure-all for poor volume output. In a majority of cases this procedure does "tone up" the receiver quite appreciably. This usually depends upon the value of C battery and type of audio reflex transformer used.

TROUBLE SHOOTING IN THE CRYSTAL REFLEX RECEIVER

THE use of good, tested crystals in the RADIO BROADCAST Knockout crystal reflex receiver cannot be emphasized too much. Poor crystals will cause squealing due to regeneration

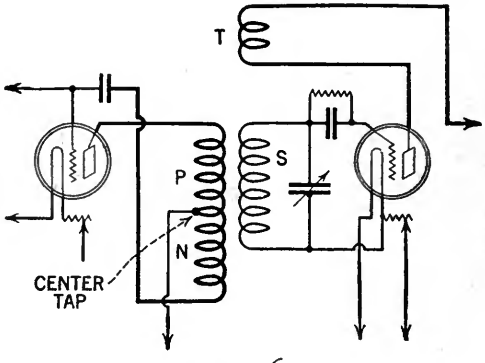


FIG. 6

produced by a high resistance contact on the crystal This condition also causes body capacity effects resulting in unbalanced operation.

It is essential that the negative side of the A battery be grounded. It would be well to have the negative side of the A and B battery connected together, thus providing a common ground for both

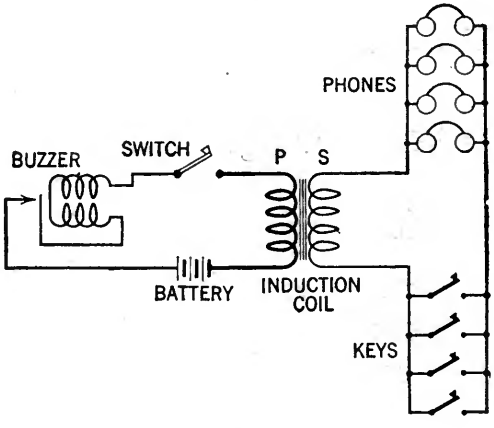


FIG. 7

batteries. In some cases, due to internal characteristics of the receiver this does not work out well and it is necessary to connect the negative B to the positive A post.

A CIRCUIT FOR CODE PRACTICE

THOSE who have a longing to know the code used in radio communication will find the circuit shown in Figs. 7 and 8 useful in the practise of sending and receiving dots and dashes. The system is especially applicable to Radio Clubs,

Modulation *plus* Regeneration

Gazette RADIO SECTION

VOL. XIV-NO. 132 – 16 PAGES★★

MODULATION PLUS REGENERATION IN NEW MODEL L-2 ULTRADYNE

20 DX Stations logged on August 25th on Loud Speaker using loop aerial at Covington, Ky.

Modulation plus regeneration is the keynote of the new Model L-2 Ultradyne Receiver. Regeneration as applied to this new method of radio reception produces greater rectification than ordinary methods of detection—a vital step in radio engineering. This combination produces tremendous amplification when receiving weak signals. Allows the Ultradyne to respond to a very small amount of energy. Signals are amplified thousands of times before they are detected and made audible.

Mr. R. H. Thomas, 509 Coppin Building, Covington, Ky., writes:

"The Ultradyne far surpasses any idea that I previously had as to what a radio receiver could be. On the night of August 25th, 1924, I tuned in on my Ultradyne, the following stations:

