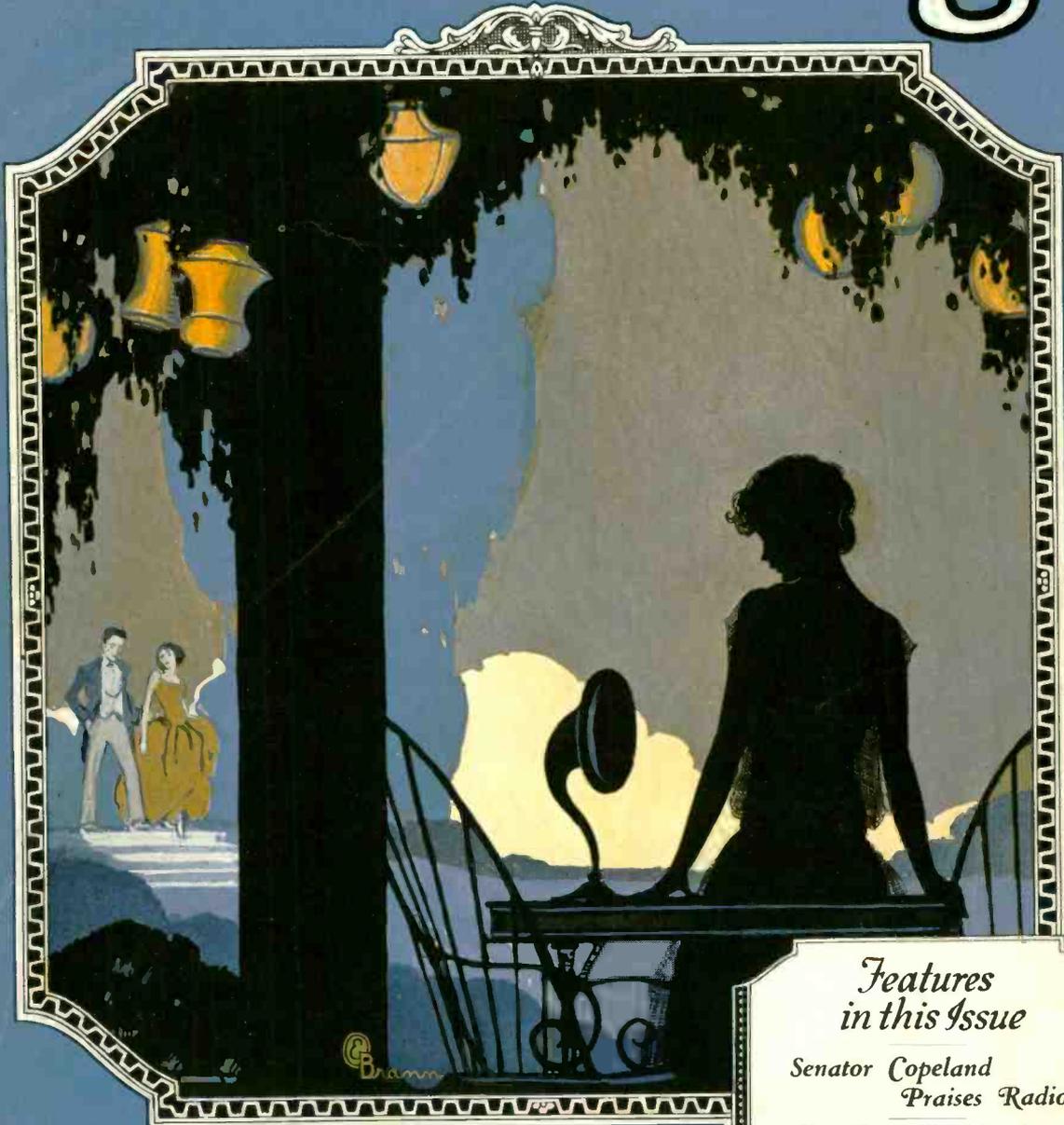


JULY 1924

25 CENTS

The Wireless Age



*“Enjoy
Summer Radio”*

Features in this Issue

*Senator Copeland
Praises Radio*

*Two Portable Receivers
fully described
Both Thoroughly Satisfactory
For Summer Use*

*King Radio
An Extravaganza*

*Sound
Dr. Minton gives scientific account
of the Ear as an element in
Radio Reception*

Cunningham
RADIO TUBES

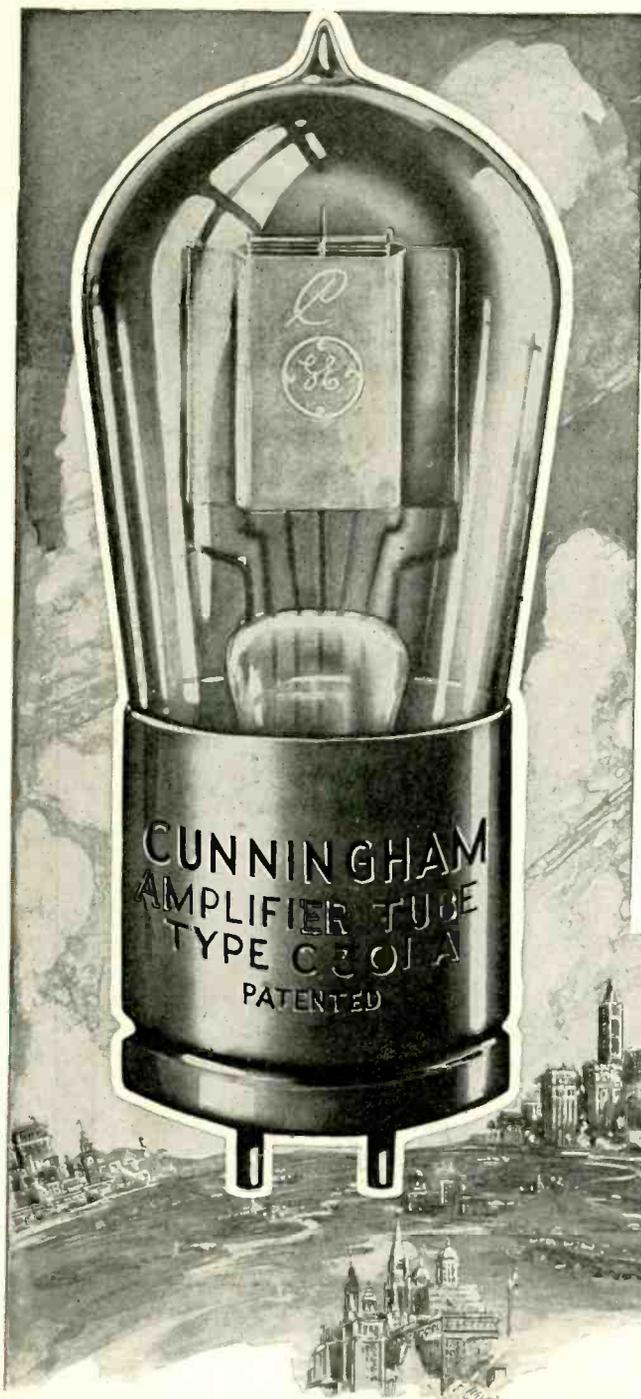
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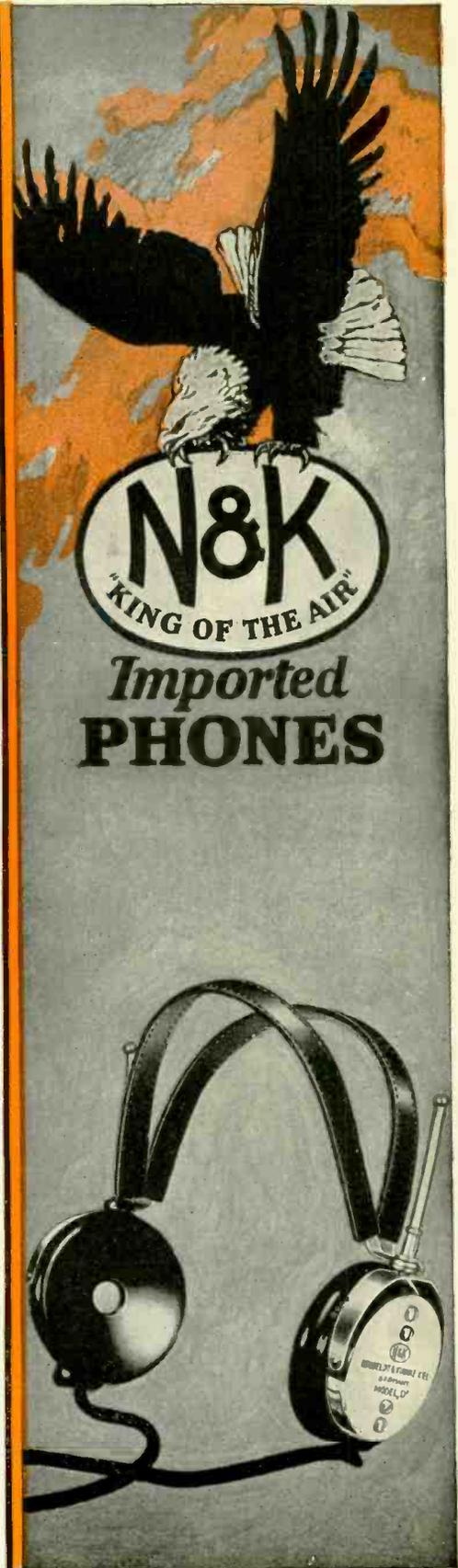
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America's Foremost
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No. 10

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Your Authors

MR. DONALD GORDON WARD (Condensers) was born in Portland, Maine, and was educated in the schools of that city. He constructed his first receiver by utilizing a pair of arc light carbons filed to sharp edges, and a steel needle—borrowed from his mother's work basket—a single 75-ohm telephone receiver, a run down dry cell, and a four wire 20-foot aerial. The tuner was a single slider affair, and this "set" got a distance of 2 1/2 miles. Mr. Ward is now the technical instructor in the Radio Institute of America.

ROYAL S. COPELAND (Radio Will Improve Politics), United States Senator from New York, has enjoyed the reputation of always going straight to the point with brevity and decision. Some time ago, he had occasion to confer with President Coolidge on matters that brought the conversation around to radio. The President expressed his confidence in the potential benefit of broadcasting during the presidential election campaigns. Mr. Copeland had his own particular views on the subject which he voiced at that time, and then recorded exclusively for The Wireless Age.

DR. J. P. MINTON (The Human Ear and Radio Reception) was born and raised on a farm in Illinois. After his public school education, he graduated as an Electrical Engineer at the Bradley Polytechnic Institute; graduated in Mathematical Physics, Massachusetts Institute of Technology with the degree of B. Sc. As post graduate student in Physics and Mathematics, University of Chicago, Dr. Minton was awarded the degree of Doctor of Philosophy, the highest honors given by the University. He then worked three years in the Research Laboratories of the General Electric Co. Here he developed the cathode ray tube to a high degree of perfection, inventing the cathode ray tube wattmeter and oscillograph. He also made extensive investigation on dielectric phenomena, particularly at high voltage.

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Because certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein. Printed in U. S. A.

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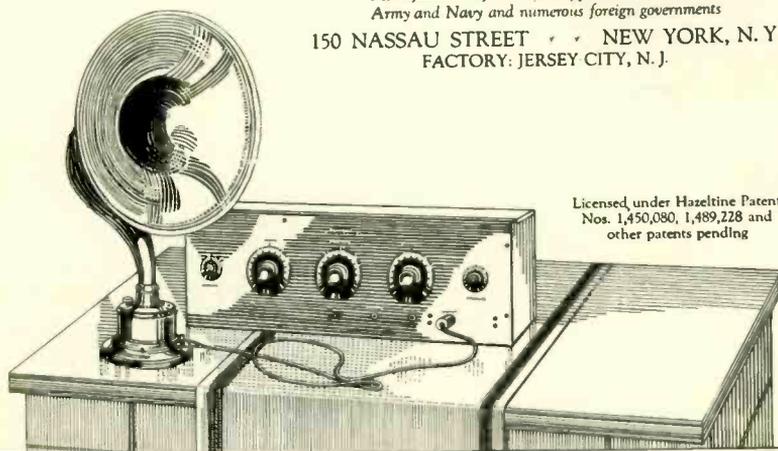
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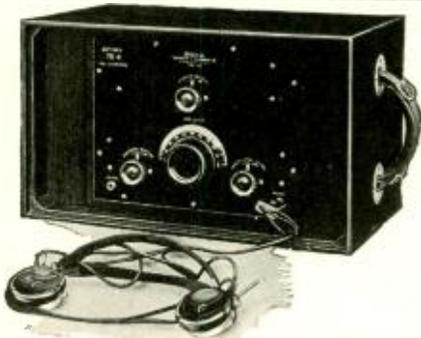
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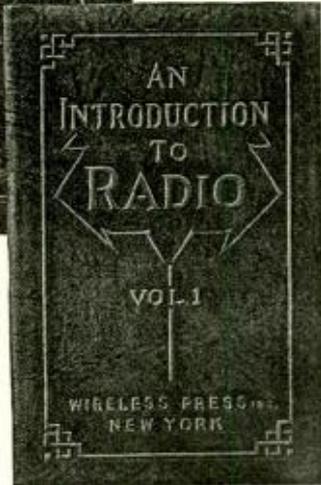
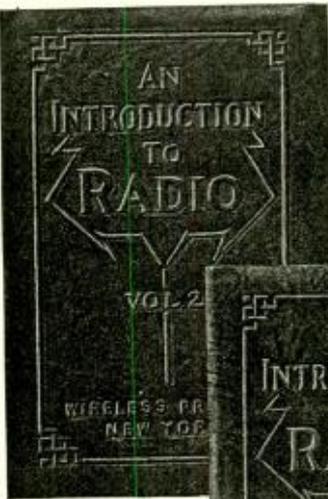
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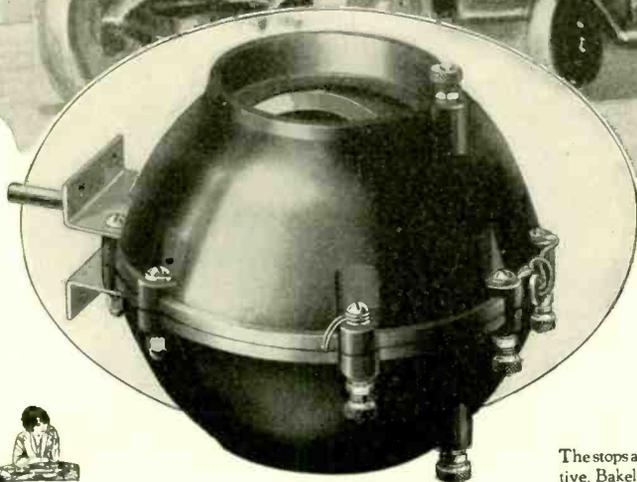
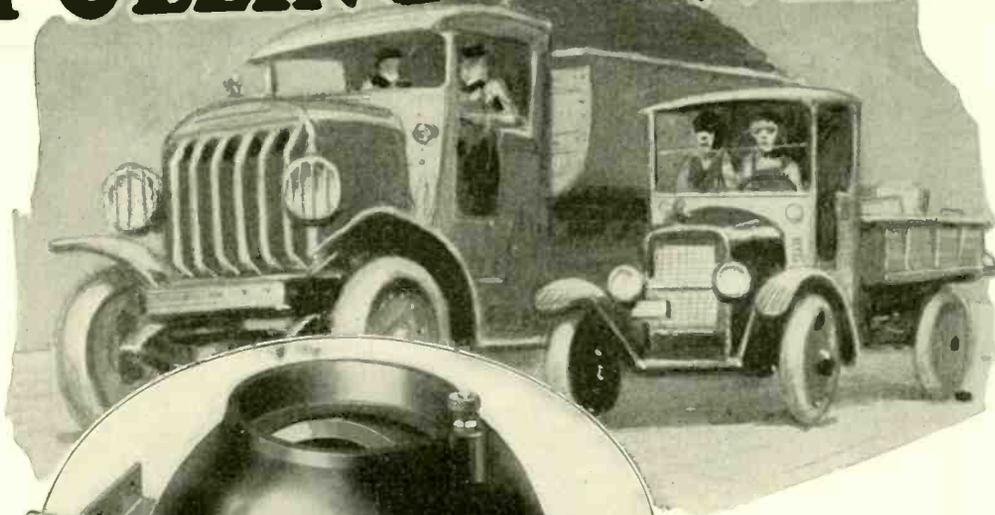
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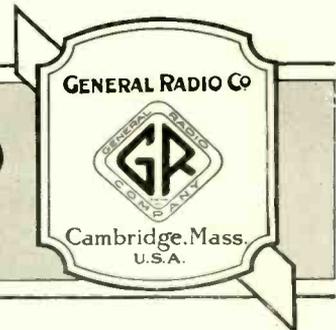
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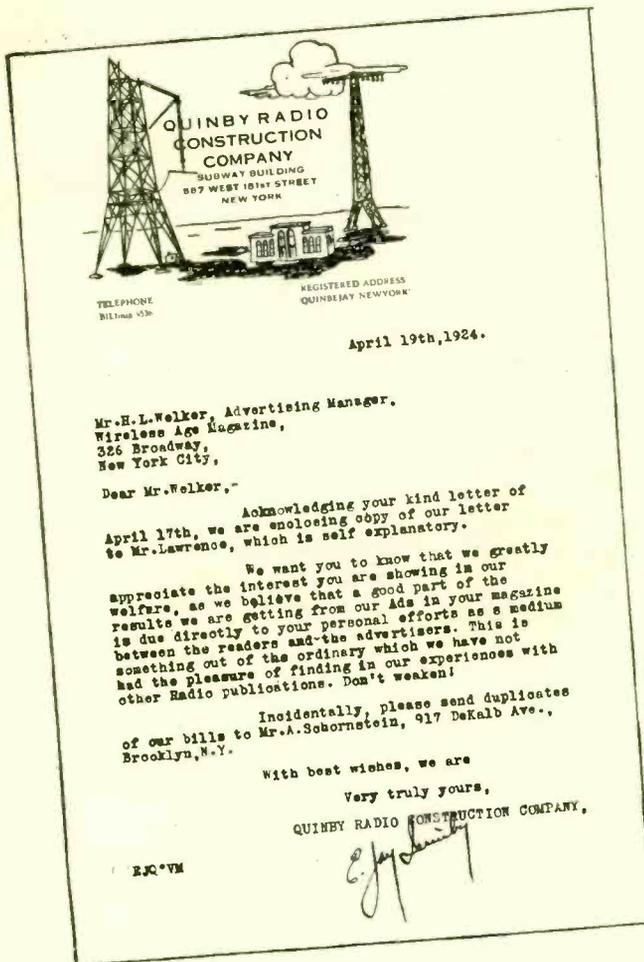
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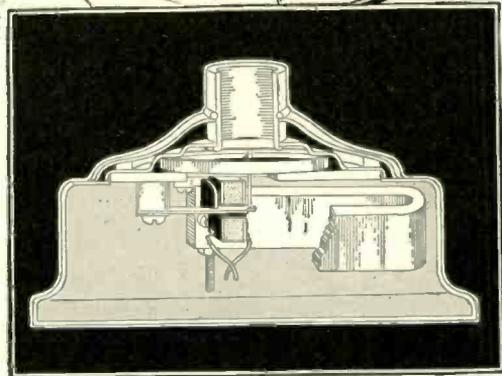
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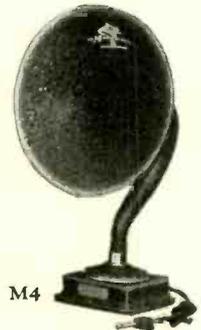
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M4



R3

Editorial Chat



RADIO receivers are surely developing sport to continually greater proportions. We thought that "sport-loving" had already become almost synonymous with "Americans." But this was an exaggeration. Many people, probably most women, were untouched by the appeal of sport. For millions the only sport was a game of cards or an occasional family picnic. Sport has been over-stressed by many of its devotees, and unknown to multitudes. Henceforth, thanks to radio broadcasting, we may expect to see interest in sports becoming rapidly universal. B. C. L.'s who have been reluctant to attend sport events or who have been handicapped by remoteness from sport centers, can this summer listen in to the great meets and the championship games of the metropolitan districts. Furthermore, the broadcast stations are spreading the gospel of sport by including on their programs speakers who describe sports and give helpful instructions so that listeners heretofore unacquainted with sports can not only take an intelligent interest in the accounts of games, but can even attempt a certain degree of active participation. Some of these sport talkers have become the most popular drawing-cards on several station programs. Prize-fights, baseball games, tennis and golf tournaments can all happily be broadcast with a dramatic style that will hold listeners for hours, if a competent announcer is employed for the purpose, and the extension to other sport events is exemplified by the recent broadcasting from WBZ, of the results of the try-outs at the Harvard Stadium for the Olympic team which is to carry the hopes of the American sportsman to France. Our radio is a season ticket to the big sport events of the summer.

B. C. L.'S have heart! writes 5XV. The interference from transmitters is, some of it, necessary, but some of it will pass. The days of the spark or otherwise interfering transmitter are probably numbered. Methods of transmission that will not interfere with broadcast reception, will surely be developed. Above all, it is quite unnecessary to lay blame at the door of the operators, who are only performing their proper functions. Operators for the most part obey the radio laws. But the laws, while they regulate to some extent the traffic in code messages, still permit the practice of shore stations in calling ships for information. It may be questioned if such practice, in the existing state of radio interference, is defensible. It is not a navigation service so much as a commercial news agency. This is one of the many matters to come up for consideration by the conference which Secretary Hoover is expected to call this summer.

IT is often by means of striking contrasts that values are impressed upon us. It is likely that radio service and radio-broadcasting will soon come to be regarded as among the ordinary accompaniments of our civilization, in a class with the railroad, the telephone, the automobile and other one-while wonders of the age. The novelty of a thing cannot be perpetuated. But, before the wonder of radio broadcasting has quite lost its appeal, we will respond to its significance as illus-

trated in the career of the Rev. Dr. Edwin W. Rice, who graduated from Union College in 1854 to enter into service as a missionary. He reckons that from 1854 to 1870 he traveled over 86,000 miles, delivered 5,000 addresses and visited 16,700 families. He accomplished this work by travel on foot, by boat, on horseback and by stage coach.

Now, at the ripe age of ninety-three, Dr. Rice is able, through the agency of station WGY, to reach by a single address and in a single evening more families than in all those arduous sixteen years. Certainly the wonder of radio broadcasting is strikingly epitomized in this incident. Despite his ninety-three years, Dr. Rice showed his acute interest in present-day problems by delivering to his radio audience a sermon on "Tyranny or Toleration in Religion."