WBZ	Springfield, Mass.
WOR	Newark, N. J.
WGY	Schenectady, N. Y.
WHN	New York, N. Y.
WCAP	Washington, D. C.
WEAF	New York, N. Y.
WOO	Philadelphia, Pa.
KDKA	Pittsburgh, Pa.
WCBD	Zion, Ill.
WIAR	Providence, R. I.
WGR	Buffalo, N. Y.
WTAS	Elgin, Ill.
WAAM	Newark, N. J.
WABM	Saginaw, Mich.
WNAC	Boston, Mass.
WEAN	Providence, R. I.
WLW	Cincinnati, O.
KSD	St. Louis, Mo.
WWJ	Detroit, Mich.
WHO	Des Moines, Ia.
WTAM	Cleveland, O.
WHAZ	Troy, N. Y.
WOS	Jefferson City, Mo.
WSB	Atlanta, Ga.
WMC	Memphis, Tenn.
WOC	Davenport, Ia.
WBAP	Ft. Worth, Tex.
WNYC	New York, N. Y.
WOAW	Omaha, Nebr.
WFAA	Dallas, Tex.
WSAI	Cincinnati, O.
KFKX	Hastings, Nebr.
WCK	St. Louis, Mo.
WBT	Charlotte, N. C.
KFKB	Milford, Kan.
WGAQ	Shreveport, La.
KGO	Oakland, Calif.
KFJM	Grand Furks, N. D.
KFI	Los Angeles, Calif.
WDAF	Kansas City, Mo.

"I consider the above reception remarkable as it stands, but considering it was all accomplished on a *24-inch loop*, and all but WGAQ, KFJM and KFI, were heard on the loud speaker, it far surpasses anything that I have heretofore experienced.

"As regards selectivity, will say that I am only four or five miles from the powerful WLW station at Cincinnati, operating on 423 meters, and his wave is so powerful that I can receive him on the loud speaker, with one stage of audio, loud enough to be heard a block away, *without using antenna, ground or loop.* When WLW is on the air, I can tune him out completely, and receive WSB on 429 meters, WHB and WDAF on 411 meters, and PWX, nominally on 400 meters, but usually somewhat above that wave.

"I know of no other receiver that will even approach this performance for extreme selectivity, volume and distance."

ULTRADYNE

MODEL L-2

This application of regeneration is the most recent development of R. E. Lacault, E.E., A.M.I.R.E., since his perfection of the "Modulation System" used exclusively in the Ultradyne and which has so revolutionized all conception of selectivity, sensitivity, volume and range.

This Model L-2 Ultradyne, without a doubt, represents the peak of present day super-radio engineering skill.

ULTRADYNE KIT

Consists of one low loss Tuning Coil, one low loss Oscillator Coil, one special low loss Coupler, one type "A" Ultraformer, three type "B" Ultraformers, four matched Grid Condensers.

The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, Consulting Engineer of this Company and inventor of the Ultradyne.

To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers.

Ultraformers are guaranteed so long as this seal remains unbroken.

$30.00

Send for the 32 page illustrated book giving latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver.

50c.

PHENIX RADIO CORPORATION

5–7 Beekman Street **New York City**

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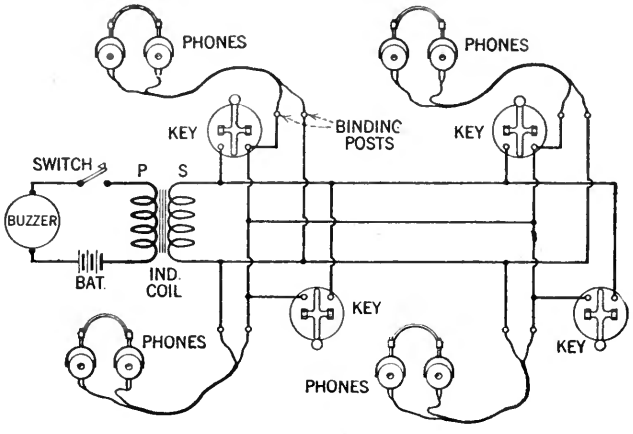


FIG. 8

A picture diagram of the actual layout of the parts and wiring. Only the keys, buzzer, coil, binding posts, etc., need be mounted on the top of the operating table while all the wiring is made on the under side. As may be seen from the schematic diagram in Fig. 7 the secondary-key-phone circuit is a series parallel one allowing provision for additional operating positions

school classes, and other organizations desiring a means for group practise.

The material needed is a buzzer capable of producing a high-frequency note (the General Radio and Federal buzzers are very good for this work) a telephone induction coil, a switch, a key and pair of phones per person, and the necessary batteries.

By arranging the parts as shown in Fig. 8 the circuit may be controlled by any one of the keys, the signal being heard in all the phones. In this way it is possible to maintain intercommunication between the several receiving points.