THE Marconi experiments with directional transmission have reached a point such that communication by the radio beam has been carried on successfully between England and the Cape Verde Islands, a distance of 2,250 nautical miles, with the expenditure of only a fraction of the energy used in the prevailing method. This brings up before radio engineers the interesting question of whether the present high power installations will soon become quite obsolete or may be economically altered to serve the directional method.



GENERAL ELECTRIC COMPANY finds a Caruso among its shopworkers, and puts him on the air through WGY. At least his name's Caruso—Antonio Caruso—and General Electric Co. hopes his talent will rival that of the great tenor. Radio broadcasting is proving itself in more ways than one a stimulus to music. Not only is it engendering in the millions of listeners a keener relish for music and a better appreciation of good music, but it is making musicians. The paths to glory in music, as in most other niches of the hall of fame, are pretty congested, and many eager, promising young Verdis and Wagners and Linds and Carusos have been crowded out or trampled under. Broadcasting has suddenly afforded fresh trails along which developing talent can tread a track to triumph.

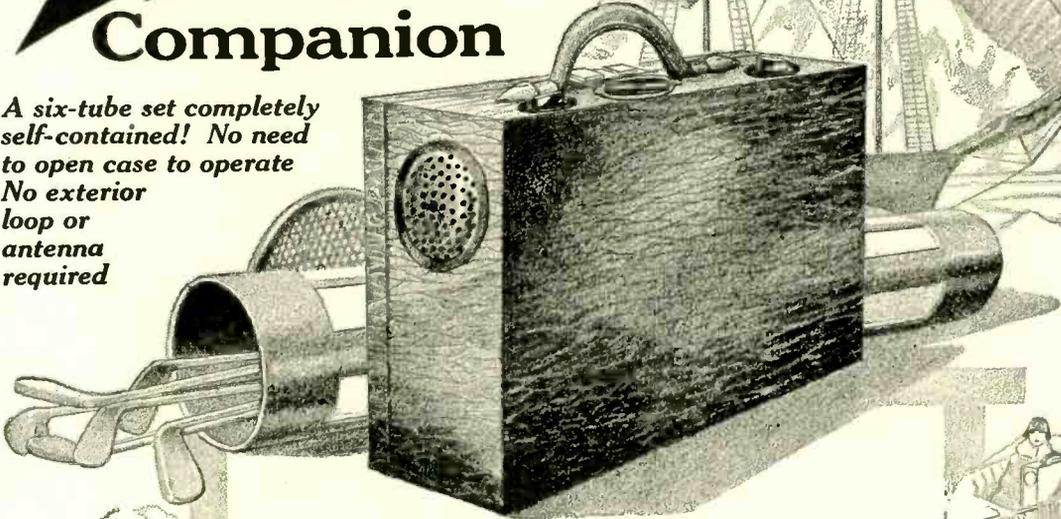
BROADCASTING has attracted such popular interest that it is easy to lose sight of the great progress which is continually being made in radio communication. While radio transmission of pictures, the radio printer and the radio-motion picture are still in the experimental stage, radio communication is an accomplished fact over most of the civilized portions of the globe. In this number mention is made of the Marconi Company radio exhibit at the British Empire Exhibition which illustrates the present status of radio progress, and one is reminded by the last report of the Radio Corporation of America to its stockholders that this corporation, organized in 1919 for the purpose of establishing American-owned and operated radio communication, has well met such purpose and has succeeded in putting the United States foremost among the nations of the world in international radio telegraphy, marine radio service, as well as in radio broadcasting and the development of radio apparatus.

ZENITH

TRADE MARK

Radio Companion

A six-tube set completely self-contained! No need to open case to operate. No exterior loop or antenna required.



Zenith — MacMillan's Choice Encased in a Light Traveling Bag!

Here's a six-tube radio set that's entirely self-contained—tubes, "A" batteries, "B" batteries, loud speaker and loop antenna complete, and it's a **Zenith!**

Packed into a small, beautifully finished traveling case—much smaller than the average suitcase—this new Zenith is the most compact set ever made giving clarity, quality, volume and distance.

Do you see those two little buttons close to the handle? Those are the controls. In order to operate the new Zenith Radio Companion you simply turn the controls to bring in the station you want—then for maximum volume you swing the case so that the loop is facing that particular station. You will be astonished at the clearness with which the music and the voices come through—and in what volume!

Think what it would mean to you to be able to take one of these new Zeniths with you on your travels and outings. A real radio set—the exclusive choice of Donald B. MacMillan for his Arctic expedition—yet so compact that it takes up no more space than a light traveling bag!

Think of the fun you could have with this set—the dance music you could listen to on moonlit nights—the orchestras that would play for you as you and your pals gathered round the camp fire—the com-

panionship it could give you on your motor parties—at the bathing beach. Picture the enjoyment it could bring your guests at the house-party or the weekend gathering.

Again, think how such a set would while away a lonesome evening in that dreary out-of-town hotel—what a godsend it would be to that invalid mother—to that dear relative or friend who must spend weeks and months in the hospital!

But if you have already been initiated into the wonders of the Zenith, you don't need to be told the extraordinary use you could get from this new model or the fun it could give you.

Just the knowledge that you could pick up this beautifully finished case—even as you would pick up your hand bag—and take it with you across city, country, lakes, mountains, and still turn those two controls and be able to listen at a moment's notice to the world you have left behind—that thought alone should be enough to suggest the infinite delights provided by this new Zenith Radio Companion.

You will want to know more of this remarkable set—so light and compact, so easy to operate, so wonderfully convenient. You will want to see it for yourself, at the very earliest moment. No ear-phones, volume, quality, distance! A real Zenith, packed into a traveling case!

Your name and address on the coupon, and the coupon placed in the mail, will bring you full particulars.



Listening, with the keenest pleasure, to music and voices in the cities they have left behind!



Lively orchestras entertain these boys, miles and miles from civilization.



Receiving the latest market reports, the latest news developments, with the aid of the Zenith Radio Companion.



The height of luxury—motoring to music!



When three is company at the bathing beach.



A constant source of entertainment and delight to the invalid.

Zenith Radio Corporation
McCormick Building
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ZENITH RADIO CORPORATION,
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Gentlemen:

Please send me illustrated literature on Zenith Radio, including full particulars of the new Zenith Radio Companion.

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Every radio user should have these books

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To take the mystery out of radio batteries, read these four booklets. Write for them to-day. Remember, they are FREE.

EVEREADY HOUR GLASS

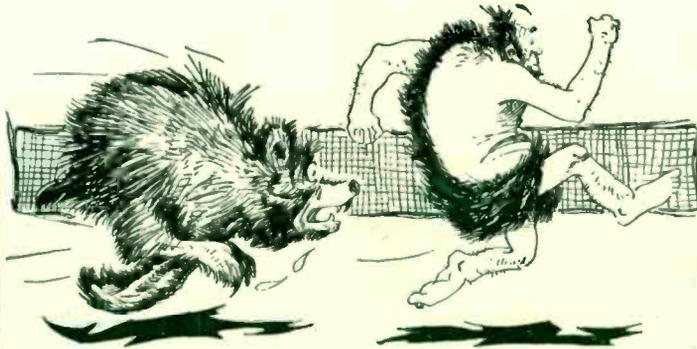
When you wonder what that station is, turn to this list of Class B broadcasters and their schedules of transmission without waiting to hear the call letters. You can pick the station from its wave-length and the time at which you hear it. Sent FREE.

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When writing to advertisers please mention **THE WIRELESS AGE**



Radio Plays the Game



THREE hundred thousand years ago, Man played the game in the weird, primeval forests. That was an epoch of thrillers now buried in the dim shadows of antiquity.

The lonely figure of an ape-like man doing a mile and a quarter steeplechase with a disgruntled bear might well be a legend on a race course today. A fifteen-round bout with a saber tooth tiger was a prize-fight of the championship class. Nine innings with the Neanderthal home team was a game worthy a page in the annals of history.

As civilization progressed, the race and the bout and the ball game emerged from the mire of prehistoric reality to the stadium where thousands gathered to witness the re-enactment as sport events.

The new epoch has come with radio. The volume of spectators has immeasurably increased with the advent of broadcast sports.

Race memory finds expression in our modern minds as we listen in on the races, the championship fights, and baseball.

* * * * *



THE grand stand is packed. An array of color; bright summer dresses, broad brimmed straw hats with pink ribbons gayly fluttering over feminine shoulders; neat suits of Palm Beach male attire, salt and pepper "sports," perhaps a cane, a field-glass case dangling at the end of a shoulder strap, Panama hats and straw sailors; below, restless figures lean on the fence, some whisper to brisk individuals who carry open satchels and forever copy things on pads, or perhaps, groups of threes and fours gather together with a chance "tip from the stables" overheard; all seem holiday-bent; for the race track is the Mecca of steeplechase lovers.

A murmur that spreads over the throng swells with the volume of ejaculation. The horses have been led on to the track. Brilliant, silk-clothed jockeys glance over their thoroughbreds. The horses seem to know, to respond, and lift their hoofs rakishly over the turf.

The mount! The gong! They're off!

We switch in the power amplifier—we hear the crowds yelling—we stick our heads into the loud speaker—the announcer shouts—Spark Plug wins!



It is it evening, and the neighbors have joined us on the front porch? The big fight is scheduled.

We listen in to the even cadence of the announcer's voice, stationed at the ringside. A bit of patronizing comment on the preliminaries, and a word of sympathy for the suffocating crowd sweltering under the auditorium roof. We listen and chat, pretending to back our judgment if one is so bold as to contest it. Our banter is punctuated with the buzzing and thumping of a bottle-fly against the screen.

Time for the big fight. The announcer's voice becomes tense, vibrant as he describes the champions; their walk, their robes, their expressions. We crowd nearer the radio. The high-pitched, ringing voice of the fight-announcer slowly, tantalizingly introduces the big champs. A pause. The broadcast announcer tells us they are shaking hands—the gong—Dempsey leads with a right—another right—Wills returns with a left—Wills in the corner! Second round—third round—Dempsey looks tired—backed to the ropes—down! He is up—a left—another left—a right! Wills down! . . . OUT! The count—he is OUT!

What's this? Grandma standing on her chair? Mother, head perked forward, wide-eyed, listening for more?

That is radio, dear souls. Sports are broadcast.

* * * * *



UNDER the mid-summer's sun are seventy thousand baseball fans; coats over arms, bald heads glistening here and there, handkerchiefs tucked into collars. White coated boys with baskets pick their way through the crowd. "ALL kinds of sand-wit-cheese! ICE-cold pop!"

Spontaneous cheering greets the team as it straggles out over the diamond. Shouts proclaim a newly discovered hero. Tiny figures scurry out to the fields. Players weigh and swing their bats. Some practice a few throws.

At our radio we hear the tumultuous clamor of care-free souls pledged to one afternoon of hilarious abandonment. It is infectious. One allure of baseball is the foregathering of our fellow beings to yell and shout and stamp until the innermost recesses of our systems have been purged of the dregs of inhibition and the residue of daily restraint.

The ninth inning—the Babe at the bat—the score in the balance! Pandemonium reigns. Great waves of intonation sweep across the grandstand and break over the bleachers in a blast of triumph. The rhythmic cadence of a baseball game comes to us—grips us—becomes alive for us—in our radio.

Take Your Radio Out-of-Doors



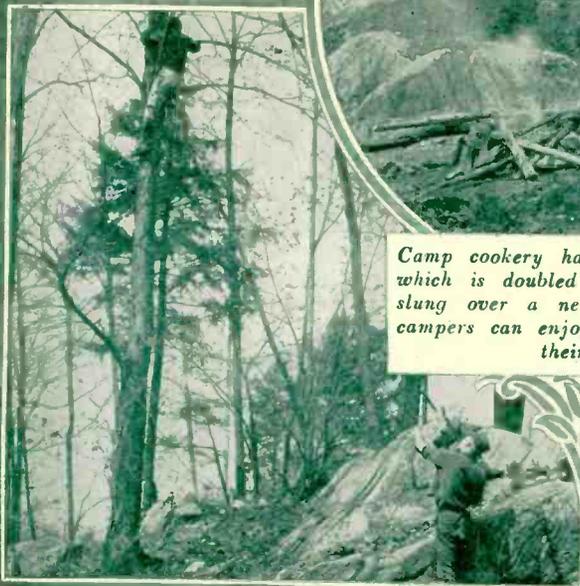
This World War veteran at Walter Reed Hospital cannot get out-of-doors, but his radio will bring the out-of-doors to him, as described on page 53



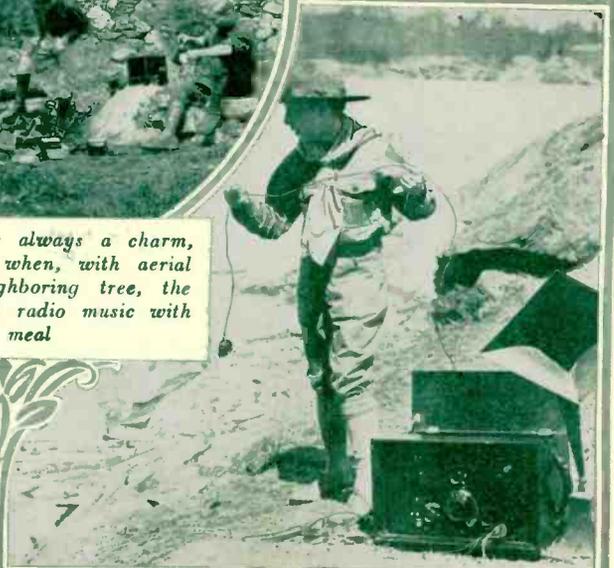
What better adjunct to a canoe trip than a radio receiver? Upon landing, hold a radio dance on the shore, like these happy voyagers



Camp cookery has always a charm, which is doubled when, with aerial slung over a neighboring tree, the campers can enjoy radio music with their meal



You can get plenty of height for your aerial while on a camping trip. Your agility and ingenuity will have full scope, and if your receiver is a good one, you will be amply rewarded



If your camp or picnic is by the water you can get an excellent ground by following the example of this Boy Scout who makes a few turns of the ground wire around a stone and casts it into the water

THE Honorable Royal S. Copeland, U.S. Senator for the State of New York, is a man of broad activities and wide interests which makes his statements made to readers of *The Wireless Age* on the subject of politics and radio of great significance. Senator Copeland is a member of the medical profession which he has graced with many accomplishments. After completing his medical studies in England, Germany, Belgium, France and Switzerland, he returned to his native State of Michigan where he practiced his profession, later joining the medical faculty of the University of Michigan. In 1918 he became Commissioner of Public Health and President of the Board of Health of New York City, which position he vacated upon his election to the United States Senate. He has been Mayor of Ann Arbor, Michigan, and President of the Board of Education; this in addition to numerous exceptional activities and writing in connection with his profession of medicine. Newly involved in national politics, it is natural that Senator Copeland should be much interested in the political aspects of radio broadcasting.

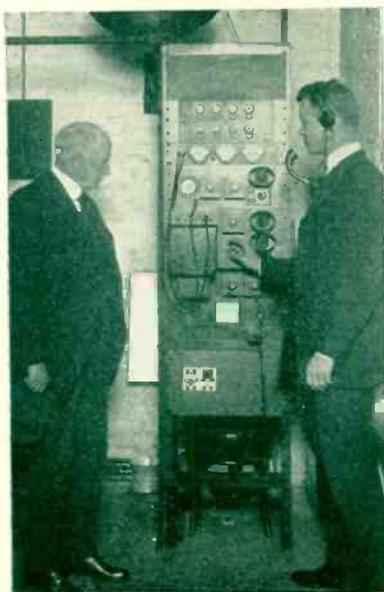


Senator Royal S. Copeland and his son, Royal, Jr.

Senator Royal S. Copeland

Writing expressly for
The Wireless Age, says:

Radio Will Improve Politics



Speaker Gillette (left) of the House of Representatives, Mr. A. Bodwell (right), operator in charge of the broadcasting system installed at the Capitol awaiting the bill authorizing broadcasting of all speeches on the floor of the House

WE are living in a remarkable age. No one dares say today that the thing always counted as impossible cannot be done.

I have read the accounts of many political conventions and campaigns. I venture to say that the approaching conventions and campaigns will differ from all preceding ones.

Space has been annihilated. Even the blind can know what is going on in politics. Through the boundless ether the proceedings of the conventions will be broadcast. To every household, no matter how remote, will be carried the voice and words of the candidates for high offices.

There can be no doubt that we learn much more of the character through the spoken word than through the written page. The honesty and sincerity of the speaker can be measured by his voice and the manner of his presentation of the speech. "Out of the fullness of the heart the mouth speaketh." It is impossible to hide the impulses of the heart in the expressions of the voice.

The arch hypocrite can sit down in his closet and pen words which have all the semblance of the truth. They may be untruthful statements of the real motives of the man who writes them.

I rejoice in the invention of the radio because it will give to every citizen, no matter where he is, an intimate knowledge of men and events. The next six months will reveal to the millions of our country the worthiness or unworthiness of candidates for high offices. With greater intelligence than ever before the electorate will march to the polls next November and determine the fate of the country during the next four years.

ROYAL S. COPELAND.



A Baseball

How the Opening Game of Into a Game of Strategy. The and How *The Post* Made a

A Story by

THIS was Red Letter day for *The Post*. Broadcast receiving equipment had been installed for the world series. The opening game would soon be on the air.

A score-board, mounted on the front of the building, is laid out in the form of a diamond, provided with blank squares in order that the name of each player can be inserted in the space that will indicate his position during the play. A loud speaker, above, will provide the broadcast announcer's description of the game.

The crowd, gathering in front of *The Post*, has already swelled to mob-like proportions. The north-bound trolley, with a great amount of bell-clanging, forces its way through the surging mass. Automobiles, angrily protesting with blatant horns, turn down side-streets in last paroxysms of despair. Mass-confidence becomes evident in the occasional cheering that spreads through the jostling crowd. Blue-coated reserves circulate through the jam, striving to break the unity that becomes more apparent as the baseball fans respond to the infectious mob-spirit and press forward.

A tousled-haired street-urchin climbed up on a water-plug, his bare toes clinging to the spouts, and one dirty hand gripping an unfortunate bystander. With his cap waving in his free hand, he yelled, "Come on wid d'game! Wud d'you think we're here."

His spirited rooting was cut short by the man he had grabbed. The injured party jerked the bewildered waif from his point of vantage. "And what do you think I'm here for?" he demanded.

The little Arab wriggled from captivity and lost himself in a forest of legs.

* * *

THE editorial office was a scene of tense, feverish excitement. The city editor glances over each sheet that is passed to him by the proofreaders. Without looking up he calls *copy* and then passes on to the next. The office boy slips the copy into a cartridge, injects it into the tube for the type room, and dashes off on another errand. The managing editor rapidly scans the columns of contemporary newspapers. It is inconceivable that he can read the news so quickly. He clips, marks, and passes the items to feature writers. Reporters rush in, hammer at type-

writers, rip the sheets from the machines, toss them on to the copy desk and rush out again for more news. No one is aware of another's presence. Intent concentration is broken occasionally, only to settle again, as the spasmodic eruption of one job done has passed to another, and yet another, in the frenzied haste to get the first edition on the press.

To the uninitiated, chaos would seem to be paramount. Actually, the editorial staff worked with machine-like precision. The linotypers and compositors were fast and efficient. The web pressmen stood by the giant presses, alert. Trucks, backed against the curb, engines throttled low, waited for the first bundles of newspapers. The editorial office, like the main-spring wheel of a watch, has started. All through the mechanism, cogs slip into cogs. The minute-hand will soon be ticking off the seconds of news that will grow stale with the dissipation of exhaust-gas from the fleeting delivery trucks.

* * *

HERBERT KNOWLES, the managing editor, has the sharp features indicative of a nervous, driving energy. His sparse, iron-gray hair is brushed back in pompadour fashion from a high forehead. One imagines,

at first glance, that Herbert Knowles is less of executive timber, than of artistic temperament. The vague suggestion of drawn lines at the corners of his mouth, however, contradicts one's first impression.

Knowles stepped over to the city desk. "How about it, Gaston?" he inquired.

The one addressed is the city editor. "All set," he replied.

Harry Gaston, as city editor, had never failed to support Knowles with the practical initiative essential to the success of each new project instigated by the latter. Knowles's query was, in effect, nothing more than a gesture of impatience. He meant to imply that if the first edition was ready, it would be well to get it on the press and out of the way for the afternoon's broadcast reception. Gaston's reply was cryptic. It indicated that he was master of the situation, and that the stage, having been set, only awaited the proper signal. The cue had been given.

The presses roared. It is a sensation less of hearing than of feeling. The "beat" note injects new enthusiasm into the workers — stimulates them to greater effort.

PRIZE WINNER
in the "Radio in the Home Picture Contest." Receiver and loud speaker combined in a home-made cabinet that harmonizes well with the furnishings.
Won by
Thomas J. Neece,
Colorado Springs,
Colo.



Scoop by Radio

the World Series Developed Unexpected Turn of Events, Scoop on the Final Score

William A. Hurd

TIME for the game. A man stepped out onto the platform in front of the score-board. A voice from the loud speaker announces the players. A voice from the grandstand, a thousand miles away! Batter up! The game starts!

A thousand voices rise from the street in a yell that reverberates long after the noise of the grandstand and bleachers has subsided in the loud speaker.

Type is set as fast as the broadcast announcements come over the air. Not one moment, even for display type, can be lost in getting out the final baseball edition. Seven column heads, in giant type, are prepared; one for each possible result. Every member of *The Post's* organization is keyed to a high-strung passion of expectancy. Each new edition off the press increases the tension.

Outside, the continuous cheering breaks into a shouting, that breaks again, and sweeps through the crowd in great waves of tumultuous yelling and whistling. A left-handed batter has been put in against a left-handed pitcher. A right-handed pitcher has been substituted. A right-handed batter has been brought up in retaliation.

A left-handed pitcher is again put in. Batters are changed. The game becomes a contest of strategy. Head work must win against brawn. The broadcast announcer follows the game with a photographic image of each play registered in his mind. He translates the visual picture in remarkably self-controlled, dispassionate phrases, transcribing the clear, verbal picture with vivid exactness. Listeners "see" the game a fraction of a second after it has been witnessed in the grandstand and bleachers.

Bases full in the ninth inning. A slugger at the bat. A resounding crack announces the hit before the broadcast announcer can locate the ball, soaring into the sky. It's dropping into the left field. The outfielder slips in the mud of the morning's shower, regains his footing, and reaches for the ball. He's got it!

While the milling crowd in front of *The Post* was still trying to out-yell the voices in the loud speaker, the final baseball edition was rushed from the presses to the waiting trucks, and hurried off to the news stands. The editors gathered at the windows to watch the throngs below. Newsboys were selling *The Post* as fast as they could be distributed to fans who had just heard the score direct from the



scene of action, and who, just this moment past, witnessed the score in white chalk on the board, which is still to be seen if one cares to look. But, no! These are baseball fans. They want more news, more of the same news. They must go over the details again, recalling each thrilling incident.

The crowd gradually dispersed. Spaces widened as the impatient traffic pressed its advantage. The loud speaker suddenly made a startling announcement. The rapidly thinning crowd paused, then gathered again. Knowles, at his post in the window, turned to stare, questioningly, into the eyes of Gaston who had also turned, his gaze fixed. Both grasped the import of the situation at the same instant. The broadcast announcer had just given a reverse decision on the game!

The outfielder had missed the ball. It had struck the mud, and sunk. In a flash he had seen that it had escaped the notice of the players—had not been detected from the grandstand. He had slipped his hand into his pocket, as though to deposit the ball, and nonchalantly removed his glove as he strolled over to the benches. In the midst of the wild pandemonium that immediately followed his catch, there was small likelihood that his ruse would be discovered.

A few, on the extreme end of the left bleacher, had seen—or believed they had seen—the ball slip to the ground. They were followers of the losing team. Doubt warranted an investigation.

Point by point, the investigation was broadcast. A baseball crowd is not to be quieted so easily in the face of a sensational fraud. Voices rising above the tumult could be heard: "Kill the umpire! Call the game off!" Such exclamations were irrelevant, but excitement had reached the fever heat that demands somebody's "scalp," be he ever so far removed from blame.

* * *

The presses roared—throbbled—ejected the EXTRA. The printed copy from the frantic editorial office appeared on the streets with blaring headlines: RADIO EXTRA * * * REVERSE DECISION ON GAME!

Radio that day had given *The Post* a sensational beat. The baseball fans had acquired season tickets to the World Series.



PRIZE WINNER
in the "Radio in the Home Picture Contest." George M. Maxwell of Duluth, Minn., wins a prize with this photo of his four-tube reflex appropriately installed in a library table. The batteries are contained in the drawer



King Radio

An Extravaganza in One Act

By Adam Hull Shirk

SCENE

The Magnetic Field of King Radio's Domain. A vast plain with great coils rising in the background.

TIME

The Present

CHARACTERS

King Radio, a modern monarch.
 Atuba, his beautiful daughter, the Princess.
 Prince Aerial, her lover.
 Clicks, a despicable fellow, also in love with Atuba.
 Blooper, his henchman.
 Grid Leak, a buffoon.

(Chorus of Electrons, Condensers,
 Battery A, Battery B, etc.)

OPENING CHORUS

Electrons—Beautiful maidens, the Princess' favorites all
 attired in flimsy blue garb.

'Twixt grid and plate, it is ever our fate
 To be buffeted to and fro—



We dance with glee, then we cease to be,
 When dims Atuba's glow.
 When the filament flames, we play joyous games,
 And ne'er from our homes we stray.
 We're electrons—so small—but we do it all—
 With never a cent for pay.

(Enter Clicks and Blooper—The Electrons draw back in
 fear.)

CLICKS—Aha—the fair Electrons are out.

BLOOPER (Squealing)—Whee-oo, whee-oo.

CLICKS—Good boy, you make music after mine own
 heart.

BLOOPER—Nobody loves me.

CLICKS—Hist—aid me and thou shalt have a million
 electrons for thy very own.

BLOOPER—Squeals with delight.

CLICKS—Listen, Blooper—I love Atuba, but she will
 have none of me. To win her I have a plan. You shall aid
 me. We will kidnap her electrons and hide them. If she
 will not accept my suit I shall destroy them.

BLOOPER—But you promised me—

CLICKS—Aye—but if I give them to thee, they are
 destroyed. Now I know several members of Battery B.
 They are all low fellows. Why they have lost many volts
 since last night—soon they will be dead unless I can aid
 them. Go, summon the B Battery and we will capture
 these electrons on the Magnetic Field—go!

(Exeunt Blooper while Clicks approaches the huddled
 group of Electrons with a low bow.)

CLICKS—Ladies, thou art extremely beautiful. I fain
 would entertain you with a song.

FIRST ELECTRON—We like not thy voice, and it please
 you, sir, you are so rough and our sweet music is spoiled
 whene'er thou singest.

CLICKS—Ah, but my latest song is wonderful—hearken
 to my dulcet tones—(Song by Clicks)—

I LOVE TO SPOIL A PRETTY TUNE

When the Listeners-in are listening
 To a far off DX call,
 I love to rattle off a song
 And hear the ear-phones fall!
 I bring a crash like thunder,
 While the fans sit lost in wonder;
 And I split their ears asunder
 As these words I loudly bawl—

CHORUS

I love to spoil a pretty tune.
 I do it morning, night and noon.

I'm hated by the BCL's and all Broadcasters, too.
While the violin is wailing and the 'cellos softly moan,
I set my cracked voice sailing and I hear the listeners groan—

Yes, I'm Clicks, so erratic,
But my voice is most emphatic

When I spoil some soft, alluring little tune.

(Enter Battery B, a lot of rough looking chaps, with Blooper at their head. They all rush toward the terrified Electrons and quickly take them prisoners. All exit.)

(Enter Grid-Leak, a bullet headed fellow in a yellow suit.)

GRID—I thought surely I heard voices—perhaps some of the sweet Electrons are about. Oh, how I love 'em. If only I weren't married to Condenser—as it is I'm fixed for life.

(Enter Prince Aerial, a tall, handsome young man, with a couple of insulators on his head and a long pole or staff in his hand, to which is attached a lead-in of bright copper.)

GRID—(Falls on one knee)—Oh, kind master, illustrious Prince Aerial, I think there are electric strays in our magnetic field; in other words something is interfering with reception.

AERIAL—What reception?

GRID—(Getting up)—The lovely Princess Atuba had planned a reception for you, but I fear me it will never be held.

AERIAL—What mean you?

GRID—That villain, Clicks, is planning mischief—I heard his voice anon. He too loves the Princess.

AERIAL—I will slay him.

GRID—Hist!—he comes. Hide, sir, here.

(They draw aside behind a coil and enter Clicks alone.)

CLICKS—(Rubs his hands)—Now I have the Princess in the hollow of my hand. I have her maidens closely mewed up—and ere nightfall, and the DX stations are on the air, I will have destroyed her power and she will be disgraced—then she shall sue me for mercy and even King Radio himself shall bow to the will of Clicks. Ah, someone approaches—I will hide.

(He hides behind another coil and enter King Radio with his courtiers—the Battery A's; a lot of mica condensers; Loud Speaker, his Minister—a noisy fellow; Spaghetti, the Court Cook; Bus Bar, who runs the saloons of the Kingdom; Transformer, an actor, etc.)

KING—So—the Magnetic Field seems deserted. 'Tis here I would fain conduct the mains 'twix gallant Knights. Is all in readiness for the jousts?

LOUD SPEAKER—Aye, sire, even now, the valiant Knights approach—see, there is Crystal, on the white charger and yonder approacheth the mighty Neutrodyne.

KING—I see, I see—and yet I hear there is one greater than Sir Neutrodyne.

TRANSFORMER—Pardon, your majesty, you mean—Sir Superheterodyne?

KING—Even so, but here come our knights.

(The two knights ride up and presently, at an order from the King, and a cry from Loud Speaker, canter to opposite points of the field and with lances thrust forward ride like the wind toward one another. Crystal is unseated and Neutrodyne rides up and dismounting, bows low to the King who places over his shoulders the loop of merit. A bugle is heard a distance off and presently another knight rides forward. It is Sir Super. He is a powerful knight and around his head are ten brightly glowing bulbs. He challenges Sir Neutrodyne to combat and



they take their places. After several tilts, Neutrodyne is badly hurt and Super is given the Loop of Merit).

(Prince Aerial emerges from his hiding place and approaches the King; the King greets him kindly and he faces Sir Superheterodyne.)

AERIAL—Sir, thou art a braggart and a knave. By foul play which I observed from my hiding place thou didst unseat poor Sir Neutrodyne, but for all thy loop of merit and ten tubes of brilliancy, I will outdistance thee—I challenge thee to a race.

SUPER—Bah—stripling—I will defeat thee—knowest not that I am the greatest in all the Kingdom of Radio?

(Song by Super)—

I TOP THEM ALL

You may talk of distance getters,
And of logs both great or small,
But in speaking to your betters
It is meet that you should fall
On your knees to worship rightly
One about whose head so brightly
Shine the tubes of vacuum nightly
Bringing distance to us all—
For I top them all—I'm the Super!
I fear not Clicks or Bloopers!
Yes, I'm Superheterodyne;
Ever brightly will I shine;
Henceforth the world is mine—
For I am Super!

AERIAL—Bah—I can still outdistance thee—(He springs on the horse of the fallen Neutrodyne and races off, with Super in hot pursuit. As they disappear in a cloud of dust, enter Atuba weeping).

ATUBA—Oh, father, father—I am undone.

GRID (who has followed Atuba—anxiously)—where?

KING—My child—what's amiss?

GRID—An unmarried woman.

KING—Silence or I'll have you fixed.

GRID—I'm already fixed.

ATUBA—(wringing her fair hands)—My electrons.

ALL—Yes, yes—go on—

ATUBA—They are gone—vanished—I am helpless, alone, my light is out, my plate is empty, my filament is cold.

ALL—Ye gods! Her electrons are gone.

KING—But where—?

GRID—Pardon, sire, I think I know—I suspect that that varlet Clicks hath kidnaped them—he and Bloopers.

KING—But why?

GRID—He seeks to get you and the fair Atuba in his power—he loves her and hates Aerial.

(Re-enter Aerial. He has outdistanced Super.)

AERIAL—It is as I said—an aerial is always best when distance is concerned. (Sees the excited crowd, and goes to Atuba and takes her in his arms). My darling, what is it? Lean on me.

(Song by Aerial)

LEAN ON ME

What ere betide, sweetheart,
Lean thou on me.
When by my side, dear one,
No ill thou'lt see.
I'll bring thy fair Electrons back to thee,
Dear heart.
Lean thou on me, lean thou on me.

ATUBA—Save my Electrons and my life and I am thine—my Prince.

AERIAL—I'll rout Clicks with the aid of my good friend Wave Trap and ere nightfalls thy Electrons will be safely home again. Farewell.

(Aerial again mounts the steed and gallops away and all others exeunt save Atuba who sits by the side of a huge coil and sings:)

(Song by Atuba)

I LOVE HIM SO

I love him so—my Aerial,
And now I'm sure, he knows it well.
If he should save my maidens fair,
My hand he'll win, my heart he'll share.

I love him so, my Prince of Air,
But oh, my love, if you do care—
Bring back my maidens all to me,
Or life a vacuum e'er will be.

(A great noise a distance off. In a moment, enter Aerial with Clicks as a prisoner, while Wave Trap, a square, solid chap, holds the squealing Bloopers. From opposite side enter the King and others.)

AERIAL—(Turns Clicks over to Grid and comes to Atuba, whom he takes in his arms)—My darling, you are saved; thy electrons are rescued from the cruel hands of these miscreants of whom, I'm sure, thy father and Wave Trap will make short work.

GRID—I'll shake Clicks up a bit on my own account.

(Shakes Clicks, who growls and snorts, but is helpless at last.)

ATUBA—Where are my Electrons? I see them not.

AERIAL—Here they come.

(As he speaks the stage grows more brilliant than before and the maidens enter. With them is Neutrodyne with his head bandaged, but looking better. Super, at one side, shows his anger. Bloopers squeals and Clicks curses and growls.)

ATUBA—I am so happy (embraced by the Electrons, she breaks away to take her father by one hand and Aerial by the other).

(Picture formed and the villains are led off to be punished.)

ENSEMBLE CHORUS

For we are the people of Radioland;
It's just around the corner from Fairyland.
Fans everywhere our happiness share;
There's pleasure for all and a lot more to spare;
So sing with us, laugh with us, joy with us—
Friends of the air—
And join us in Radioland!

(Curtain)

Scouts Who Have Made Good in Radio

Scout Lyman F. Barry made an early start in radio, and through persistent effort won the ten-year veteran's badge and a recognized proficiency as a radio man and scoutmaster

By Armstrong Perry

THERE are different kinds of radio "bugs." There are technical amateurs who love to pull their apparatus apart and assemble it in different ways, without ever waiting to understand or use what it brings in from the ether. There are amateur operators so selfish that they want the air all to themselves and complain because the growing interest in broadcasts forced the Government to keep amateur signals from interfering with them during the evening hours. When technical ability is hooked up with the Scout spirit, then there is produced a radio amateur who makes his mark in the world, as is proved by the experience of the Scout whose story is briefly told below.

Scout Lyman F. Barry became interested in radio through his Scouting activities and received his early instruction from the chapter on "Tracks, Trailing and Signaling" in the "Handbook for Boys."

In 1917 he set up his first radio station, which consisted of a crystal detector receiving outfit. It did not remain in service long, for the United States entered the World War that year and the police called to inform the Scout that the use of radio by private citizens had been prohibited.

Barry engaged in such signaling practice as was permitted, and in October he secured the merit badge for signaling. It was not until 1920 that he was able to take the merit badge test in radio, but he secured the badge then and kept right on until he had twenty-six merit badges in all.

He was a charter member of the Manhattan Association of Radio Scouts, in New York City, and often operated their transmitter at headquarters. The station's call letters, 2BDS, have been heard by many amateurs. With other radio scouts he visited the headquarters of the District Communication Superintendent, Third Naval District, and received instruction in the methods by which the Navy covers the world with its communication system.

He registered with the Radio Amateur Bureau conducted at these headquarters, as Amateur No. 345. Later he passed a code test at twenty words a minute and was advanced to Radio Amateur No. 2, being next to the Sea Scout Radio Commodore on the reserved list. He copied the amateur



Lyman F. Barry in his uniform of 2d Lieutenant of the Officers Reserve Corps of the United States Army

broadcasts transmitted daily for members of the bureau and sent copies to the Sea Scout Radio Commodore.

He entered the College of the City of New York and became a charter member of its radio club, operating the college's two experimental stations, 2XN and 2XNA on 200, 360 and 600 meters. He was elected secretary and afterward vice-president of the club, and was active in affiliating it with the Second District Executive Radio Council and the American Radio Relay League. He had been a league member and relay operator for several years.

Barry's first amateur station license was earned by passing the governmental examination in December, 1919.

soon after war-time restrictions were removed from amateur transmitting stations. His call letters, 2OH, are still heard over a wide area. He began with a spark set and worked his way up through various types of transmitters until he was able to handle the four-tube continuous wave transmitter at City College without difficulty. He built most of his own apparatus and before he was through college had a triple honeycomb coil regenerative set with two stages of amplification.

In 1920 he went with the Reserve Officers' Training Corps to Camp Devens, Massachusetts. Colonel Holden, the commanding officer, placed him in charge of the radio station. Scout Daniel O'Connell was his assistant. They copied the weather forecasts and news from NAA, the Navy station at Arlington, and posted them for the benefit of the whole camp. Barry was then a lieutenant and O'Connell a sergeant. Both became captains in the R. O. T. C. and received commissions in the Officers' Reserve Corps of the Army. Both also became scoutmasters.

His military work did not keep Barry away from scouting. He went to the winter camp of the Manhattan Council in 1920, and his portable crystal detector set gave the camp its only news of the outside world, though the best he could do for the temporary installation was to put a thin wire aerial fifteen feet up in the air. As the nearest telephone was across the lake, Barry and his radio outfit were important additions to the camp.

When summer came, he took a vacuum tube receiver to Geneseo, New York, where he spent a vacation. He posted the weather forecasts and the news of the day so that the people in the village could have as up-to-date information as the city residents have. He received from NAA the first reports of the disaster to America's first great dirigible balloon, being only a short time behind the Sea Scout Radio Commodore who, in Washington,

(Continued on page 80)



FIRST PRIZE
won by G. W. Rose of
Winfield, Kansas

The set is an eight-tube Super Heterodyne, everything self-contained in the cabinet but the loop antenna and the A battery. The set, and the inside cabinet were designed and built by Mr. Rose, the large cabinet being purchased at a furniture store. The entire cabinet work is of the Gothic period design and is of solid Mahogany in Tudor antique finish.

The panel is bordered by a mahogany frame. There are only four visible controls: "oscillator" dial to left, tuning dial to right, volume control or potentiometer upper center, and master filament switch lower center. All the other controls are contained within the two small doors to the right and left. All metal work such as dials, pointers, switches, etc., are gold plated. The dials are also hand engraved in Roman numerals. The horn for the loud speaker is acoustically designed.



Radio in the Home
Conclusion of Prize Contest

You must agree that this page is an appealing exhibit of the beauty of radio in the home. In the April number of "The Wireless Age" and again in May, readers were invited to compete for some valuable prizes by sending in photographs of their radio sets in home surroundings. The results have been more than gratifying and some of the entries are presented to readers of "The Wireless Age" in this number. The winner of the first prize, a fine Wireless Age Receiver, is G. W. Rose of Winfield, Kansas, whose beautiful photograph of a remarkable radio set is shown above. The second prize, \$10.00, is awarded to Tompkins and Lyon of Chicago, whose entry, shown below, is worthy of emulation. The third prize, \$5.00, was won by L. E. Saft, Jr., of Union Hill, N. J., with the remarkable artistic photograph shown at the left. Awards were made not alone upon the basis of beauty of photograph and furnishings, but in consideration of what contestants had managed by their own ingenuity and artistic sense to contrive in the way of cabinet, housing for batteries, disposition of wires, etc. On the opposite page and elsewhere through this number other prize-winners are shown, making altogether an interesting exposition of Radio in the Home.

SECOND PRIZE

shown at the right illustrates a 5-tube neutrodyne set designed by Tompkins and Lyon of Chicago.

The cabinet used is a dining room server large enough to accommodate the B batteries and a Timmons Talker. The storage A battery is installed in the basement along with the charger, being connected so that the battery may be charged by turning a switch.



The THIRD PRIZE was awarded to the beautiful photograph shown above, which is a 3-tube Reinartz set made by L. E. Saft, Jr., of Union Hill, N. J. A Timmons Talker is used with this set also, the A battery being placed behind it, and the B batteries installed in a specially made base that extends under the receiver and Talker. The whole set is placed in a serving table with doors.



Radio in the Home Prize Winners



Austin H. Martin of Glen Ellyn, Ill., places home-made receiver in discarded desk with batteries in drawer, and uses Victrola for loud speaker



This radio installation submitted by Harry M. Dittman of Narberth, Pa., is an example of artistic arrangement

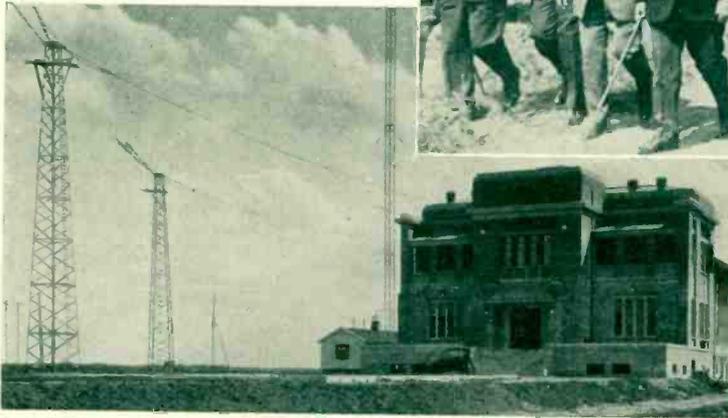


J. B. Michaels of Bristol, Conn., encloses his set in a case of Japanese driftwood; batteries and chargers too; phone connection block at right provides for six headsets. The panel and dials are of mahogany



A library gives an excellent opportunity for a harmonious radio installation. This illustrates radio in the home of D. E. Prendergast of Brooklyn, N. Y.

The President of the Argentine Republic, M. Alvear, inspects the new high-power wireless station and is pleased with this great accomplishment of the engineers of the world's great radio companies



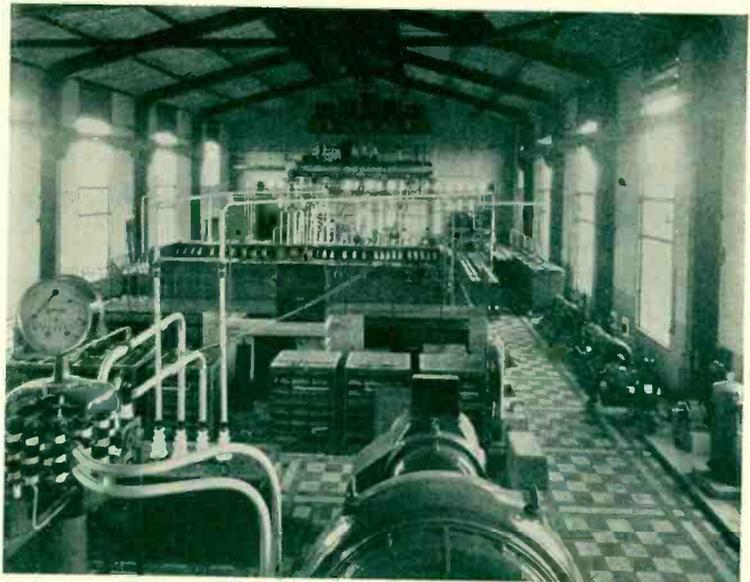
TRANSRADIO

ARGENTINA TO THE FORE

New Station reaches out to New York—5,500 miles
and to Europe—7,000 miles

By Col. C. H. Nance

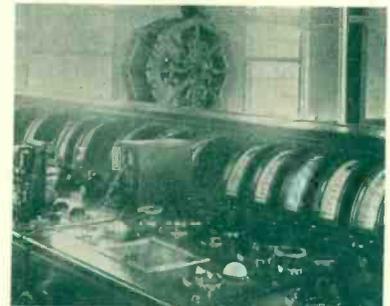
THE high-power radio situation in the Argentine Republic three years ago was little short of chaotic. The four large radio companies of the world, the Radio Corporation of America, Marconi's Wireless Telegraph Company, Ltd., the Compagnie Générale Française de Télégraphie sans Fil and Telefunken, each were interested in an Argentine concession for the establishment in the vicinity of Buenos Aires of a station capable of communicating with their respective countries. Had all of these stations been constructed and operated so closely together, the interference difficulties in an already overcrowded ether can be imagined. Commercially, the different companies were confronted with the staggering figures of the investment necessary to build such powerful stations, and the possible traffic flowing from Argentina made a suitable income from such capital appear doubtful. Then too, each company only possessed certain of the Argentine patents needed to insure good communication and completely modern equipment, while the others owned other equally valuable ones. The result of this unsatisfactory state of affairs was the formation of Transradio Internacional, an Argentine corporation with a capital of 14,000,000 pesos, which under a concession granted by the government in January, 1922, proceeded with the erection of a super-power radio transmitting station at Monte Grande, some thirteen miles south of Buenos Aires, and a receiving station at Villa Elisa, some twenty-five miles away, and distant about twenty-three miles from Buenos Aires. Each



Here are the high frequency alternators that generate a 6,000-cycle current of 1,000 amperes with a voltage of 750. The control table, the transformers and the condensers are also shown here

of the four companies named possessed a proportionate interest in the new concern, in which Argentine capital was also strongly represented, and the uniting of the various concessionaries assured to the country the use of the best patents and the combined technical skill of the best radio companies of the world, so that by the middle of January, 1924, another gap in the net of world-wide radio communication was closed.