By putting the buzzer in a continuously operated circuit, the tone produced will be more constant than if the several keys were used to interrupt the buzzer circuit. Also, by placing the keys in the secondary side of the circuit there will be no appreciable "lag" or "key thump" in the signals as transmitted.

A POWER AMPLIFIER AND C BATTERY

THE fundamental idea involved in the design and construction of a power amplifier is briefly outlined in the circuit shown in Fig. 9. First, a low ratio audio frequency transformer is necessary to prevent distortion and unbalance in the input side of the vacuum tube. The resistances unit composed of various values of resistance from 25,000 to 100,000 ohms directly shunts the secondary of the audio frequency transformer and is a positive means for controlling the volume with its resultant distortion. The Bradleyleak and other commercial types of variable resistance are admirably suited for this use.

In a unit of this kind a power amplifier tube works better than the ordinary type of vacuum tube—the UV201A. The standard 5 watt tube or any of the Western Electric power amplifier tubes are fine for this purpose. Power amplifier tubes require a higher plate voltage than the UV201A's and in most circuits the addition of a C battery inserted in the lower lead of the secondary of the transformer returning to the negative side of the filament supply will often clarify and stabilize the circuit quite noticeably. The negative side of the C battery should connect to the secondary of the transformer and the positive terminal of the C battery should connect to the negative side of the filament supply. The value of C battery is governed by the amount of plate voltage used and is outlined in the following table:

PLATE VOLTAGE	C BATTERY VOLTAGE
40	0.5 to 1.0
60	1.0 to 3.0
80	3.0 to 4.5
100	4.5 to 6.0
120	6.0 to 9.0
150	9.0 to 12.0

The use of a C battery in any audio-frequency amplifier circuit will materially reduce the current drain on the B batteries, thereby increasing the number of hours of use of these batteries. A C battery will also permit a vacuum tube to function at its most efficient point of operation, amplifying the signal applied to the grid of the tube in a distortionless and also economical manner.

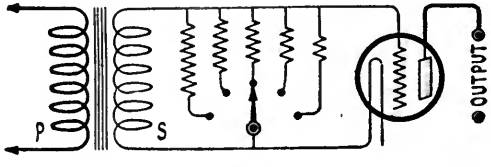


FIG. 9

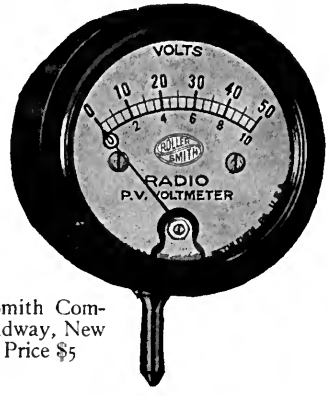
Shows a power amplifier circuit. The volume output is controlled by the shunt resistances

New Equipment

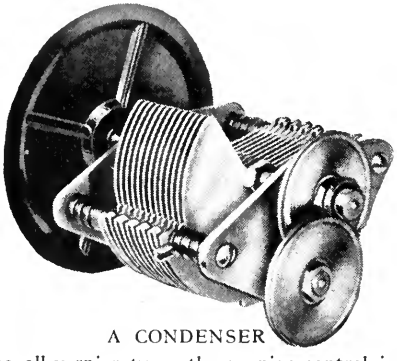
GRIMES INVERSE DUPLEX

An inverse duplex receiver designed by the inventor of this system of reflexing. It employs three tubes and a crystal detector and is very satisfactory for quality and distance. Made by David Grimes, Inc., 1571 Broadway, New York City

RADIO VOLTMETER

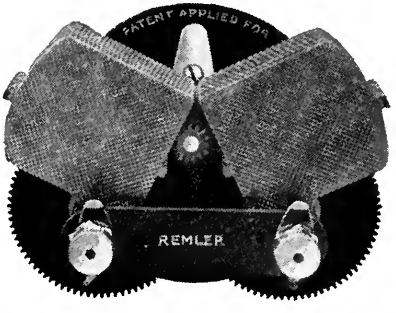


A double range, 0–10 and 0–50 volts, voltmeter which is well made. The double range makes it possible to take accurate readings of A, B and C batteries. Made by the Roller-Smith Company, 233 Broadway, New York City. Price $5



A CONDENSER

Of the all-vernier type, the vernier control is attained by means of the friction plates showing at the back of the condenser. One possibility of loss is eliminated because the stator plates are stamped from one piece of aluminum and not severed. A very good range of capacity is covered. Made by the U. S. Tool Company, Inc., 117 Mechanic St., Newark, N. J.

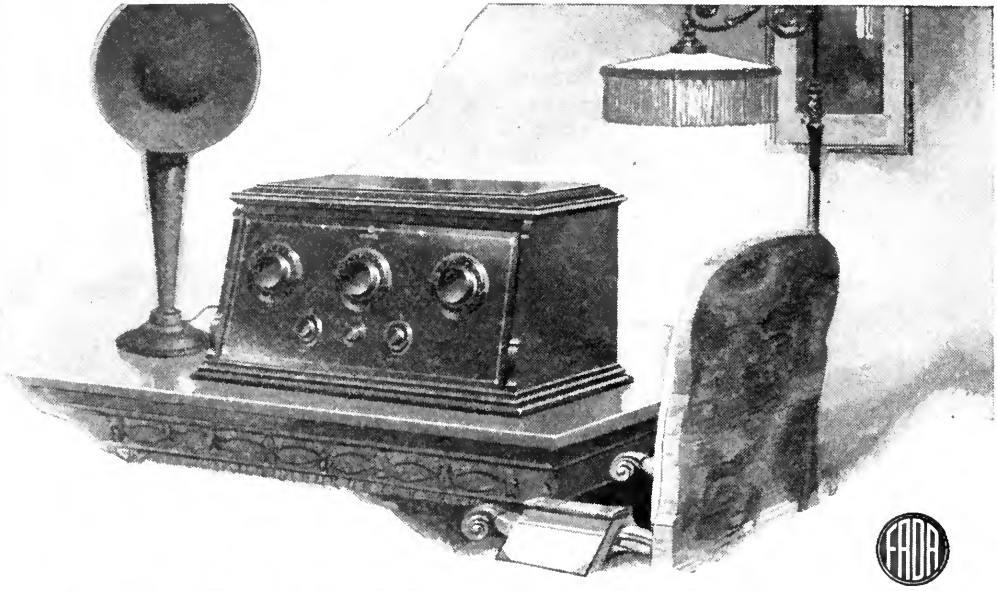


REMLER CAPACITY UNIT

An instrument of novel design very well built. The photograph is the rear view showing the embossed plates, twin rotors, and all-vernier control. Made by the Remler Radio Mfg. Co., 154 W. Lake St., Chicago, Illinois

SPLITDORF RECEIVER

The Splitdorf receiver is a five-tube neutralized set of the tuned radio-frequency type. It is of fine appearance and a very pleasing set to operate. Made by the Splitdorf Electrical Co., 392 High St., Newark, N. J. Price $150



The FADA Neutroceiver

will surpass anything you have expected of a radio receiver

VOLUME? The FADA Neutroceiver will give you all the controlled volume you can possibly desire. Designed to use powerful tubes and operate on either indoor or outdoor antenna, it is guaranteed to give powerful results.

Clarity? This wonderful, five-tube Neutrodyne offers you a tone quality which is unexcelled. It reproduces every tone of the human voice and of every musical instrument with lifelike fidelity.

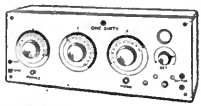
Selectivity? Separates stations, tunes through powerful local broadcasting and brings in distant concerts — even when their wave lengths are but a few meters apart.

Simplicity of control? Anyone, without experience, can operate the Neutroceiver. You can turn your dials to previously located stations and bring them back night after night.

Beauty? As a piece of art-furniture, the FADA Neutroceiver is a masterpiece. The cabinet is solid mahogany, with the panel perfectly balanced and sloped gently to facilitate easy tuning.