The Argentine government and the public generally welcomed the advent



Section of the Control Table

of this new service, because in addition to its thorough modernity, it assured the country an independent outlet for its external traffic, and the two outstanding traits of the Argentinian are his love for the latest and most modern of everything, and his patriotism.

President Marcelo T. de Alvear turned aside from his many executive duties and graciously accepted Transradio's invitation to open the station. Early in the morning a special train speeded his private car to Monte Grande, and accompanied by four of his ministers, the governor of the province of Buenos Aires and numerous other high government officials, the president journeyed by automobile from the railroad five miles out to the station proper.

After being conducted over the entire transmitting installation by Engineer Eugene Reinhardt, the technician in charge of the construction of the station since its beginning, the President set in motion the automatic transmitter which sent five special messages, four to the chiefs of state of the United States, Great Britain, France and Germany, and one to the heads of all nations of the world possessing receiving stations.

President Alvear's message to President Coolidge read as follows:

To His Excellency the President
of the United States of America.
Mr. C. Coolidge,
Washington.

On the occasion of the inauguration of the ultra-powerful radiotelegraphic station at Monte Grande, the President of the Argentine Nation has pleasure in sending to the president of that great friendly nation his best

wishes and the expression of the sympathetic regard of the Argentine people, whose democracy stands solidly beside that of your vigorous republic in the noble task of struggling for the material and cultural betterment of America.

ALVEAR,

President of the Argentine Nation.

Similar expressions of amity and esteem were contained in the other messages.

In replying to the address of Engineer Eduardo Huergo, President of Transradio Internacional, on the occasion of the inauguration, the chief executive said that it gave him the greatest pleasure to be present at such a demonstration of national wealth and power, which placed the Argentine on a par with the foremost nations of the world in the matter of radio communication, and undoubtedly Monte Grande would be called upon in the future to perform great services for the country. He added that Argentina in following the desires of its great founders and leaders, had always welcomed to its shores the sons of other nations without discrimination, and that Monte Grande constituted a demonstration of the good resulting from such a tradition, uniting as it did different races in an undertaking for human progress which without such a fusion of capital, purpose and energy, would have been impossible.

Toasts to the success and prosperity of the new national company were drunk, and that very evening commercial traffic commenced to flow in both directions with New York, Paris and Berlin. The direct circuit with England only awaits the building of a complementary station by the Marconi interests.

The Monte Grande transmitting station is built upon a plot of land containing more than 1,400 acres, the property of the company. The antenna is supported by ten 210-meter steel towers, in two lines, five hundred and fifty yards apart, each tower being an equal distance from its neighbors. More than nine miles of steel cable were used in guying the towers and the 32-wire antenna contains twenty-five miles of copper. The earthing system consists of a great underground net of copper, a total of sixty miles of wire having been employed.

Electrical power is carried to the station by eight miles of underground cable from the sub-station at Banfield. At a tension of 12,500 volts, more than 1,000 kilowatts of energy is carried by this line. The normal antenna charge is from 400 to 500 kilowatts, produced by alternators giving a primary frequency of 6,000 cycles per second. Frequency transformers and condensers permit the use of various wave lengths between 6,400 and 27,500 meters.

At Villa Elisa two receiving systems are being installed, reception being had meanwhile by means of a gigantic temporary loop. One system employs two great goniometers some 75 meters high, a mile apart and connected by a subterranean cable with the receiving station at the center. The other combination uses three small flat-top antennas, 30 meters high and 700 yards apart, all built on the great circle passing through Paris, with the receiving station in the middle.

The city office, nerve center of the entire system, is connected to the transmitting and receiving stations by an eighteen-pair underground cable,

(Continued on page 80)



Crowd returning from inspecting the station. The President of the Argentine Republic is seen in the center foreground, with Engineer Reinhardt (hat in hand) construction engineer of the station, just behind him



How United States Cavalry Uses Radio

Radio links up trotting columns across the prairie. Used in warfare practice. Enemy spy destroys tubes

By Garland C. Black

First Lieutenant, United States Army, Signal Corps.

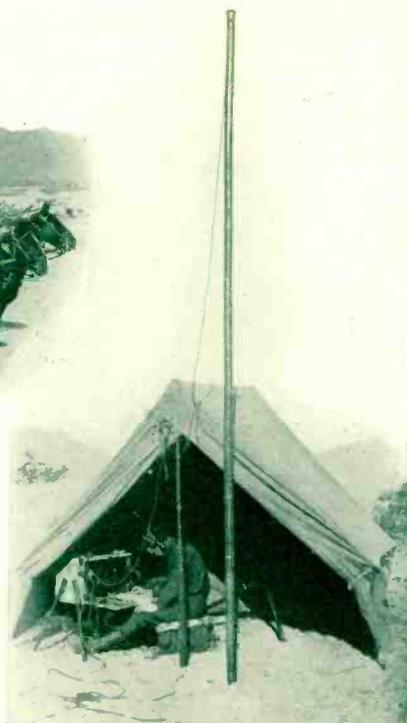
WITH the increased use of radio in the commercial world it will no doubt be of considerable interest to the readers of THE WIRELESS AGE to note the extent to which our Army, particularly the Cavalry, is employing radio telegraphy as a means of communication between troops in the field. While most of us are familiar with the army radio net which links together the various posts widely scattered throughout the United States and our possessions, and have probably listened-in and copied many of these stations, still very few realize the large number of radio sets in use by troops for maintaining communication in the field.

In this connection it is interesting to review the manner in which these sets functioned and the uses made of them during the annual field maneuvers of the First Cavalry Division. The maneuvers took place down on the Mexican border in a sector known as the Big Bend Country of Texas. Various component parts of the division are stationed along the border from Fort Bliss (El Paso), Texas, to Fort Clark (Bracketville), Texas, a distance of approximately four hundred miles. It was necessary that these different organizations be concentrated at Marfa, Texas, in the heart of the Big Bend, as a starting point from which to engage in the tactical exercises. The maneuver as a whole was divided into three parts, namely the march of the

troops from their home stations to the maneuver area, the tactical problems in the Big Bend District, and the return march to home stations.

Throughout all stages of this period it was absolutely essential that all elements of the division be in daily communication with one another and that the division headquarters be in touch with the Corps Area Headquarters. It was impossible to take advantage of commercial telegraph to handle this traffic as the troops were only in the vicinity of this service a small part of the time, and too, the cost of this means would have been prohibitive. Hence it was necessary to rely upon the field radio sets.

Communication on the march was handled by employing stations at Fort Bliss, Fort Clark, and Camp Marfa and with each of the three marching columns which made up the command. These columns were made up of the First Cavalry Brigade which marched from Fort Clark, the Second Cavalry Brigade which marched from Fort Bliss, and Division Headquarters and auxiliary troops which also marched from Fort Bliss. These columns marched an average distance of two hundred miles each and as the radio sets with which the troops were equipped have a working range of approximately one hundred miles and the time of the year being rather poor for operation due to unfavorable atmospheric conditions, it was necessary to



Cavalry Pack Radio set carried by a mounted section in the field, and housed in a tent in camp

establish two relay stations. This was done by sending sets in motor trucks to points about midway between Fort Bliss and Camp Marfa, and between Fort Clark and Marfa. These relay stations continued in operation until their column arrived at the place where they were set up, at which time they ceased to function and joined the column. This scheme worked very satisfactorily and traffic was well handled. In several instances when the atmospheric conditions were favorable it was found that the sets accompanying the troops could work through without the use of the relay stations.

While the division was engaged in the tactical exercises in the maneuver area the radio fulfilled a two-fold mission. In addition to furnishing a means of handling traffic for the various commanders it was also employed as a means of communication for the umpire system. The division was divided into two forces, the Browns and the Whites, and these pitted one against another. All problems were controlled by a chief umpire who had an assistant chief umpire with each force and these in turn had numerous assistants assigned to the various units of that force. All messages handled between umpires were in code so that they were unintelligible to the troops, which prevented them from getting information of their "enemy" in an unauthorized way. This scheme afforded a very valuable opportunity to the

umpires. Not only did the chief umpire who was probably located at some place where he could view only a portion of the action know in detail what was taking place on both sides continually, but also the assistant umpires were familiar with the situation confronting the unit to which they were assigned and could better judge the manner in which the situation was handled by the commander they were observing.

Thus it is readily seen that this is another instance where radio telegraphy has played a large part in helping to make an undertaking successful which would probably not have been so without the use of radio.

There were several other instances where radio entered into the events of the day in an interesting way. During the world baseball series results of the games were received at division headquarters play by play over a commercial telegraph line and in turn broadcast from there by radio telegraph so that all the units of the division were able to tune in and enjoy the games.

Another time there was a troop of cavalry detailed to go on a long reconnoitering mission. A pack radio section was detailed to accompany the troop in order that the brigade commander might be in constant touch with it. They had great luck in their mission and kept pushing up closer to the enemy; several prisoners were



The pack radio set used by the Cavalry Division set up for operation under field conditions

captured and some valuable information obtained as to the enemy's positions. However, the enemy soon found out that this detachment had a radio set and sent a man out who was to let himself be captured and then after being in the troop's camp to put the radio set out of order. The prisoner not knowing much as to the whys and wherefores of radio was at a loss how to put the radio set out of order after he was in the camp. Nevertheless he waited till after dark and being paroled with the freedom of camp he watched for his opportunity and when the operator left the station for a few

minutes he managed to break all the tubes. And while he was ignorant as to the amount of damage he had done, still in his overzealousness to carry out his orders he had certainly rendered the set unserviceable for that day. And later when the troop commander decided to remain in his position over night, instead of being able to use his radio to report his plans to the brigade commander and to request food and forage for his men and animals he was forced to send a messenger about ten miles with a written message, and supplies did not reach them until late that night.

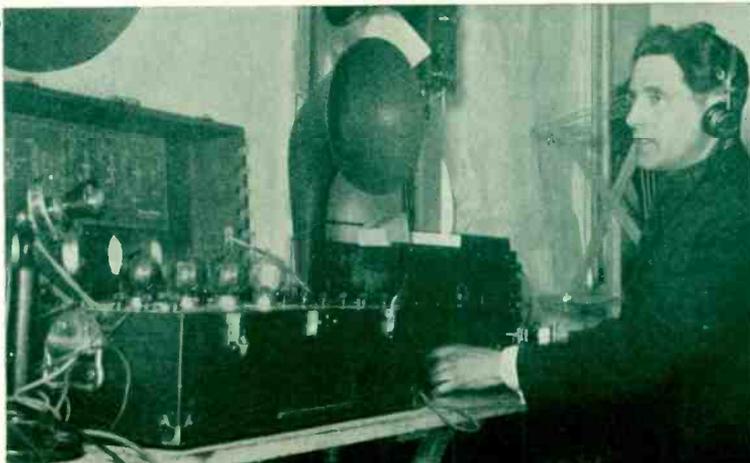
The Radio Fan—à la Milton

By Spencer S. Prentiss

Hence, loathed, noisome duties,
Of teachers, furnaces, and flivvers born
In home and school forlorn,
'Mongst books and Fords and all else
lacking beauty.
Find out some uncouth hole
To live in foulest Hades, black as coal.

But come, thou Pastime, free and fair,
Born of knowledge new and rare,
With thy tubes and jacks and plugs.
Oh come, thou joy of Radio Bugs!

Success that comes with any trials,
The joy of mounting knobs and dials,
The test of circuits old and new,
The fight to make the old junk do,
These are the pleasures I would court
And find in thee, thou greatest Sport.



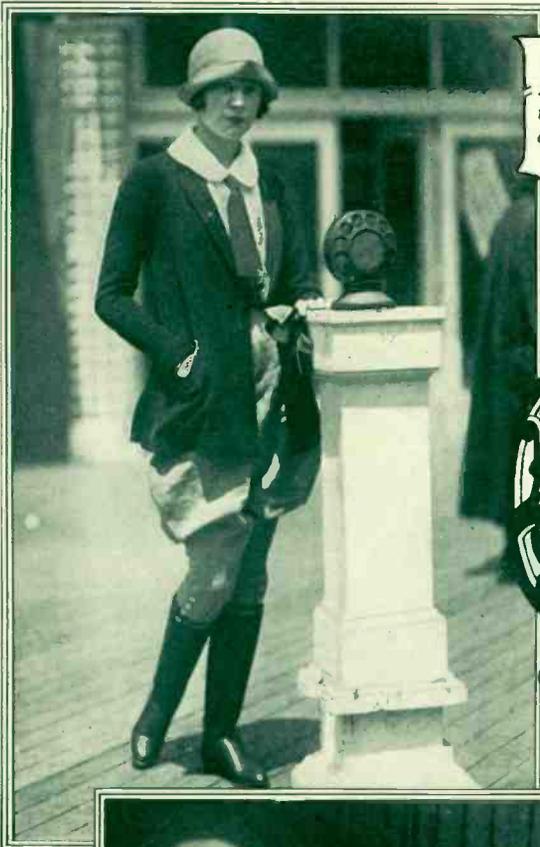
Home-radio idea extended to apartment house. Operator tuning 4-tube set that connects with 72 apartments

The bell that sounds the joyous call
That rings in liberty for all
Permits me go as fast as might
To charge my batteries for the night.
And then until the evening meal
I work to overcome each squeal.

At eight o'clock the local stuff
I always tune in well enough;
In fact so well they always drown
The stations from without the town.

But when at last they leave the air
I get the distance great and fair.
I hear New York, St. Louis too,—
It's great what one tube sets will do.
As hours get large and then get small,
The middle states, I hear them all.
The lark begins its song and flight,
Proclaims abroad the death of night,
When wearily at last I climb
To downy bed and sleep sublime.

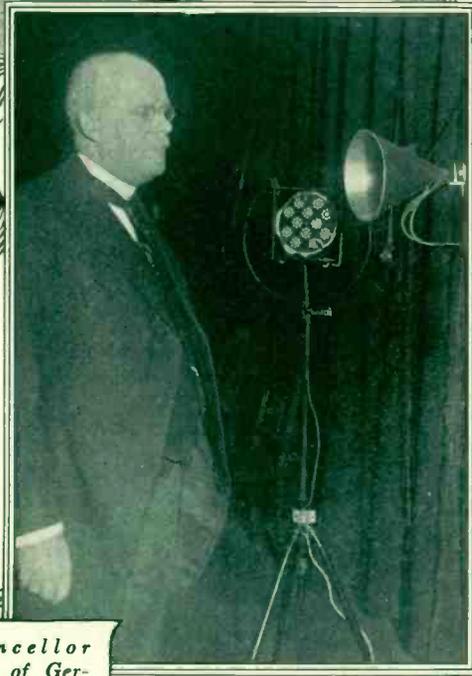
Some Prominent Broadcasters



Miss Winifred Ayres broadcasts talk on sport clothes from Atlantic City



Hughes broadcasts keynote speech at N. Y. State Republican Convention



Chancellor Marz, of Germany, employs radio to good purpose



Former Senator Chauncey M. Depew appears before the microphone

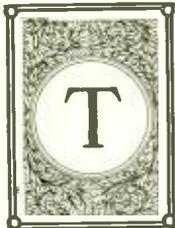
The Human Ear and Radio Reception

First Instalment of a series of articles on

SOUND IN ITS RELATION TO RADIO

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THE transmission of ideas or the communication of intelligence is one of the most important functions of all those performed by the human race. The social development of the whole family of races on the earth has been made possible largely through this channel of advancement. All this has been made possible by the ear and the voice with which nature has endowed us. This development and application of these two organs, extending down through the ages, has been long and tedious. Gradually, however, the process of spoken words evolved as man developed conscious control over those parts of which the mouth and throat are composed.

Over this period of time of perhaps many hundreds of centuries, a simultaneous development of the use of the human ear kept pace with that of the voice. These two developments must of necessity have occurred simultaneously because they came about as a result of the necessity for the transmission of ideas of intelligence from one individual to another. We can readily imagine the confusion, which would have occurred had not both developments gone hand in hand. Our helplessness is altogether too distressing even now when we find ourselves among foreign people whose language we may understand with great difficulty or not at all.

Our languages today may not be even remotely connected with the first sounds spoken by the voice and recognized by the ear, as pertaining to a definite communicated idea or thought. The natural barriers with which nature has separated one tribe or group of people from another caused the development of numerous different languages, dialects or spoken and recognizable sounds, whichever way we choose to designate them. No doubt these developments of numerous languages occurred among the various groups of people simultaneously, but, of course, at different rates and in

different ways depending on the characteristics and environment of the various groups. These likenesses and unlikenesses of the languages and dialects have continued down to the present time. Radio broadcasting, however, is destined, I believe with others, to change ultimately this whole state of affairs.

BROADCASTING WILL BRING WORLD LANGUAGE

In Europe where there are many countries scattered over a small area, speaking in terms of distances used in broadcasting, there is already a recognizable need, which may become pressing, for a common universal language. The use of a common language is certain to come and because of the rapid development of broadcasting in America and England it is my prediction that the universal language will be the English language. Thus, after many centuries when "The Lord did there confound the language of all the earth" the curse will have been removed and again we may say "And the whole earth was of one language, and of one speech." Let us hope the human race has at least developed sufficiently during these intervening centuries that it

will not again try to "build a tower, whose top may reach unto heaven," and cause the destruction of our new universal language for whose acquisition radio broadcasting will be responsible!

There is no scientific reason why such a universal language cannot be used throughout the entire world. In all of them the same human mechanisms, the voice and the ear, are used. These two delicate organs are the vehicles which have made possible the carrying of ideas originating in one mind to the minds of other people. They play the leading rôle in radio which is, itself, a link in this scheme of transmission of intelligence. Of course, we take the voice, the air and the ear as a matter of fact because we have not developed them. Nevertheless, their development is perhaps much more wonderful than radio which has been developed by man. Consequently we praise ourselves for the latter and say, "Behold, see what man hath done." The former we pass over without much consideration, until, of course, something goes wrong with the voice or the ear. This group of articles, therefore, on the general subject of acoustics, acoustical apparatus and the transmission of intelligence as they are involved in radio broadcast and reception is not only timely, but of considerable general interest to the radio public. Such articles, of course, as we shall present are based on the highest type and most recent results of physical research covering these fields of investigation.

THE EAR IS PART OF THE RECEIVER

The human ear is as much a part of a receiving set as the loud speaker or head phones are. The former are taken as a matter of course, the latter two, however, since they were developed by man, are considered intimate parts of the set itself. Faults in the former, however, are far more serious than in the latter. In the latter cases the apparatus can be discarded for new ones or themselves repaired, but in the former case repair or improvement can scarcely be hoped for even with the help of the best medical skill obtainable.



Dr. John P. Minton engaged in testing the acoustic properties of loud speakers

Sound Is the Instrument That Radio Plays Upon

The Ear Is As Important As the Radio Receiver.

The following brief description of the normal ear will be sufficient to make it possible for the reader to readily grasp the results which will follow. The ear consists of three main parts, known as the external, the middle and the internal ear. The former is familiar to us all and consists of the external lobe, the ear canal and the small drum membrane at the end of the canal. For most people this is about all there is to the ear. This is far from the truth, of course. The accompanying sketches, figures 1 and 2, illustrate the construction of the external ear, as well as the middle and internal ears, all in their proper relation to one another.

THE CONSTRUCTION OF THE EAR

The canal of the external ear is about one inch long and the drum membrane closing off its interior end is about one-quarter of an inch in diameter and concave with respect to the exterior lobe. That is, the drum is bowed away from the exterior toward the middle ear cavity as shown by the sketch. The middle ear consists of three tiny bones, H, I and S. The first bony lever, H, called the hammer, because of its peculiar shape, is attached to the drum. The third tiny bone of the series, S, is called the stirrup because of its resemblance to a stirrup. This stirrup is connected to the hammer by means of the connecting link, I. The other end of the stirrup is connected to a thin membranous substance called the oval window of the wall of the internal ear. This membrane window is about one-quarter of an inch in the direction of the longer axis and about three-sixteenths in the direction of the shorter axis.

The internal ear leads off from the oval window. It is an extremely complicated, delicately constructed and a wonderfully acting piece of human mechanism. Encased in its own hard bony structure, well within the bony walls of the head, it is completely protected from injury due to external causes. The main feature of the internal ear which is of interest to us at present is the small membrane with a few thousand transverse fibers. The bony structure containing the internal

ear mechanism resembles a small snail shell which is about one-quarter of an inch at its base and about the same height. The basilar membrane containing the many transverse fibers is wound around the snail shell throughout its entire length and divides the interior of the shell into two compartments each filled with liquid. The length of the fibers varies linearly from

the small oval window where the shortest ones are located to the remote end of the shell where the longest fibers are found. The length of these fibers varies from about 0.05 of an inch to 0.15 of an inch. All of them are covered over by a thin membranous substance to prevent the passage between them of liquid from one compartment to another.

Midway from the ends of each of these fibers is attached one foot of a small bony arch, the other foot being connected to the end of the fiber where it joins the bony projecting wall of the internal ear. The accompanying sketch, figure 2, will serve to illustrate the constructional details. The sketch also shows the auditory hairlets projecting out from the apex of the arches. Above the arches is the tectorial membrane against which these thousands of little hairlets move and cause auditory stimuli to be excited in

the nerve endings in which the hairlets terminate. These stimuli are carried from the nerve endings, through the auditory nerve cells and thence along the thousands of auditory nerves to the acoustic center in the brain. In this construction of the internal ear we see that there are several thousand transverse fibers in the basilar membranes. There are a corresponding number of cortis arches and several times this number of auditory hairlets, auditory nerve endings, nerve cells and nerves, all of which are laid out in a linear fashion and all of which function in a beautiful manner as revealed by recent physical research, to which the writer has been able to contribute in some degree as a result of his own extensive researches.