Supplementing the FADA Neutroceiver and making a complete FADA line, are five other Neutrodyne receivers—three, four and five tube sets—in plain as well as artcraft cabinets. You have a price range from $75 to $295 from which to select. Each model extraordinary in results; each a remarkable value. See your dealer.

LICENSED BY INDEPENDENT RADIO MANUFACTURERS, INC. UNDER U.S. PATENTS NEUTRODYNE PATENTS PENDING

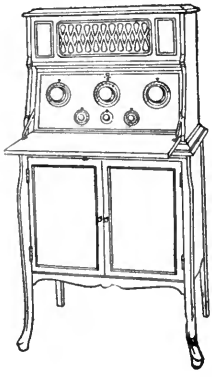


FADA "One Sixty" No. 160-A

"The receiver that has taken the country by storm." The best known of all Neutrodynes. Four tubes. Price (less tubes, batteries, etc.) $120.

FADA Neutrola Grand No. 185/90-A

The five-tube Neutrola 185-A, mounted on FADA Cabinet Table No. 190-A. Price (less tubes, batteries, etc.) $295.



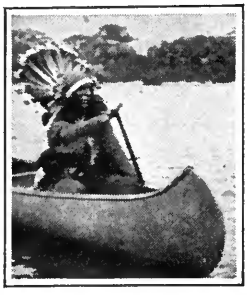
F. A. D. ANDREA, INC., 1581 JEROME AVENUE, NEW YORK

FADA Radio ★

★ Tested and approved by RADIO BROADCAST ★

Among Our Authors

REMINGTON SCHUYLER is represented with the cover on RADIO BROADCAST this month and a story "Static Days and Nights" both of which tell some of his experiences in ranch life in the West. "Building a house has certainly kept me busy," writes Mr. Schuyler, but my first celebration in the new home is going to be a Four-Tube Knock-out set." Mr. Schuyler is one of the best known of American painters of Indians. During Maréchal Foch's recent tour of this country he was official American Legion painter and made portraits of French and American officers on the trip.



REMINGTON SCHUYLER
In Indian Costume

IN SEEKING release from amateur photography, I found a substitute in radio. I hocked all my cameras and bought condensers. I haven't had a fish rod in my hands since I became infected. I am fond of soldering paste in my coffee and own a Roberts Knock-out receiver." The photograph is a flashlight of Mr. Bradford being much pained by the squealers. Mr. Bradford, cartoonist for the Philadelphia *North American*, did the cartoon which appears as our frontispiece this month.

W. R. BRADFORD
In a self-posed photograph, saying something definite about "bloopers"

B. F. MIESSNER

B. F. MIESSNER is a consulting engineer with Wired Radio, Inc., New York. He has been for many years engaged in radio and electrical work for the Navy, John Hays Hammond, Jr., and Emil J. Simon. For a time, he was director of the acoustical research laboratories of the Brunswick Balke Collender Company at Chicago. Mr. Miessner invented the Automatic Heliotrophic Machine (the Electric Dog). He is also the author of *Radio Dynamics*, published by D. Van Nostrand and Company.

JAMES MILLEN is a student at Stevens Institute of Technology and is specializing in radio work.

ALBERT C. ALLEN "was born and raised in the regular army, and served in the Spanish and Phillipine wars." He has always lived in what he calls "the real West"—West of the Rockies, and has of late been particularly interested in horticulture, and also in photographing wild life.

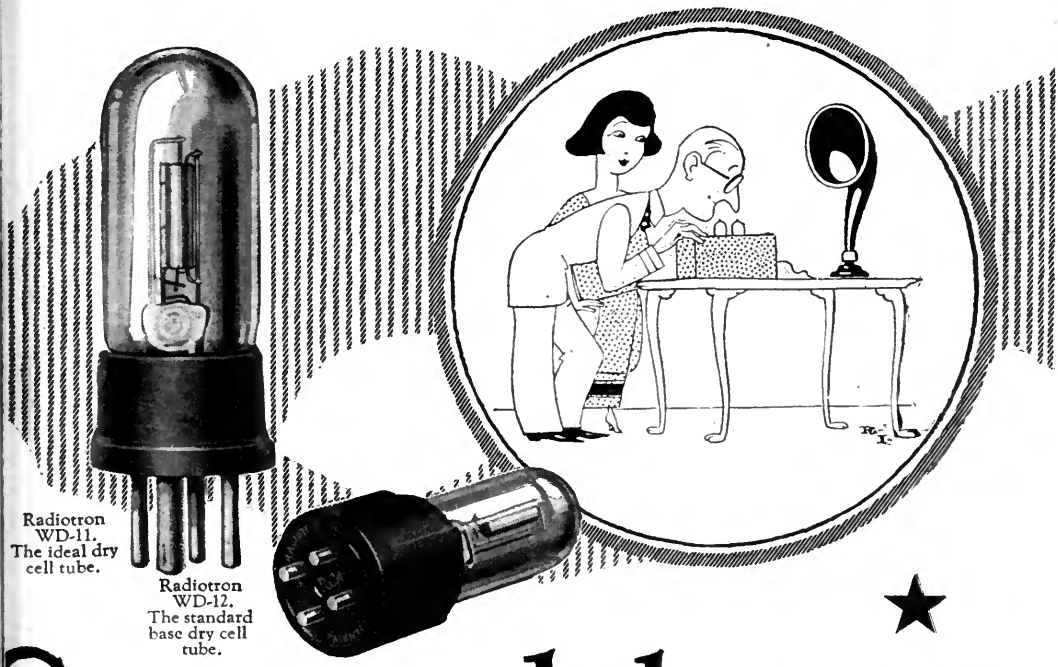
ALBERT C. ALLEN
Taking movies of wild life

ROBERT H. MARRIOTT is not unfamiliar to readers of this magazine, for his contributions have appeared here quite frequently. One of Mr. Marriott's distinctions is that he was the first president of the Institute of Radio Engineers. He was one of the first to take up radio engineering as a profession and began actively in 1901. He is now chief radio engineer for the Puget Sound Navy Yard at Bremerton, Washington.

FRANK E. BUTLER is well known to many old timers in radio when it was wireless. The story of his experiences with Dr. Lee De Forest in the early experimental days is printed in this magazine for the first time, and, according to the mail we are receiving in the office, is attracting an unusual amount of attention. There are more articles by him to follow.

MC MURDO SILVER is a rare combination among radio men. His spare hours, instead of being devoted to radio, as are those of most other radio men, are devoted to James Branch Cabell, Arthur Machen, and Roland Firbank.

MCMURDO SILVER



Radiotron WD-11. The ideal dry cell tube.

Radiotron WD-12. The standard base dry cell tube.

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Get a good detector

Radiotrons WD-11 and WD-12 are the same tube but with different bases.

Radiotron WD-12 has a standard navy-type base. With it, you can change your set to dry battery operation. Ask your dealer today.

RCA

This symbol of quality is your protection

What will Radiotron WD-11 and WD-12 do as detectors? First—they are sensitive to weak signals—superlatively sensitive, as remarkable distance performances show in thousands of one-tube sets. Second, they are good "oscillators"—and that is important in regenerative circuits. And third, they are quiet in operation—add no electrical noises to the music, or speech. Radiotrons WD-11 and WD-12 are famous as audio and radio frequency amplifiers—too—and have made possible the hundreds of thousands of dry battery receivers that are in use today. They mean clear, true reception—over big distances—with dry batteries! Be sure to get a *genuine Radiotron.*