HOW THE EAR ANALYZES SOUND WAVES

Having presented a sufficiently comprehensive description of the ear for our purpose, let us see how it is possible for the ear to perform the most remarkable and astonishing function imaginable. I refer to the analysis or separation of sound waves, no matter how complex or mixed up, so to speak, into their component parts, so that the brain and mind can perform its even more remarkable function of the co-

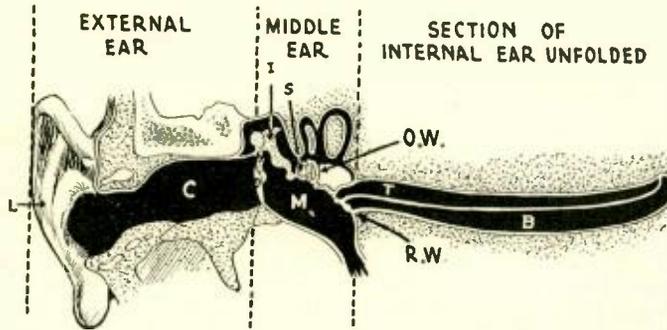


Figure 1—Diagram of Ear. L—Lobe; C—Canal; D—Drum Membrane; H—Hammer; I—Incus; S—Stirrup; M—Middle Ear Cavity; O. W.—Oval Window; R. W.—Round Window; T—Tectorial Membrane; B—Basilar Membrane

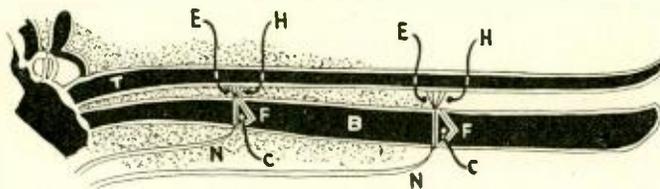


Figure 2—Diagram of Internal Ear unfolded showing two of Cortis Arches. T—Tectorial Membrane; B—Basilar Membrane; F—Basilar Membrane Transverse Fibers; C—Cortis Arches; H—Auditory Hairlets Projecting Against Tectorial Membrane and Connected to Nerve Endings; E—Nerve Endings; N—Auditory Nerves

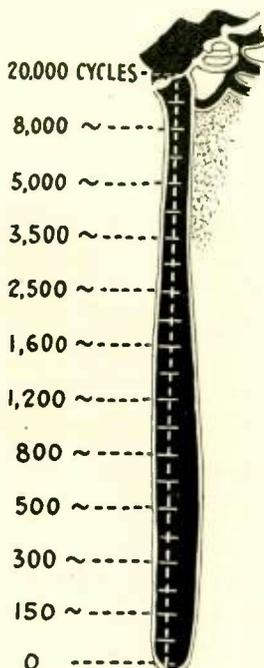


Figure 3—Locations of Various Frequency Regions on Basilar Membrane. Distance from Oval Window in Millimeters. (Total Length — 31 Millimeters — 1.22 Inches)

ordination and interpretation of the auditory nerve stimuli.

No matter how simple or complex a sound wave, it is nothing more or less than rarefactions and condensations of the air; that is, a decrease and an increase of the normal air pressure in the atmosphere. These changes in air pressure are brought about by some vibrating body, such, for example, as a violin string, a piano sounding board, or a vibrating column of air like that enclosed in an organ pipe. These increases and decreases in air pressure are propagated away from the sounding body in all directions. They constitute a sound wave and the ear drum responds to these minute changes in pressure.

The air in the middle ear is confined and maintained at a constant pressure equal to the average air pressure in the outside air. The pressure changes causing the sensation of sound enter the ear canal and cause corresponding pressure changes on the ear drum. The ear drum is caused to move back and forth, or to and fro, in actual bodily vibrations. The motion of the drum is passed on by means of the chain of hinged bones to the liquid of the internal ear. The liquid moves back and forth in unison with the drum membrane. Motion of this liquid in turn causes the transverse fibers of the basilar membrane of the internal ear to vibrate back and forth. This motion in turn moves the bony arches attached to the fibers and thus causes the auditory hairlets to stimulate the nerve endings. Nervous energy, perhaps electrical in form, is thus released and sends a definite auditory stimulus to the brain, which in the final analysis is the wonder of the whole operation because it must interpret these auditory nerve stimuli and translate them into concrete ideas. Thus, the remarkable and unexplainable process occurs in the brain.

A single pure tone, such as is produced by the mouth during the expulsion of air out through a small orifice formed by the lips, sets up air

Study of Radio Includes a Knowledge of the Ear

pressure changes which follow the simplest known form of vibration, called sine wave vibrating or simple harmonic vibrations. These pressure changes cause a corresponding motion of the drum membrane, which motion is communicated to the fibers of the basilar membranes of the internal ear. If the tone is a high pitched one, those fibers in the region of this membrane nearest the oval window are affected more than any other region. The lowest pitched tones affect most the fibers farthest removed from the oval window; that is, those fibers at the most internal part of the internal ear. The former fibers are the shortest ones and correspond to the high pitch region, while the latter are the longest ones and correspond to the low pitch portion. The arrangement, then, is similar to the layout of strings of the piano and is illustrated in the accompanying sketch, figure 3. We can see, then, how the numerous different tones set up when an orchestra is playing in combination with a chorus of many voices produce a most complex pressure change on the ear drum, how the corresponding motion of the drum membrane communicates its motion through the tiny middle ear bones to the basilar membrane of the internal ear, and finally, how the basilar membrane separates or analyzes the complex pressure changes into the hundreds of different simple harmonic changes each of which are finally transmitted by its own individual auditory nerve to the brain. The internal ear, then, with its several thousand individual parts in combination with the several thousand auditory nerves perform this remarkable and astonishing function of analysis of any sound or combination of sounds no matter how intricate and complex they may be. No other organ of the body performs any function so marvelous.

CHARACTERISTICS OF THE EAR

In order that we may have some definite concrete impressions to retain about the operation of the ear let us present briefly a few of the physical results which we have obtained to represent the average performance of a large number of ears.

1. There is a lower limit of the pitch of a sound below which the ear cannot hear. This lower limit is in the region of 20 complete vibrations per second. The reason for this may be that there are no parts of the internal ear to respond to this pitch or it may be due to the fact that the stiffness of the vibrating parts of the whole ear is too great for these low frequencies. The analogy is similar to a head-phone diaphragm being unable to vibrate at these very low pitches because of its stiffness. Again the cause may be due to the liquid motion of the internal ear being shunted around the basilar membrane and thus exerting no pressure on this membrane.

2. There is an upper limit of the pitch of a sound above which the ear does not hear. This upper limit is about 20,000 complete vibrations per second. The cause of this upper limit as well as the lower limit is largely a matter of speculation. There may be no parts to vibrate at these high pitches or the weight of the whole ear system may be too great to follow such rapid changes in the pressure, acting on the drum membrane.

3. There is a minimum intensity of sound below which the ear cannot detect the presence of any auditory stimulus, or if it does, the brain cannot be stimulated by it sufficiently to bring it into consciousness. This lower limit of audition varies with frequency in accordance with the accompanying curve (see lower curve, figure 4). The air pressures are shown in dynes—a dyne corresponding to about one-five hundred thousandth of a pound.

4. There is a minimum intensity of sound above which the sound pressure

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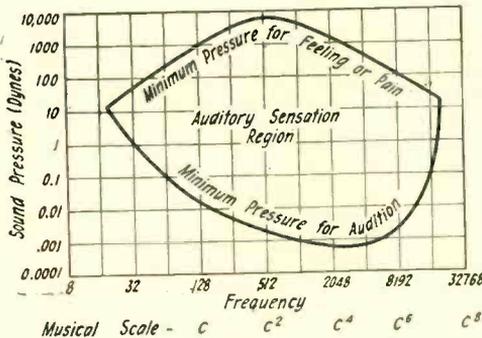


Figure 4
Limits of upper and lower audition

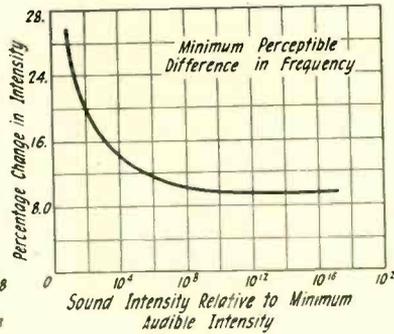


Figure 5
Graphic curve of intensity increments

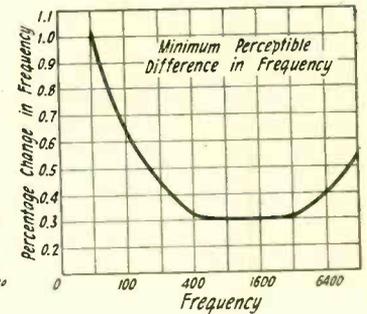


Figure 6
Relation of pitch discrimination to wave frequency

The Radio Joys of a Camp



The Companionship of Friends in the Open Air With Radio

By Sinclair Arthur

FOR several years Dr. Hobart and I have had a camp on Rye Lake. Every week-end, winter and summer, we go to the "shack" for a rest from the stress of city existence.

Our shack is a corrugated iron cabin with a large living-room, a kitchen and a screened sleeping porch. The interior is finished with bark woodwork. Strings of tiny pine cones cover the cupboards and hang in the doorways. A large stone fireplace in the living-room and the kitchen range furnish enough heat to make the shack cozy in the coldest weather. During the hot summer months we live on the open porch, going within only for our meals. Our location is on a high point overlooking the lake with dense woods surrounding the other three sides. The exposure is right for a constant breeze throughout the torrid days of July and August.

A flower garden planted in stone terraces surrounds the shack. Winding paths, rustic benches and stone seats add a touch of artistry to our garden in the heart of the wild.

Of late, we have enlivened this retreat with radio. The ever changing programs of music and sports bring to us a touch of the caprices of the world beyond.

* * *

"Why is it," Dr. Hobart demanded, "that my patients button-hole me to spend the week-end at their suburban homes?"

We were sitting on the screened porch listening to the strains of "Raggedy Ann" broadcast by Paul White-man's Orchestra from WEAf.

"It seems so foolish," he continued. "I have to sample their home-brew, sleep in their uncomfortable guest rooms, and get up early Sunday morning—not because I am awakened, but

CAMP CAUTIONS

In camping with a radio, if your receiver is one of the antenna type, erect your aerial wire from the camp to a branch of one of the tallest trees in the immediate vicinity. If thunderstorms are prevalent, it will be found advisable to erect an additional antenna not over ten to twenty feet off the ground. That type of aerial is not so readily influenced by atmospheric disturbances. An aerial of this character can be of any length from 100 to 200 feet.

See that you have a good ground connection. If such cannot be obtained at the camp, the equivalent of a good ground connection can be had in the use of a piece of wire 100 to 200 feet in length laid over the surface of the ground and directly underneath the aerial.

Receiving apparatus in the camp should be duly protected from moisture and dampness.

The electrical constant of aeri-als erected in a camp, may be quite different from the electrical constant of the aerial used with the same set at home. This means that stations formerly heard at home will not come in at the same point on the dials in the camp. It should not be difficult to locate new positions for such sets after the first evening's operation.

because I feel guilty after listening to footsteps for an hour—simply to visit the garden, hear a long-winded dissertation on why beet seeds are planted, or sowed, or whatever you do with beet seeds, then to the attic, down to the cellar, and after dinner, sight-seeing around the village square."

Dr. Hobart had a pained, quizzical expression that seemed to concentrate in a frown just between his eyebrows.

"Why is it," he demanded again by way of emphasis, "that I must always be the sacrifice of good intentions? Do you suppose my being a bachelor has anything to do with it?"

When I had managed to regain a decent composure I ventured a guess

that he was merely a party to his own outrageous tactics. Doc will insist upon dragging his friends up to our camp, sublimely unconscious of any possible reluctance on their part.

* * *

At the Grand Central Terminal in New York, take the New York Central to White Plains. Buy your groceries at the general market, stagger aboard the one-man trolley, and get off at Silver Lake. Then embark in a taxi and direct the driver to Birch's Camp—just below Carpenters'. The drive is only three miles through tree-lined back roads.

After you have paid your fare, climb the rock-studded bank on the right and follow the path that winds through heavy underbrush. You can't possibly lose your way. The path leads up over ridges, down through swamp-land and finally brings you abruptly to the foot of the stone steps leading up to our camp. That is to say, if you have been able to struggle through the swarms of gnats and mosquitoes (with both arms full of supplies) and managed the two-mile tramp without succumbing to heat prostration, or some one of the other tortures of the trail. Of course your hat has been knocked off by low-hanging branches and your shoes ooze-coated with swamp-mire and rock-scratched. But you have encountered comparatively few other discomforts, except a little mud spatter on your new summer suit.

Having arrived, you deposit your bundles on a rustic bench, mop your brow, the while critically examining your disheveled arrangement, and finally—according to your nature—reconcile or resign yourself to the rigors of the untamed woods.

You will then, and surely, become enraptured with the sweep of view across the chain of lakes and woodland

stretched below and melting into lavender outlines on the distant horizon. Off to the right you can see a white ribbon—a road—winding around and up a green mound. Across, and away to the left on the shore of the furthest lake, the corner of a secluded monastery peeps through the branches of a thick verdure. At your feet, mountain laurel, scrub oaks and dogwood, all in a scramble, recede to the shore of Rye Lake. A great rock here, and a pine tree there, mark the tenacious grip of the wild on the stealthily creeping fingers of the cultivated regions beyond.

Once you have drunk your fill of nature in its virgin glory, you will pause to wonder that you were capable of such a thirst.

Then you may enter the cool, "woody" interior of the shack and step out on to the screened porch. There you will find Dr. Hobart and I comfortably ensconced in wicker chairs, our pipes simmering, and our lazy minds occupied with the broadcast sports on our radio.

"Hello there, old-timer!" will probably be the Doc's greeting. "Come on out on the bleachers—batter's up!"

* * *

After a supper of juicy sirloin steak, crispy French-fried potatoes, sliced onions and lettuce, and real coffee, we light our pipes and listen to the Dinner Dance Orchestra broadcast from WOR, basking in the comfortable indolence of appeased appetites. Our dormant inclinations having been humored, we dash down to the lake for a plunge—back again—and standing on a rock still warm with the day's sun, we rub down with a Turkish towel, laughing and bantering under the luxurious stimulant of carefree camp existence.

We then push our folding beds out on the porch, set the radio, turn off the lamp, and settle down to an evening of music in the quiet sanctum of a dense wood.

The carpets of grass and moss are bathed with a mellow glow of silvery moonlight that streams through the branches, casting shadows about in spectral fantasies. A refreshing breeze

rustles the leaves. The glow and flare of a pipe, an occasional murmur, seem to emphasize the companionship of friends in the peace and rest of the open air.

* * *

We are awakened by a phoebe bird calling its mate. The clear morning air is washed by the early sunlight and is intoxicating. Dew-crystals gleam on the rose petals. Everywhere life has awakened to the invigorating freshness of a new born summer's day.

Down to the lake and out in a boat we fish the morning through. Our radio is not tuned until Sol rides over the zenith and time has lengthened out to a blazing afternoon.

After dinner, we sling the portable receiver over our shoulders and set off for a hike through the woods. Whenever we stop, the radio is played. Part of the time our fun is had in little more than experimenting, trying for this station and that station, always delighted with a newly discovered trick in wayside reception. Often, we find a sheltered nook where we may rest and enjoy the baseball game broadcast from a distant city. But always, we find our old byways and haunts the more pleasing because of our radio.

As evening approaches, we build a fire for a camper's meal. With bacon and toast, fire-baked potatoes and coffee, and "Roxie" on the air, we learn of the joys of camping life—a truly pleasant life enhanced with the broadcast programs of music and sports.

* * *

"And now," the Doc exploded as we prepared for another radio evening on

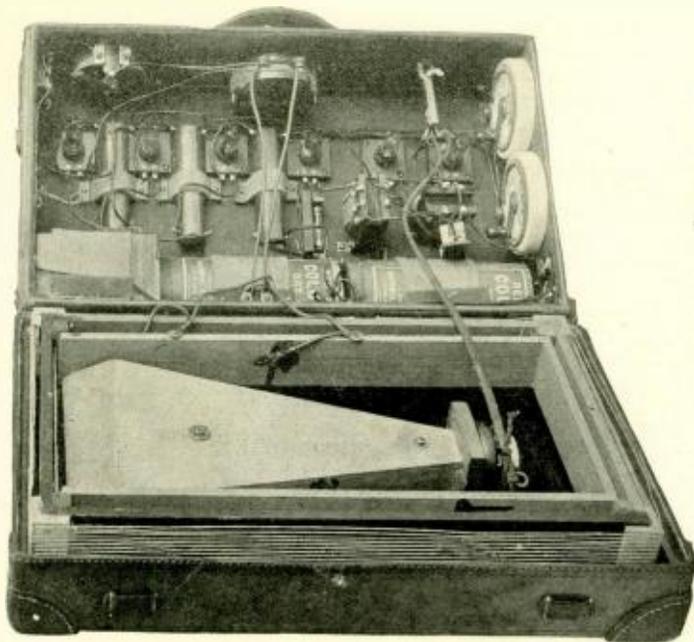
The sets used in this camp are **THE WIRELESS AGE 3-Tube** (described in March issue) and **THE WIRELESS AGE Uni-Control** (described in December issue). Results in all cases were satisfactory with an aerial wire thrown over a high limb of a nearby tree.

the porch, "tell me that your friends didn't enjoy this week-end more than they would looking over the village library and meeting the boys of the volunteer fire-department."

Rain pattered on the corrugated iron roof. A fresh, cool wind had come up, forcing us under the covers. The deep intonation of an organ prelude broadcast from WGY kept time with the staccato rhythm of the rain drops. I thought of the remarks I had heard—expressed at random—but always centered around the associations with which each was most familiar.

"To tell you the truth, Doc," I replied, "every blessed one of them used this week-end for a basis of comparison. What they most enjoyed were the attendant discomforts of our particular camp. They will now go home to their own radio sets, and between times of tuning, will think of reasons why it would hardly do to visit us up here again. They all have their own ideas about what a camp ought to be like."





Approved

The WIRELESS AGE
 "Uni-Control" in a
 Bureau of Standards
 Package

By S. R. Winters

No antenna; dry cell batteries. You can use it immediately in hotel or camp

Simple to operate; only one control. Powerful amplification provided. Sensitive and selective

IF you are a devotee of Izaak Walton and go a-fishing this summer, or if you are among the multitudes that camp on the 156,000,000 acres of woodland reservations of the Federal Government, radio entertainments may attend your out-of-door recreational activities. This assurance does not imply that your "excess baggage" limitations will be exceeded by the inclusion of 100 feet of antenna wire, storage batteries, a loud-speaking horn, and a cabinet for containing the radio instruments.

These things, in a manner, are provided. But, with the refinements in the manufacture of vacuum tubes which makes possible their operation from dry-cell batteries, there has been introduced the compact radio receiver. In fact, so little space is required for a complete radio receiving set that all the necessary units may be enclosed in an ordinary leather suitcase. This portable outfit, sometimes referred to as a "Portafone," was designed and built by the Radio Laboratory of the Bureau of Standards, United States Department of Commerce.

Self-contained, is the word fittingly descriptive of this equipment, since not only the vacuum tubes, batteries, transformers, and wiring are enclosed between the covers of this suitcase but a loop antenna and loud-speaking unit are similarly accommodated. The latter two units are contained in one section of the suitcase. The loop or coil antenna is simply constructed, con-

sisting of a square wooden frame around which are wound twelve turns of fine wire. The loud-speaking unit is built of wood and fits snugly in the open framework of the loop antenna.

This self-contained radio-telephone receiver is comprised of three stages of radio-frequency, two stages of audio-frequency, and a detector. The types of radio-frequency and audio-frequency transformers used in this

READERS who are practiced and skilled in the construction of sets will have no difficulty in making this portable receiver, which is worthy of their best efforts and will reward such efforts richly. For those who desire more assistance with the construction, the article describing the construction of THE WIRELESS AGE Uni-Control Receiver in the December, 1923 number will be very helpful. The latter article, although describing the set as constructed by the designer in a layout different from that followed by the Bureau of Standards, gave minute construction details and valuable suggestions with respect to wiring, testing and operating. Finally, our "Information Desk" is always ready to render assistance.

portable outfit duplicate those employed in the set built and demonstrated by THE WIRELESS AGE in its laboratories several months ago—that is, the former were made by the Radio Instrument Company and the latter by the General Radio Company. The type of electron tube originally used in this suitcase receiver was Radiotron WD-11, but Radiotron UV-199 is preferable. The low filament consumption of the latter makes it especially adapted to service in portable outfits where the number of batteries used are necessari-

ly reduced to a minimum. For instance, two dry-cell units are employed for "A" batteries in this particular equipment. Of course, dry cells are used for the "B" batteries since the transportation of storage batteries would contribute materially to the weight and cumbersomeness of any portable outfit.

Once the covers of this suitcase are shut, the contents are cleverly disguised. Other than two tuning controls placed near the handle of this leather container, the knobs or rheostats are not markedly discernible, the outward appearance is conspicuously absent of any radio "ear marks." It is not excessively heavy, weighing probably less than 50 pounds, and may be carried about from place to place as if it only contained wearing apparel, the original purpose for which this container was designed.

This compact receiver meets the demands of summer—when radio goes to the country. The pleasure of receiving concerts in a remote region, a hundred miles or more removed from a broadcasting station, is not to be discounted. However, as great an outdoor sport as this may be, the merriment caused by introducing this suitcase radio receiver in a village unacquainted with the marvels of radio telephony is even greater.