Radio Corporation of America

Sales Offices: Suite No. 32

233 Broadway, New York — 10 So. La Salle St., Chicago, Ill.

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Radiotron

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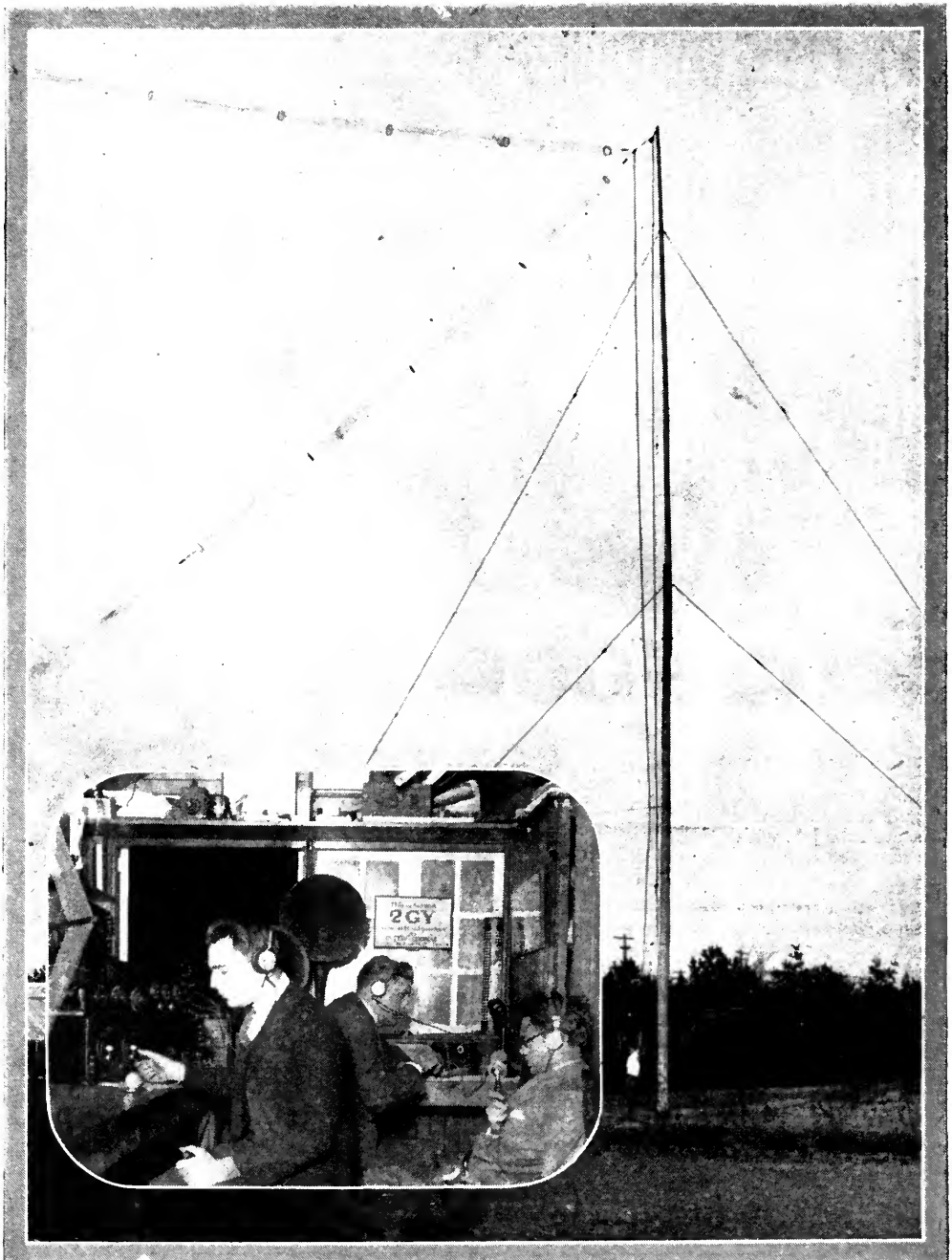

THE HUB OF THE INTERNATIONAL RADIO BROADCAST TESTS

The masts of the receiving and transmitting station at the laboratory of this magazine. Two separate cage antennas are used, one for receiving and one for transmitting. The insert shows a corner of the laboratory with John B. Brennan, Willis K. Wing, and Zeh Bouck of the editorial staff. Mr. Brennan is operating a super-heterodyne and a Knockout four-tube receiver as an alternate. Mr. Wing is operating the line which controls the wireless circuit to London, and Mr. Bouck is talking over the radio to official listening posts at Mitchel Field