This "Portafone" is a convenient method of taking radio to the great out-of-doors by the automobile route. In fact, tests have demonstrated its capacity to intercept ether waves and convey speech and music to persons

Portable Receiver

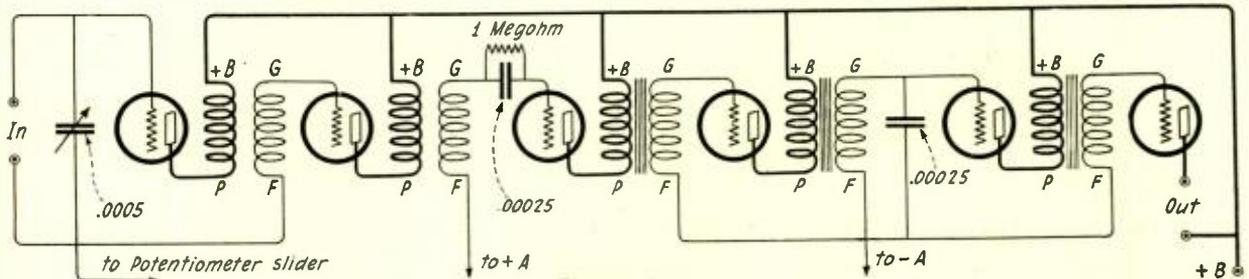


Figure 1

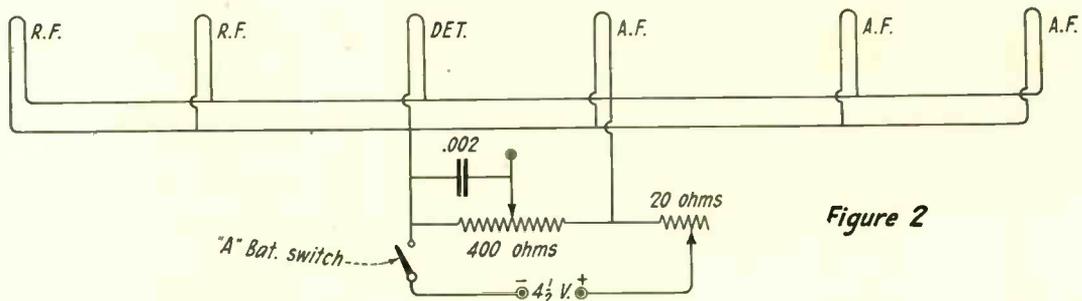


Figure 2

while traveling in an automobile. The experiments were conducted at short range from broadcasting stations and though the ignition of the fuel in the automobile engine was a slight disconcerting factor, the clarity and reliability of the radio signals was unmistakable.

The fisherman, who sits on a bank all the day long anticipating the catch of a big fish, would find this portable outfit a means of relieving the monotony, provided his pastime was negotiated in close proximity to a broadcasting station. The city-dweller, who flees from brick walls, paved streets and clanging trolley cars, for a sequestered spot in the wilderness, may invite the companionship of this "Portafone" for keeping in touch with the civilization he left behind. The automobile tourist with no pre-determined destination in view may hear concerts, news, and the speeches of the great and near-great as he travels, if his suitcase is filled with radio instruments. The Boy Scout, too, need not forsake his hobby when hikes call him over stony ways and through a wilderness. A suitcase, chockful of radio apparatus, is the one connecting link between the city he left behind and the rough-hewn paths which are being explored.

The possibilities of this and similar radio apparatus in compressed forms

are too numerous to recount. The portable outfit, whether contained in a suitcase or comprised of several units, is calculated to explode the claim that radio is an exclusive indoor sport. The loop antenna, dry-cell vacuum tube,

The six tubes occupy considerably less room than most one-tube receivers. There are two stages of radio frequency amplification, a detector and three stages of audio frequency amplification; inter-tube coupling is provided through suitable radio and audio frequency transformers.

The circuit is so arranged as to permit the grids of the three audio frequency tubes to be at 3 volts difference with respect to the negative terminal of their filaments; necessity for a grid battery is thus obviated. Moreover, by this arrangement the voltage on the grids of each radio frequency amplifier is the same.

A positive acting cut-off switch and a high resistance potentiometer are the only extra equipment in the filament circuit.

In figure 1 particular attention is directed to the radio and audio frequency transformer connections. On the transformers G and P represent the outside terminals of the secondary and primary winding; F and +B the inside terminals of the same coils.

Great care must be taken that the grid return leads are exactly as shown. On the R.F. tubes they both are connected to the potentiometer slider; on the detector to the positive "A" battery

(Continued on page 88)

EQUIPMENT

- One .0005 (500 mmfd.) variable condenser with a mechanical vernier.
- One 400-ohm potentiometer; the specified resistance is not essential, but it should be as high as possible.
- Three audio frequency transformers, all low ratio.
- Two radio frequency transformers covering the range of 220-550 meters.
- Six vacuum tube sockets.
- One battery switch.
- One .002 mfd. fixed condenser.
- Two .00025 mfd. fixed condensers.
- Bus bar, wire, tubing, mounting screws, etc.

ACCESSORIES

- One loop wound tautly with 12 turns of solid No. 20 copper wire spaced 1/2 inch.
- Six UV-199 or C-299 vacuum tubes.
- One plate battery of 67 1/2 volts.
- One "A" battery of three dry cells.
- One loud speaker.

and the dry-cell battery itself, have brought the country nearer to the city and made of the isolated region a potential radio receiving station.



Gertrude Bryan
broadcast from
WJZ

- Spanish Nights—
- French Nights—
- Five Language Events—
- The Opera "Faust"—
- Entertainment *en route*—
- The League of American
Pen Women—
- Detection of Tubercu-
losis by Radio—
- Training for Negro Spiritu-
als

Broadcast Programs Broaden
to International Scope

Digest of Outstanding Broadcast Events

IN 1884, George Westinghouse started a small plant in Garrison Alley, Pittsburgh, Pa. He staked his judgment on the alternating current system of electric generation, weathered the spectacular war that was waged between alternating and direct current advocates, harnessed Niagara Falls for electrical power, produced the first successful single-reduction street car motor, electrified great railroad systems, and after a score of other remarkable achievements, erected four first class broadcast stations. Although George Westinghouse did not accomplish all that individually, he was at least the founder and promoter of what the Westinghouse Electric and Manufacturing Company has produced.

* * *

KDKA, the pioneer broadcast station of the Westinghouse Electric and Manufacturing Co., has inaugurated the first real approach to international broadcasting.

The Spanish programs recently started by KDKA are in answer to a real and definite need for such programs as evidenced by hundreds of letters from South America. KDKA has a stable range and the radio listener in Buenos Aires can hear KDKA every

night, but if he is an Argentinian who speaks only Spanish, the program is meaningless because it is spoken in English. So the Argentinian writes a letter in Spanish to the program manager telling of his good receiving apparatus, but also stating that he wants to hear a program in his own language.

Such letters come with every mail and after the Westinghouse Company had installed its repeating station KFKX, at Hastings, Nebraska, more letters than had been received before were found in the mail.

Long before the first Spanish program was broadcast, the officials in charge of the station were aware of its international range. When KDKA co-operated with the British Broadcasting stations in relaying its programs first transmitted on the extremely short wave lengths, letters were received not only from the people living in the European countries adjacent to Great Britain, but also from India, Turkey, the Balkans, even the northern part of Africa.

The first program that consisted entirely of Spanish music was announced in both English and Spanish so that the people of the United States would

be kept informed of the progress of the program.

For the Spanish programs, one of the employees, Señor D. Santini, whose birthplace was Santa Fé, Argentina, was trained for the announcing.

Mr. T. P. Gaylord, acting vice president of the Westinghouse Company broadcast the opening announcement to the Spanish speaking people of the United States, Central and South America. Señor Corriola, vice-consul of Spain then followed with a message to the people who speak his native language.

The big news associations of the United States carried dispatches on the South American wires previous to the special broadcast. Thus every radio fan in those countries was notified of the day and of the hour.

The government of Cuba ordered all broadcasting stations to shut down during the hours KDKA broadcast in Spanish.

Thus when the great event was under way there was a Spanish-speaking audience whose size probably has never been equaled.

The success of the Spanish program was cabled to KDKA from all parts of South America and Mexico.

Señor F. M. de Stefano, owner and editor of the "Havana Life," the first publication in the world to print radio news in Spanish, dictated a ringing commendation to the broadcast station in behalf of the Republic of Cuba. He also remarked on the clear reception of KFKX which re-transmitted the KDKA program.

The second program broadcast in Spanish included two former residents of Buenos Aires to feature the program. These artists were the Señor and Señora Narud. Señora de Narud was the former Ada Lia Virasoro, daughter of one of the most prominent families, politically and financially, in Argentina. Señor Narud was born in Christiania, Norway, but later entered the business world in Argentina where he was married.

Again, as on the occasion of the first program, the South Americans plainly heard the programs and responded with thousands of letters of appreciation.

So today Spanish programs have come to be a fixture on the broadcasts of KDKA and will continue to be so for an indefinite period in the future.

Even those who do not understand Spanish should listen in. Purchase a book on the rudiments of the Spanish language, or a book of elementary lessons. Then listen in again. Read about the Spanish peoples. Compare what you learn with what you know about your own people. Ibañez and Jacinto Benevente have written much that is worth while. There is a great deal you can learn through broadcasting.

* * *

WBZ recently put over a five-language program in which folk songs, Italian, Scotch, French, Russian and German were featured. The Annual French Program night was broadcast a week later.

* * *

FIRST prize in the Radio Drama Competition conducted by WGY, the Schenectady Broadcasting Station of the General Electric Company, was

awarded to Miss Agnes Miller of 150 East 72nd Street, New York, for her comedy drama of business life, entitled "A Million Casks of Pronto."

The object of the competition was to develop a type of play especially adapted to radio presentation, a type of play that will tell its story through an appeal to the ear and imagination just as the screen play is directed exclusively to the eye. Miss Miller's play was selected from nearly three hundred manuscripts as the best original drama submitted and she will receive a cash prize of \$500.

Miss Miller is a native of New York. She was graduated from Barnard College and later received her master's degree in comparative literature from Columbia University. For eighteen months, during the war, she served

the Schenectady station. The Radio Drama Competition was inaugurated for the purpose of stimulating interest among writers in what is destined to become a new branch of dramatic art. Writers were advised to bear in mind that the radio audience gets a play exactly as a blind man would receive it in a theater and they were urged to take full advantage of "Noise Effects" as a means of creating atmosphere.

* * *

BROADCAST stations are exerting every means available for the making of programs of a valuable character. WGY launched a contest for radio drama material. WLW staged a Radario contest. Both stations have employed capable directors.

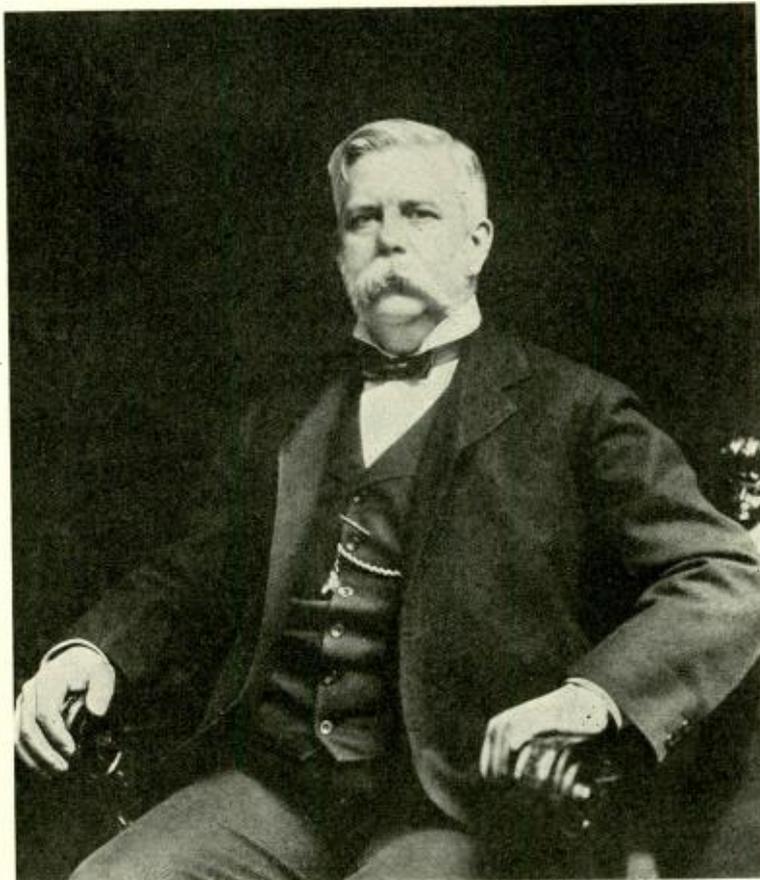
Fred Smith, studio director at Crosley Radio WLW had the good fortune to travel in Europe for eight years. Most of his time was spent in Spain—five years in all—and the remaining three years in France, Belgium, Holland, Germany and England.

During those years Smith spent all his spare time in studying the languages, arts and institutions of the countries where he was living. When he came back to America two years ago he brought with him a wealth of background for the exacting requirements of broadcasting.

Since he has joined the Crosley Staff, Mr. Smith has diligently applied himself to the development of the Radario: the radio play is broadcast from WLW at frequent intervals.

* * *

THE opera of "Faust," arranged by Edgar Wise Weaver and presented by the Women's



George Westinghouse

with the United States Naval Reserve on foreign language censorship. Some of her experiences in this work furnished the groundwork for her successful radio play.

WGY was the first station to introduce the drama to the air and the players have offered one production weekly since October, 1922. The radio drama has proven one of the most successful and popular features offered by

Glee Club and Orpheus Club of Mankato, was broadcast from WLAG direct from the auditorium in the Mankato armory.

"Faust," created in the distant past, tells the story of man buying wealth and love at the expense of his immortal soul.

Goethe has taken this symbolized being and placed him permanently in literature, while Gounod has sung this

story through years of time and his opera is the most popular of all operas and Gounod's fame rests largely on "Faust."

Faust—an aged philosopher, has grown weary of life in his vain effort to understand the real essence of existence. His vigil lasts through the night and as he sees the light of a new day he seizes a cup of poison to end his life.

His hand is stayed by the sound of Easter carols sung by passing maidens. It tells of the joy of living.

Then enters Mephistopheles. He offers Faust gold, glory, power—youth, all he has hitherto missed—and with a vision of Marguerita before him, Faust signs the contract—the devil is to serve Faust here—but the relations are to be reversed below in Hades.

Then Faust successfully woos the maiden Marguerita with the aid of Mephistopheles.

But Valentine, Marguerita's brother, returns from war and upon learning of his sister's betrayal attempts to kill Faust, but is mortally wounded in the combat. Marguerita seeks consolation in prayer at the church, but is taunted by the fiend.

The distraught maiden slays her child and is thrown into prison. Faust follows her and implores her to fly with him but Marguerita, seeing his companion, Mephistopheles, falls on her knees and in an agony of remorse implores the pardon of heaven.

The prison walls open, angels of heaven appear and bear the soul of Marguerita with them as they sing their song of redemption—Christ is arisen again.

Three microphones hung in the Mankato armory transmitted the sound waves over 106 miles of wire to the broadcasting station at Minneapolis, whence the music went out onto the air. Another complete telephone circuit kept the operators at the armory in constant touch with the Minneapolis sta-



Lilyan Tashman broadcast from WOR

organizations of the Twin Cities. The station is supported by confidence born of civic pride and community spirit. WLAG has performed a real service; thousands of people in the great mid-west have tasted of grand opera.

A few years ago Minneapolis was the gateway to the north—the flux of lumberjacks and Sioux Indians. Music halls were the center of attraction. Radio has been the shortcut from cabarets to "Faust."

* * *

ABOARD the private car "Boston" on its way to the annual Motion Picture Convention in Frisco, was a party that was not experiencing the monotony of long rail travel. Adolph Zukor, of the Famous Players-Lasky Film Corporation, was dean of the delegates from New York. Their private car was equipped with a Radiola Super-Heterodyne set which, according to telegraphic reports filed at the various cities on the route, furnished music and entertainment continuously to the party all the way from New York City.

Another party left New York City in an automobile equipped with radio for the long journey to the Pacific coast.

Travel has become very fast. But apparently not fast enough. By train, by automobile, and probably by airplane in the near future; we will find the agent to greater speed by employing our time *en route*. Radio will very likely concentrate the vast number of things we now find too many for consumption in the few daily hours. We can now absorb a great deal in broadcast reception.

* * *

WILLY LAMPING, one of Europe's greatest musicians and a far-famed master of the violoncello, is a director of the German Violoncello School, founder of the Bruehl Castle Quartet, Kurkoein, artistic conductor of the Rhenish Chambermusik Festi-

tion. Two men were busy at the armory switchboard all through the performance, amplifying here, diminishing there, so that the volume of sound broadcast might be constant throughout.

This is the most pretentious feat of remote control-broadcasting that the Minneapolis station has attempted and Mrs. Poehler, the director, Mr. Sweet, the mechanical superintendent and everyone else were anxious that it be a complete success. Both they and the *Free Press* are grateful to Manager Ferguson and his staff of the Citizens Telephone Company and to Mr. Marshall of the Mankato Storage Battery Company for assistance and materials furnished.

The volume and character of response received was sufficient testimonial to the signal success of broadcasting grand opera.

WLAG is an enterprising broadcast station backed by several live-wire

vals at Cologne and the castle at Bruehl, and organizer of the International Music Festivals.

Lamping is in America in the interest of the International Chamber Music Association. He included in his tour a musical program broadcast from WIP.

Such festivals have been pretty well confined to music lovers' circles, probably because most of us do not have time to learn something of the history of various musicians. In this case, the announcer furnished a brief outline of the individual. It aroused interest and engaged the respect of an audience largely foreign to concert halls. The recital then had a sympathetic audience much greater than a concert hall could possibly hold.

Strict attention to the announcers' introductions is usually important if we wish to get the most from broadcast programs.

* * *

THE League of American Pen Women is a national organization of woman writers and composers, with chapters in almost every state in the Union. Its national president, Mrs. Louis Geldert of Washington, has appointed state presidents, which in turn have been developing radio affiliations whenever possible. In New York City and Washington, radio broadcasting is being done regularly, and in Kansas City and several other cities, radio chairmen are appointed, but as yet the work has not been constructively regular. Chicago is the first in the west to arrange for a weekly program of the members' work.

Each program, which is given on

Tuesday evenings between 8 o'clock and 8:15 from WGN, consists of cuttings from the writings of Illinois literary members, short stories, poetry and reviews of longer books, and musical numbers composed by Illinois members. Visiting league members from time to time address the radio listeners, and the contact with members over the state and in adjoining ones is highly beneficial for furthering creative work within Illinois.

* * *

A FARMER near Wilkensburg, Pa., had been a regular listener to the series of talks broadcast from Pittsburgh on the activities of the Bureau of Animal Industry. One of the talks was on the subject of tuberculosis eradication. His interest thus aroused turned to one of his own cows which had been noticeably unthrifty and affected with a bad cough.

He went to the local office of the Bureau of Animal Industry for advice. The inspector in charge informed the State representative of the case. The State man then made three futile attempts to reach the farm by following the directions which the farmer left. Failing to reach the inquirer in this manner, the farmer was "paged" by radio from station KDKA. It was announced that efforts had been made to reach him and if he were listening in to get in touch again with the office.

Two days later the farmer came to the office. Arrangements were then made to conduct the State representative to the farm for an examination of the suspected animal. The symptoms were suspicious and arrangements were planned for an official test.

HARRY BURLEIGH, leading creative genius of the Negro race in music, both as composer and interpreter, was heard by radio listeners in an exceptional program of negro spirituals when station WJY of the Radio Corporation of America broadcast the anniversary vesper service from Old St. George's Episcopal Church. The service commemorated the 30th anniversary of Harry Burleigh's entrance into the St. George choir, and presented many of Burleigh's spiritual compositions, sung by Mr. Burleigh both unaccompanied and assisted by the full choir and organ of the church.

Only because of the genuineness of Harry Burleigh's musical gift has he been able to attain his remarkable success, for he has had to overcome the apparently insurmountable difficulties of poverty, self-education and the handicap of Negro blood. From the time he was sixteen he sang in church choirs on Sunday, working outside of school hours and during vacation. Not until he was twenty-six was he able to obtain any real musical training, when he obtained a scholarship at the National Conservatory of Music. For four years Burleigh studied under the greatest masters in the country, receiving particular attention and encouragement from Dvorak, the greatest of Bohemian composers. In 1894 he won the position of baritone soloist at St. George's out of sixty other applicants, his voice outweighing in the minds of Dr. Rainsford and the vestrymen any objections that could be advanced to the color of his skin.

—W. A. H.



Clef Club Orchestra, broadcast from WOR. This orchestra plays at the Hotel Clarendon in New York City, and is also the "official" orchestra for all Spanish functions of any prominence. They first came into the limelight at a successful Spanish hall following the war. Their ability to inject real melody into any music, including jazz, is the secret of this orchestra's popularity



RADIO NEWS FROM ALL OVER THE WORLD

Hungarian Station

A NEW radio station has been erected at Szekesfehervar, receiving station at Tarnok, which will be open for general public correspondence. Call letters: HAR.

This radio station in co-operation with the old station at Csepel is intended for maintenance and development of radio communication with the European countries.

Both these radio stations, Szekesfehervar and Csepel are operated from the central telegraph bureau at Budapest.

Mexico's Need for Radio Communication

TAMPICO, MEXICO, and its environs have been subject to the troublesome exploits of bandits. The jungle country which spreads between the oil fields and the plain of Tampico offer the bandits a field of activity admirably suited to their purpose. One band in particular has succeeded in evading the rurales for a number of months. Finally it was discovered that the bandits were provided with field telephones which were tapped into the private lines of the oil companies, thus keeping themselves well informed of the dispositions adopted for their capture; and also informed them as to the companies' arrangements for paying their men. The companies tried to overcome the difficulty by sending pay rolls by aeroplane, but the telephone lines gave away the secret. The paymaster was captured before even he had reached the aeroplane. In face of such a situation the government was forced to take action. So the authorities have thought to handicap the operations of bandits by installing wireless.

The last paymaster captured was forced to turn over to the bandits 42,000 pesetas which he was carrying. Of the two Americans accompanying him, one was killed and the other wounded. The Mexican Government proposes to increase the facilities offered to commerce and industry by the existing paucity of telephone lines by organization of a net work of radio stations of the most modern type, cov-

ering the whole country. In this country of more than fifteen millions of inhabitants, the establishment of a satisfactory telegraph net work seems to be a tremendous undertaking and evidently a wireless installation is necessary. Forty-two radio stations are planned. Four stations will play the rôle of central stations, having a power of two to four kilowatts. They will



Station SPS mounted on top of the Serrath mountains and known as the highest radio station in the world. It is located in Santos, Brazil.

work on wavelengths of from 600 to 3000 meters with umbrella antennas comprising two separate sections, one for the longer wavelengths.

Radio World's Fair

THE First Radio World's Fair which is to be held in Madison Square Garden, New York City, Sept. 22nd to 28th, under the auspices of the Radio Manufacturers' Show Association, with U. J. Herrmann as Managing Director and James F. Kerr as General Manager, is attracting universal attention throughout the country. Leading newspapers here and abroad are devoting columns to the coming show.

As nine-tenths of the exhibiting space in Madison Square Garden has already been contracted for and as the remaining ten per cent. is oversubscribed, it is practically a certainty that the exposition will be forced to spread out and take in the 69th Regiment Armory, located just across the street, upon which the R. M. S. A. has just taken an option.

Among the new features to be introduced this season will be a "Foreign Division" in which many of the important radio interests abroad will be represented by carefully selected official exhibits. The European manufacturers and inventors are said to be making elaborate preparations for this their initial invasion of America and they promise to furnish the radioists of this country with a few real surprises.

A special "Board of Radio Authorities," now being chosen with great care, will award suitable prizes to the most meritorious wireless inventions perfected during 1924. The competition will be open to all and no entry fee will be charged. In addition to presenting each successful inventor with a medal, a diploma or cash, the jury of experts will also endeavor to assist each inexperienced successful inventor to market his or her invention to the best possible advantage at no cost. Public demonstrations and tests of the new inventions will be held daily, and many novel devices will probably be brought to light.

Two hours per day will be set aside for the exclusive transaction of business between exhibitors and wholesale buyers. The general public will be admitted at one o'clock every afternoon and the show will remain open until eleven o'clock every night, including Sunday, Sept. 28th, which is the closing day.

The Amateur Builder's Contest, which will be of an international character this year, will be a good sized exhibition in itself. Entries are already coming in from Europe, South America and distant points in this country. Space enough to display several hundred sets has been reserved and twenty-five valuable prizes will be awarded to the winners.

Third National Radio Show

THE Third Annual National Radio Show will be held this year in Grand Central Palace during the week of November 3.

Plans are under way for holding a convention of radio enthusiasts in connection with the annual Radio Week. This convention will embrace members of the trade as well as the army of fans. Celebrated scientists and important figures in the radio industry will participate in this congress.

Austrian Broadcasting

THE demonstrations of broadcasting by the Technological Trade Museum have made radio very popular in Austria. In view of the great economic and social importance of broadcasting, which has created a new industry in Austria, a permanent service has now been undertaken by the Oesterreichische Radio-Verkehrs-Aktiengesellschaft. At present this company co-operates with the Austrian Postal authorities in the matter of transmission.

It is proposed to use the radio installation on the building of the War Ministry for the first broadcasting station. Experiments have already been made with a normal sending power of one kilowatt. Different wave lengths will be used; on March 25, broadcasting took place for the first time on a

ket and exchange reports. Economic data, intended for a small clientele, will consist of foreign prices of commodities and stocks, tariff rates, freight rates, and other important economic reports. These reports will be given in code, which will be changed every week so as to avoid listening in by those not entitled to the service.

The tax for a radio set will be 10 gold crowns collected by the federal post offices. To cover the expenses of the broadcasting station, every owner of a radio set will have to pay a yearly fee of possibly 50 gold crowns. This fee will be reduced considerably in cases of hospitals, associations, and schools. Motion picture houses and other public places, where radio is used for advertising purposes, will pay a higher rate.

New General Electric Station

A LARGE experimental radio station will shortly be built by the General Electric Company for a more complete investigation of radio phenomena and broadcasting. It is understood that the cost of the experimental station will be approximately \$150,000, and that it will be located on land recently acquired by the company in Schenectady.

It is understood that a power house will be constructed capable of delivering high power at various frequencies, and antenna structures will be erected for a wide range of wave lengths so that systematic investigation can be made of the advantages of various wave lengths in solving the many problems with which radio now has to deal.

The requirements of the present-day broadcasting program, including stock reports at noon, an afternoon program for those at home, evening stock and market quotations, weather reports, musical programs, plays and religious services, have filled up the available time. It has also been found that the space available in the power house and operating section of the big broadcasting station is not sufficient to permit experimental work without interfering with the regular programs. On this account a new station was considered necessary for intensive experimental work.

The broadcasting station now known the world over as WGY was originally built, several years ago, for experimental purposes. Those familiar with the workings of the station know that the regular programs have been broadcast for many months at two wave lengths—the regular wave length of 380 meters available to those using standard receiving outfits and also a lower wave length of 107 meters which has been found particularly well adapted to long distance transmission for rebroadcasting. On several oc-

casions during the early spring, WGY's programs have been rebroadcast by the British Broadcasting Company in London and thus made available to the British Isles as well as to France and other continental countries. This is only one of the many experimental developments to which WGY has contributed.



A. Pawelek, radio engineer of the S.S. Columbus, holding the latest type of apparatus for testing spark gap of wireless transmitting set. Its construction is similar to a miniature crystal radio set. Antenna is enclosed in wood block with crystal detector and headphone plug in base

Spanish Radio Broadcasting

THERE is considerable evidence of the spread of radio interest in Spain. The Radio Society of Spain has in its recent radio concerts done particularly well. Radio fans in England received the speech of the Count of Alba de Yeltes, transmitted in English and in Spanish from the society's station. Radio concerts have been given by the station at Ciudad-Lineal under the direction of D. Antonio Castilla. A selected program of music and song was received by many persons all over Spain, who returned cards to this station announcing the reception of its program.

Scandinavian and German Movies and Broadcasting

COMBINING motion pictures and broadcasting, an interesting experiment is reported from Europe in which the new German radio station at Königswusterhausen broadcast a technical talk which was illustrated by a film run simultaneously in Copenhagen, Gotenburg, Christiania and several German cities. This first attempt at combining broadcasting with illustration by motion picture was made on May 11th. The broadcasting was done on a wave length of 2600 meters. This experiment opens up interesting possibilities.



S.S. Columbus broadcasting from her Brooklyn pier. This voice was heard upon the arrival of the ship, giving information to the country that the Columbus is the newest ocean liner, arrived in America

1200-meter wave length. On Easter another trial took place and regular broadcasting is to be started on July 1.

It is planned to broadcast general programs comprising musical performances, lectures, fairytales for children (in the evening), weather, mar-

Trans-Atlantic Radio Telephony Development

FOLLOWING a demonstration in January, 1923, made by the officials of the American Telephone & Telegraph Company and the Radio Corporation of America, in co-operation, radio telephone speech was transmitted for two hours from New York to London, the British Post Office appointed a committee to investigate trans-Atlantic telephony. This committee has recently recommended that the British Post Office establish a 200 k.w. radio telephone plant at their new radio station at Rugby, England. The committee recommends that this plant be of a type similar to that which has been used by the American Telephone and Telegraph Company and the Radio Corporation of America in the experiments which they have been carrying on for the last eighteen months in transmitting speech across the Atlantic.

If this work is carried out, it is the expectation that under favorable atmospheric conditions during the winter months, it will be possible to connect telephone subscribers in the United

States to telephone subscribers in London, and in this way permit them to talk to each other as they do over ordinary telephone circuits. In doing this the subscribers at each end would be connected to their respective radio stations by the wire telephone lines.

The British Post Office, to cooperate in this work erected a special form of receiving antenna, and pending the erection of a telephone transmitting station, have been carrying out careful measurements of the energy which they receive under various conditions from the telephone transmitting station in America, and also from certain telegraph stations.

The tests which will be possible when the British transmitting station is completed will form another important step in the work which has been carried on for many years in the development of radio telephony across the Atlantic Ocean. The first successful telephone transmission across the Atlantic was in 1915, when engineers of the American Telephone and Telegraph Company succeeded in talking by radio telephone from the United States Naval Station at Arlington, Virginia, across the Atlantic to Paris,

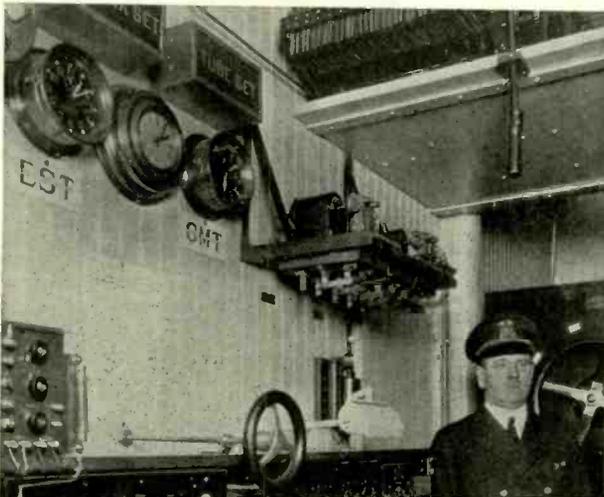
while the same messages were heard 5,000 miles to the westward at Honolulu. Another step in this work which created much interest took place January 14, 1923, at which time Mr. H. B. Thayer, President of the American Telephone and Telegraph Company, and other officials of that company, talking from their offices at 195 Broadway, New York City, were heard by a group of well-known engineers and others assembled at New Southgate, England. These tests were made possible by cooperation between the American Telephone and Telegraph Company and the Radio Corporation of America. The tests were very successful, the voices being clear and distinct, and easily recognized by the men at the receiving end who were acquainted with the speakers. The circuit remained very constant during the two hours for which speech was transmitted. Reception was carried out a part of the time through loud speaking receivers, and reporters present took down many of the messages verbatim.

The tests which have already been carried out, and the additional tests which will be made when the new British station is erected, will give information as to the practicability of establishing transatlantic telephone service, the best operating methods to be employed, the attitude of the public toward such a service, and many other factors to be determined before the opening of any regular commercial service.

Briefly, the news from London indicates that preparations are well under way for transmission from London to New York, and that when completed two-way talking, at least experimentally, will be possible. It will be remembered that transmission from New York to London was successfully accomplished in January, 1923, the answers from London being telegraphed by cable.

Moroccan Broadcasting

A MILITARY station at Tetuan, in northeast Morocco, is giving concerts and talks every afternoon from 5 to 5:50 by means of gramophone.



Above: Radio station aboard the S.S. Leviathan showing special duplex receiving apparatus which enables two operators to work simultaneously and independently. Radiograms can be sent to and received from American and European coastal stations, or ships, at the same time.
 Below: Radio staff of the S.S. Leviathan (left to right) E. N. Pickerill, chief; Geo. E. Sinclair, 1st asst.; Henry F. Bollendonk, Oscar L. Goertz, Paul W. Karr, Earl F. Whidon, Leslie Veader, Roy W. Jones, and two messengers. This staff handles a large volume of messages.



German Coastal and Ship Stations Rates

THE coast station rate of all German stations, shown in the Official List of Radiotelegraphic Stations open for general public correspondence, will be 30 centimes per word, minimum Fr. 2.40 per radiogram.

Ship tax of all German stations shown in the above mentioned list open for general public correspondence (with the exception of the naval stations, the ship station Hertha DHQ and Odin DOQ) will be 40 centimes per word, minimum Fr. 3.20 per radiogram.

The interior rate will be 15 centimes per word, minimum Fr. 1.20 for ordinary radiograms and 45 centimes per word, minimum Fr. 3.60 for urgent radiograms.

Directional Transmissions to Australia

POSSIBILITY of transmitting radio messages in a "beam" between England and Australia—an airline distance in excess of 8,000 miles—is likely to be demonstrated, according to an announcement in the Australian House of Representatives by Premier Bruce.

The Premier is quoted in a Melbourne despatch as saying the whole position of radio transmission had been radically changed "within the last fortnight."

Senator Marconi, inventor of the wireless, announced development of a system of directional radio transmission early last December. The electric waves carrying the message, he said, could under the new scheme be turned in any desired direction, like the beam of a searchlight, as opposed to the present system whereby the waves are sent out in all directions.

He announced that communication had been successfully carried on by this means between England and St. Vincent, one of the Cape Verde islands, a distance of 2,250 nautical miles. Only a fraction of the electrical energy hitherto found necessary was employed.

Argentine Broadcast Progress

NOT only are Monte Grande and Villa Elisa to be centers for transmission and reception respectively of trans-Atlantic radio telegraph messages, but these particularly favorable sites are to be utilized for the installation of a powerful broadcast receiving and sending station. The receiving station is being installed at Villa Elisa which will be capable of getting North American broadcasting stations. The programs from these stations will then be relayed by cable to Monte Grande,



Argentine government radio station, one of the most powerful in South America, located at Buenos Aires in the entrance of the harbor of Darsena Norte

where they will be rebroadcast from an antenna that is being erected close to the larger antenna of the high power station. The studio of the present station whose call letters are LOZ, located in Buenos Aires, will also be connected by cable with this transmitter at Monte Grande. The engineers claim that the installation of this broadcasting station will not interfere with the present transoceanic station. This represents the first commercial installation of broadcasting on a considerable scale.

Two new broadcasting stations of an official character have recently been established in the Argentine—one at the University of La Plata and one of equal power in Mendoza. Both these stations are expected to cover a wide range.

Secret Radio Wave

JOHN HAYS HAMMOND, Jr., the American inventor, has demonstrated to the British Admiralty his latest device in radio transmission. He has entered into a contract with the Italian Government for a number of transmitting and receiving sets of a new system, to be constructed in the United States.

This system permits of secrecy in radio transmission and enables each station to send more than one message simultaneously on the same wave length. Great utility in wartime is claimed for it because it makes use of certain combinations of wave lengths which must be known before a message can be picked up.

Belfast Broadcast Station

IN Belfast, a new broadcast station will be added shortly to the present British Broadcasting Co. installation. This new station will have the call letters 2BE, and will transmit on a wave length of 435 meters.

Danish Wireless Association Formed

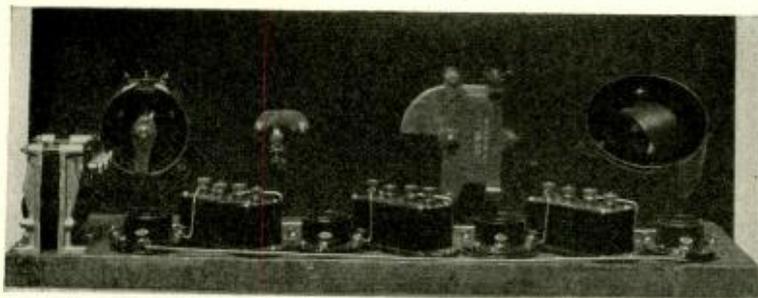
AT a recent meeting in Copenhagen, representatives of all the provincial radio clubs resolved to form a national association of such clubs. The general object of the association is to safeguard the interests of radio amateurs. The task of the association is to provide funds for the establishment and operation of a modern and powerful broadcasting station in Denmark.

Radio at the Political Conventions

THE latest developments in radio and the new method of transmitting photographs by telegraph were used to make the proceedings of the Republican National Convention audible and visible to millions of Americans, distant from Cleveland during the period of the convention.

Arrangements were perfect for sending the convention speeches broadcast from radio stations as far west as Kansas City and for amplifying the voices of the speakers so that they could be heard distinctly by every one of the audience.

Extra microphones were installed to prevent any possibility of mishap. In addition to a regular amplifying set which remained permanently in the hall, a duplicate emergency set was installed to be switched on in case there should be any unforeseen accident to the regular apparatus. Among the stations broadcasting the proceedings were: WRC and WCAP, Washington; WEA and WJZ, New York; WNAC, Boston; WGY, Schenectady; WGR, Buffalo; KDKA, Pittsburgh; WJAX and WTAM, Cleveland; WLW, Cincinnati; WLS and WGM, Chicago; KSD, St. Louis, and WDAF, Kansas City.



A FOUR-TUBE set adapted for Summer use—3 stages of radio frequency amplification, a crystal detector and two stages of audio frequency amplification gives ample distance and volume.

The Wireless Age Portable Reflex

Not So Big, But It Gets the "Sigs"

By Robert Alan

SUMMER is here again and the exodus from the cities has begun. Those who have spent the long winter evenings listening to their favorite broadcasting station, will miss a great deal of pleasure if they depart for the summer months without a radio set in the trunk. Now those who do pack a set along with their blankets and swimming suits are not going to make that set the five-tube neotrodyne or the 10-tube "super" which they have used all winter. What they will take is a nice little portable outfit that really is portable. It's going to be portable in every respect, the antenna, the batteries and the loud speaker.

First of all there is no loop which meets our idea of thorough portability, so we won't use a loop. The set must be much more sensitive than your home outfit because wherever you are, on the yacht, or camping in the mountains or at the shore, the chances are that you are going to be a distance from a broadcasting station. Your portable summer set must be able to bring in the city stations with as much satisfaction as you are accustomed to in the city. In order to do this it must have at least three stages of radio frequency amplification. Considering all things we have decided to adapt the four-tube set described in the April issue of *THE WIRELESS AGE* for summer use, and make it as portable as is possible. The only way this new set differs from the April set is in the antenna. Instead of using a loop we have incorporated a vario-coupler in its place, so that it can be used with an outside antenna. Now this antenna can be most anything in the shape of a single wire stretched out between two trees, or between your tent pole and a stake driven in the ground about forty feet away. Because of the sen-

sitivity of the set it will be possible to obtain results with a very poor antenna. With the poorest kind of antenna it will still give better results than the loop will. We are going to use a crystal detector because we like crystal detectors in reflex sets, and because it will save us one tube and because we have found a very good one. The set will include three stages of radio frequency amplification, crystal detector and two stages of audio amplification, the first of which is reflexed back to the third radio tube. This set when finished will be possibly six inches deep and twenty-one inches long and can be very easily placed in the suit case or placed in a cabinet with a carrying strap.

THE PANEL LAY-OUT

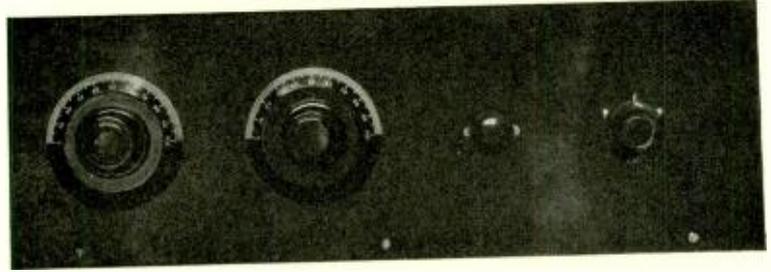
In drilling the Formica panels, start with the three holes for the screws which secure the panel to the baseboard. These are placed three-eighths of an inch from the edge of the panel

and one centered along its length and one on each end, two inches from the edge. This provides a good stable support for the panel. The vario-coupler is mounted along its extreme left end with its center hole three inches from the left hand edge. The variable condenser, Cardwell .0005, is mounted next with its center hole eight and one-half inches from the left end. Next drill the holes for the Filkostat and General Radio potentiometer. The potentiometer is located three and one-half inches from the right end and the Filkostat seven and one-half inches from the right end. Four-inch dials are used on the tuning instruments because they afford greater ease of adjustment and closer tuning. Assemble the instruments on the panel, then lay it aside and mount the transformers and sockets on the baseboard. The radio frequency transformers are mounted in echelon fashion at a forty-five degree angle with respect to the rear of the baseboard. The tube sockets are mounted between the transformers and flush against the rear of the baseboard. Starting at the left the first socket is centered two inches from the left hand edge. A transformer mounted next, the second socket six and three-quarter inches from the left hand end and so on down. The sockets are four and three-quarter inches between centers. This affords room at the left hand end for mounting the second audio frequency transformer. The first audio frequency transformer is mounted between the potentiometer and the Filkostat up against the rear of the panel. You will find the Filkostat of considerable value in the regulation of these UV-199 tubes which we are going to use and a very critical adjustment can be had. Follow the photographs closely in mounting the

LIST OF MATERIALS

- 1 .0005 Cardwell variable condenser
- 1 Paragon vario-coupler
- 4 Na-Ald UV-199 sockets
- 3 Acme Radio frequency transformers (R-2) (R-3) (R-4)
- 2 Acme Audio frequency transformers
- 1 General Radio Potentiometer 400 ohms
- 9 Binding posts (Eby)
- 1 Pacent single circuit phone jack
- 2 Quinby frames
- 1 Formica 7" x 21" panel
- 1 Formica strip 2" x 14"
- 1 .001 Dub. Micadons
- 2 .002 Dub. Micadons
- 8 Lengths bus wire
- 4 Lengths spaghetti
- 1 Base board 7" x 20"
- 1 Foote fixed crystal
- 1 Marco panel mounting tap switch—7 points
- 1 Carter jack switch for A battery

instruments as the arrangement represents much experimentation in providing general all around efficiency. This arrangement keeps the grid and plate capacities as low as possible and the radio frequency amplifier as stable as possible. Do not attempt to hook up a radio frequency amplifier with wires running criss-cross. If you do you will cause the amplifier to oscillate beyond the control of the potentiometer. Directly above the Filkostat on the panel will be found the Foote crystal detector. This is an exceptionally good one and will be found to give satisfaction. Thus the output of the third stage of radio frequency amplification is sent right into the crystal detector and the reflex audio transformer. The audio frequency tube of the third radio frequency tube is then sent into the second stage of audio frequency whence it goes into the loud speaker. The first connections to be made after connecting all the instruments are the filament leads. These connections are plainly shown in one of the illustrations. Run one of these leads to the rheostat and from there to the binding post on the sub-panel in the rear of the baseboard. Connect the other lead direct to the other "A" battery binding post. Now before going further connect up your three dry cells to these terminals and place all four tubes in their sockets and make sure that they all light properly. If this is done now it will obviate retracing your filament connections in case of an error later on. Now connect up your transformer leads. If the transformers are mounted correctly, the grid and plate leads will probably be less than one inch long which is what we have been striving for. Be sure not to omit the small fixed condensers shown in the diagram. One of the .002 mfd. fixed condensers is shunted directly across the B battery binding posts on your



The front panel arrangement is made with a view to economy of space combined with facility in operating the receiver

terminal strip and acts as a bypass condenser around the B battery. The B battery with its long leads and inherent high resistance must have some sort of bypass for the radio frequency currents. The other .002 fixed condenser serves the same purpose with respect to the primary of the second audio frequency transformer. The .001 fixed condenser across the primary of the first audio frequency transformer performing the same function as a phone condenser in an ordinary hook-up.

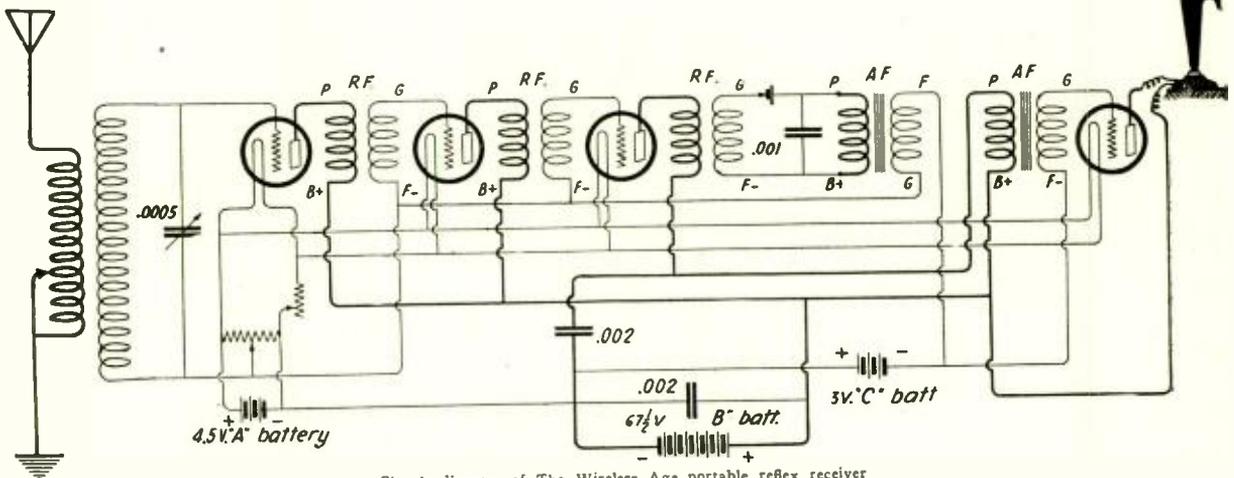
Connect the variable condenser across the secondary of the vario-coupler and then run leads from the stator plates to the grid of the first radio frequency tube and from the rotor plates to the arm of the potentiometer. There are seven taps on the primary of the vario-coupler which are connected to the panel mounting tap switch shown on the panel. This tap switch is mounted conveniently between the condenser and coupler. Be sure that the condenser plates are connected as stated, for this will eliminate any hand capacity effects—there being no difference in potential between your

hand on the dial and the potential of the filament circuit. There is a point on the plate current-grid voltage curve of every tube where that tube will amplify to its greatest extent with a minimum of distortion. If we use sixty-seven volts on the plates of our amplifier tubes we must use a three-volt "C" battery to carry out this condition. This will keep our plate current low and save our "B" battery. The leads from the audio frequency transformer posts marked F minus or A minus are brought to the negative C battery binding posts on the terminal strip mounted on the rear of the baseboard. A connection is then made from the positive C battery binding posts to the negative filament lead.

YOUR PORTABLE ANTENNA

About the simplest form of a portable antenna consists of about one hundred and fifty feet of No. 18 bell wire. When you take this out you roll it up on a spool and put the two insulators in your pocket, and you have a good antenna all ready to put up. Fasten one insulator to a tree branch

(Continued on page 84)



Circuit diagram of The Wireless Age portable reflex receiver

Condensers

Radio Frequency and the Design of an Efficient Condenser

By Donald Gordon Ward

Associate Member, Institute of Radio Engineers

PART II

IN the first of this series of two articles which was published in the June, 1924, issue of THE WIRELESS AGE attention was called to some of the general requirements which should be met in the construction of condensers and several points which should be specified by the manufacturer. The points which were previously mentioned referred to the maximum and the minimum capacity being marked upon the condenser so that a purchaser will know if the condenser which is offered him is of the proper capacity range to fit with his inductances to give him a circuit of the wave length range which he wishes to have in his receiver.

Another quality of a condenser which is very important to understand is that of the value of the radio frequency resistance that is present in the condenser. In order to thoroughly explain this phenomena and to explain why it is a vital consideration in the design of an efficient condenser it is first necessary to make a few general statements with regards to radio theory.

In a tuned radio frequency circuit the effect of resistance is to broaden the tuning of the circuit and the higher the resistance of the circuit, the greater the extent to which the tuning is broadened. It is therefore highly important, especially in view of the increasing number of broadcasting stations to have a receiver which tunes as sharply as possible. Resistance may be the result of many conditions in a circuit, such as loose joints in the antenna, unsoldered connections, which have become corroded, or resistance in the coils, but we are going to confine ourselves to an exposition of resistance in condensers, with special reference to variable receiving condensers.

One of the first causes of resistance in a variable condenser is in poor contact between the rotary plates and the terminal of the rotary plates. Where the condenser depends for its contact upon a shaft with a conically cut end resting in a concave bearing it will be found that owing to oil having been used when the shaft was turned to size that some of the oil which during the cutting process had been secreted in the pores of the material gradually works out of the pores of the shaft as it is rotated, after the condenser has been put into use and that this layer of

oil in the contact offers a very high resistance to the passage of the radio frequency currents. One great disadvantage of this type of connection lies in the fact that this resistance is not always present and that as a result the resistance comes and goes produc-

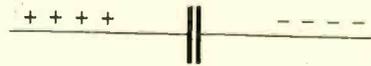


Figure 1

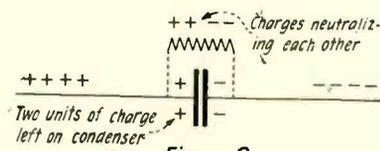


Figure 2

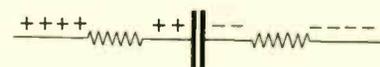


Figure 3

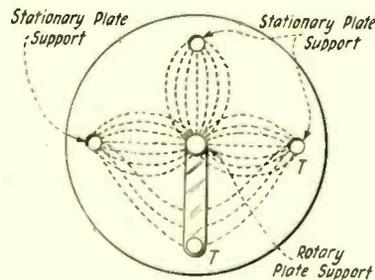


Figure 4

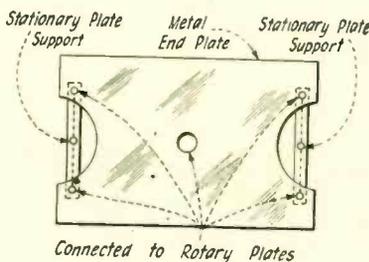


Figure 5

Elements entering into high and low loss condensers

ing a condition that is one of the most difficult to trace. Very often this trouble comes on slowly as the oil is gradually worked out into the bearing and oftentimes it comes so slowly that its action is not appreciated until after it is found that the receiver begins to bring in a lot of interference and that

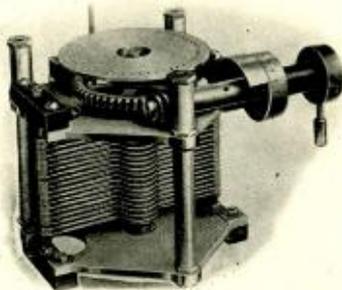
in many cases signals come in and go out with startling abruptness as the condenser is rotated, sometimes accompanied by a slight scratching noise.

It is therefore advisable when purchasing a variable condenser to pay particular attention to the type of contact that is provided for the rotary plates. This is often corrected by providing the condenser with pigtail connections to the rotary plates and at the same time installing stops upon the condenser so that it may only be rotated one complete revolution as otherwise the pigtails would be gradually twisted off. Another method of making connection to the rotary plates is by means of a contact joint of large surface area. In this case, of course, the very large surface area of the joint will prevent any trouble which might be due to poor contact and in addition when a large joint is employed there is less likelihood of having short circuits develop owing to a poor bearing which allows the plates to move from side to side.

As will be noted, aluminum is the metal which is most commonly employed for plates in a variable condenser with brass a fairly close second. The reason for this is that the radio frequency currents travel only on the surface of the conductor, and therefore the resistance which any material offers to the radio frequency currents lies in its surface. Every metal when exposed to the air gradually becomes oxidized and in some cases this oxide forms very rapidly while in others it takes a considerable length of time for the oxide to form. The metal itself and its oxide very often have radio frequency resistance values which are considerably different. It is therefore advisable to use as a metal for plate construction one which has a radio frequency resistance of the metal closely approaching the radio frequency resistance of the oxide itself or else to use a metal which oxidizes very quickly and has as low as possible a radio frequency resistance of the oxide of the metal. In the case of aluminum the oxide forms almost immediately after cutting and it has as low a radio frequency resistance as it is practicable to obtain in a metal which oxidizes rapidly. There are naturally many grades of aluminum and though the author is not aware of any recently published data on the

radio frequency resistance of different grades of aluminum there is every reason to believe that it differs greatly with the grade of aluminum employed and therefore it is advisable to employ brass in condensers instead of using a grade of aluminum which is any less than the best. These ideas should be taken as general statements and not as specific ones as it must be realized that improvements in the refining of metals are being made daily and if other metals are employed in condensers other than aluminum it is reasonable to suppose that the manufacturer of that condenser has made a study of the adaptability of the various grades of metal. If he has neglected to consider this point he will find that after the man who builds his own commences to demand a statement as to the radio frequency resistance of his product preferably tested by some standardizing laboratory that the demand for that condenser is falling off rapidly and it will be soon found necessary to stop its manufacture.

It has been noted lately in several articles on condensers that brass as a metal for the construction of variable condensers has been preferred to aluminum. The reason advanced was that brass could be soldered and aluminum could not and that therefore brass should be preferred, providing that the plates were carefully soldered to the supports. The advisability of this type of condenser manufacture is be-



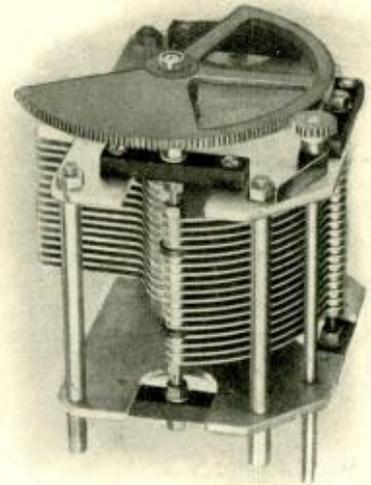
Laboratory type of low loss condenser

lieved to be open to question as solder offers a very high resistance to radio frequency currents as it contains lead and the radio frequency currents traveling as they do on the surface of the conductor will therefore naturally flow over the surface of the lead and the condenser will have a high resistance and the receiver which uses them will be found to tune rather broadly.

The final radio frequency resistance consideration lies in the type of insulation that is used between the rotary and the stationary plates, how much of it there is, and where it is placed. The very best type of insulating material that has been used so far is hard

rubber, providing that it is of the very best grade. The one disadvantage of hard rubber lies in the fact that it is not so strong mechanically as some other substances and therefore some manufacturers prefer other compounds which though not so efficient electrically are to be preferred mechanically. Other "insulating" materials many of them of the so-called "Moulded mud" variety are best left alone though no doubt some of the moulded compounds are quite satisfactory, but here again the entire matter would be settled by the manufacturer giving a guaranteed statement of the resistance of his condenser and then if a moulded substance were employed it would have to be of a certain grade or otherwise the demand for that condenser would fall off after the public came to realize that it wanted a condenser with a low resistance in order that the radio receivers would tune sharply.

The method of supporting and insulating the rotary from the stationary plates is an important consideration in the condenser which is designed with a view to low losses. In connection with this a rather amusing experience which the author had a couple of summers ago while on his vacation might be included as an example of what one manufacturer's idea was concerning condensers. (This man's product has since disappeared from the market.) During his vacation in one of the New England States he had occasion to go into a radio store to make one or two minor purchases and the statements given here were overheard as this manufacturer's ideas regarding variable condensers. At the time he was attempting, rather unsuccessfully, to sell his product to the owners of the store. One of the first statements that he made, in reply to a question as to why he did not use aluminum end plates was that his condensers were made with moulded composition because he wanted to put the best into his condensers and that the manufacturers who used milled aluminum end plates did it because it was cheaper. To anyone who is even slightly acquainted with manufacturing process of a mere matter of moulding a substance that can be poured into place as against a carefully and accurately milled aluminum plate this sounds ridiculous in the extreme. Another statement was to the effect that as this moulded insulation was a better insulator than aluminum, which I think everyone admits, it were better to use this insulation in large amounts than be economical with it as is the case in the metal end plate condensers. The point is that the more sparing a manufacturer is with his insulating material the better will be his product.



Commercial type of low loss condenser

The condenser is a device that is used to store up electrical energy in the form of electrostatic lines of force and we want to be sure that it stores them all up and that none of them are permitted to leak away as in the latter case our condenser loses in efficiency. This action results in two charges being stored up on the plates of the condenser as per figure 1. We will say that the charge on one set of plates is positive in character and the other is negative in character. The natural tendency of these two charges is of attraction and if all of the charge on the positively charged plate can pass over to the negatively charged plate the result is that the electrostatic lines of force have disappeared and when we want to use this energy to operate our detector tube it is no longer there.

One of the most important of these resistances is in matter of fact a lack of resistance between the plates thus permitting our energy to pass from one plate to the other in the form of a leakage of current. For example let us suppose that we have as illustrated in figure 1 four units of charge. In this case let us use a perfect insulating material. The four units are then held in the condenser in the form of electrostatic energy and are available for use in our detector a minute fraction of a second later when we want to use them. Now let us suppose as per figure 2 we have such a leakage path between the plates of the condenser, presumably caused by a poor dielectric or insulating medium, or the insulation in the wrong place, etc., that two of these units pass through the insulation and cancel two of the negative units on the opposite plate, then when we come to use the

(Continued on page 92)

Antennas and Grounds

Regulations for the Proper Installation of Lead-in Conductors, Ground Switches, Fuses and All Wiring—The National Electric Code for Radio Receivers

ANTEENNA and counterpoise outside buildings shall be kept well away from all electric light or power wires of any circuit of more than 600 volts, and from railway, trolley or feeder wires, so as to avoid the possibility of contact between the antenna or counterpoise and such wires under accidental conditions.

Antenna and counterpoise where placed in proximity to electric light or power wires of less than 600 volts, or signal wires, shall be constructed and installed in a strong and durable manner, and shall be so located and provided with suitable clearances as to prevent accidental contact with such wires by sagging or swinging.

Splices and joints in the antenna span shall be soldered unless made with approved splicing devices.

The preceding paragraphs shall not apply to light and power circuits used as receiving antenna, but the devices used to connect the light and power wires to radio receiving sets shall be of approved type.

LEAD-IN CONDUCTORS

Lead-in conductors shall be of copper, approved copper-clad steel or other metal which will not corrode excessively, and in no case shall they be smaller than No. 14, except that bronze or copper-clad steel not less than No. 17 may be used.

Lead-in conductors on the outside of buildings shall not come nearer than 4 inches to electric light and power wires unless separated therefrom by a continuous and firmly fixed non-con-

ductor which will maintain permanent separation. The non-conductor shall be in addition to any insulating covering on the wire.

Lead-in conductors shall enter the building through a non-combustible, non-absorptive insulating bushing slanting upward toward the inside.

Each lead-in conductor shall be provided with an approved protective device (lightning arrester) which will operate at a voltage of 500 volts or less, properly connected and located either inside the building at some point between the entrance and the set which is convenient to a ground, or outside the building as near as practicable to the point of entrance. The protector shall not be placed in the immediate vicinity of easily ignitable stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

ANTENNA GROUNDING SWITCH

If an antenna grounding switch is employed, it shall in its closed position form a shunt around the protective device. Such a switch shall not be used as a substitute for the protective device.

It is recommended that an antenna grounding switch be employed, and that in addition a switch rated at not less than 30 amperes, 250 volts, be located between the lead-in conductor and the receiver set.

FUSES

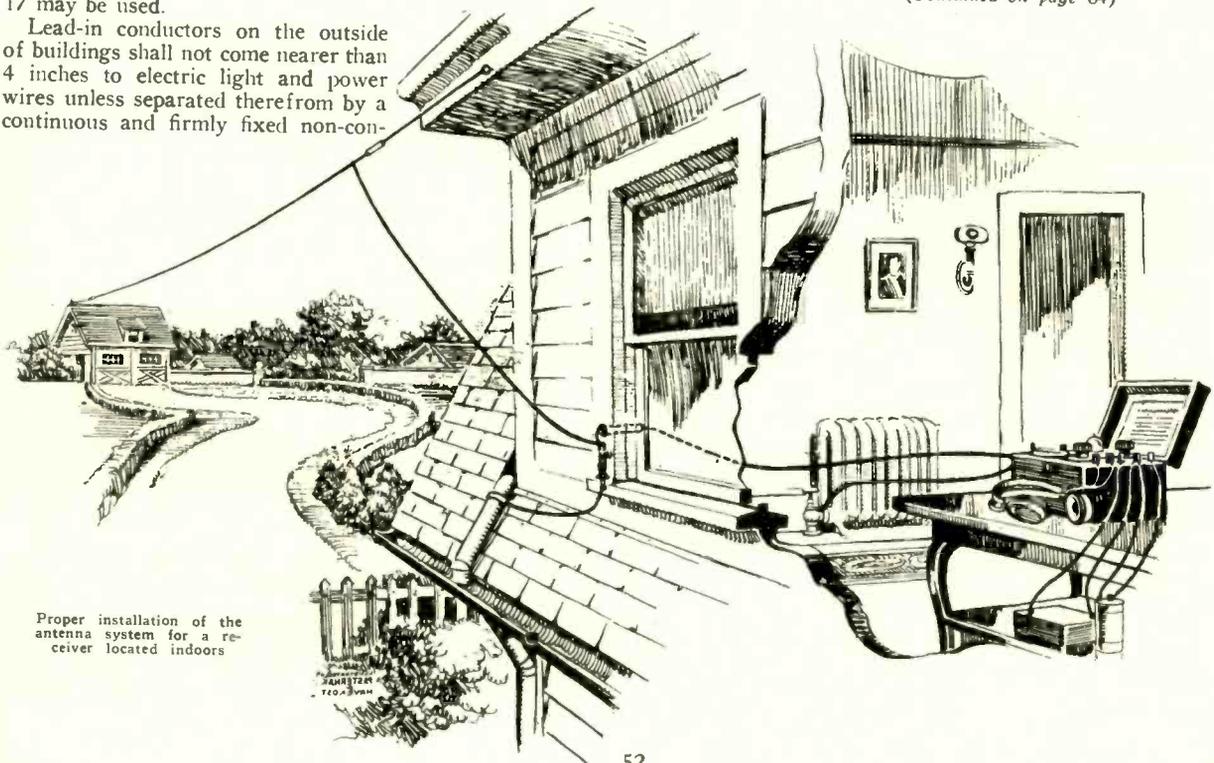
If fuses are used, they shall not be placed in the circuit from the antenna through the protective device to ground. Fuses are not required.

GROUNDS

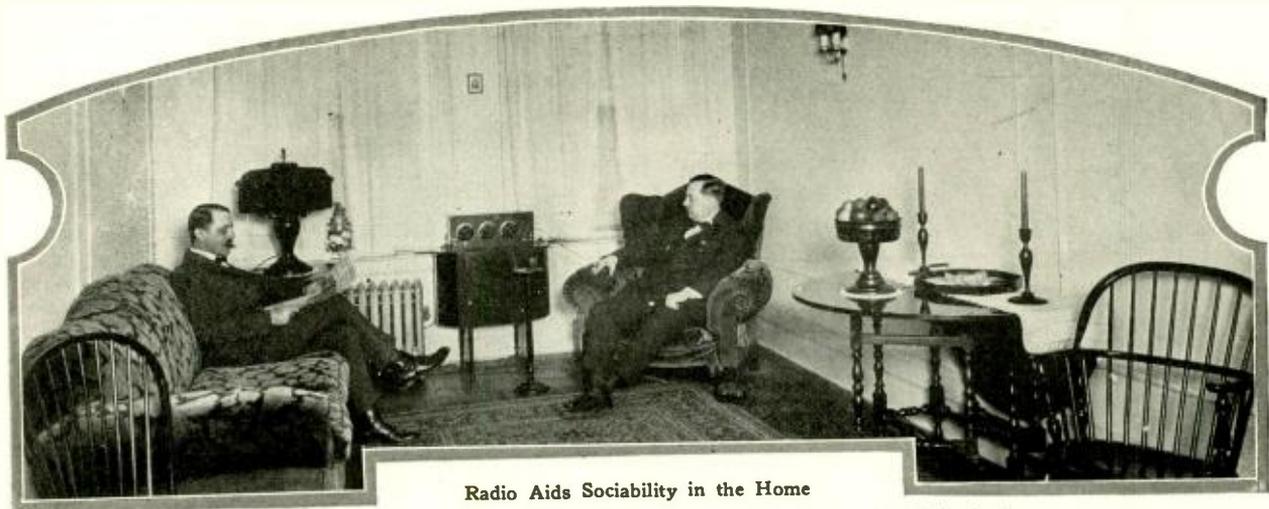
The protective grounding conductor may be bare and shall be of copper, bronze or approved copper-clad steel. The grounding conductor shall be not smaller than the lead-in conductor and in no case shall be smaller than No. 14 if copper nor smaller than No. 17 if of bronze or copper-clad steel. The grounding conductor shall be run in as straight a line as possible from the protective device to a good permanent ground. Preference shall be given to water piping. Other permissible grounds are grounded steel frame of buildings or other grounded metal work in the building, and artificial grounds such as driven pipes, rods, plates, cones, etc. Gas piping shall not be used for the ground.

The protective grounding conductor shall be guarded where exposed to mechanical injury. An approved ground clamp shall be used when grounding conductor is connected to pipes or piping.

(Continued on page 84)



Proper installation of the antenna system for a receiver located indoors



Radio Aids Sociability in the Home

Mr. Van Blaricom Disguises His Loud Speakers as a Lamp and a Fruit Bowl
A Prize Winner in "The Wireless Age Radio in the Home Picture Contest"

Radio for Veterans in Hospitals

General Frank T. Hines, Director of the United States Veterans Bureau
Is Arranging Complete Radio Installation for the Disabled Veterans

"RADIO brings a new form of remedy to disabled veterans of the World War," declared General Frank T. Hines, Director of the United States Veterans Bureau, recently, in discussing the effect of radio on the sick and disabled ex-service men in the Veterans Bureau hospitals.

"The minds as well as the bodies of our disabled soldiers must be made well and the great growth of the radio industry provides entertainment and education that heretofore has been denied. It must be remembered that many of our patients are bed-ridden. Others are suffering from tuberculosis and still more are afflicted with nervous and mental disabilities. Radio is a means of entertainment for these shell-torn veterans which will take their minds from their afflictions. The educational lectures which form a great part of many of the radio broadcasting programs are enlightening and serve as a medium of keeping the bed-ridden patient in touch with the doings of the outer world."

Orders have recently been issued by General Hines which will provide each of the U. S. Veterans Hospitals with complete radio equipment. This is in keeping with the established procedure of providing every possible assistance to enable the veterans of the World War to regain their former health.

The general plans for the installation of radio equipment call for one master set located in a central point of a hospital. This master set, preferably a

By Charles W. Swan

neutrodyne or super-heterodyne receiver, will be under the direct supervision of the medical officer in charge and operated by employees of the hospital. Leads will be run from the master set which will also be provided with suitable amplification for the various wards and assembly rooms where loud speakers will be located. For the bed-ridden patients, the plans call for leads to be run parallel with their beds and phone plugs and connections with head sets at each of the beds. These sets will be able to receive programs broadcast from a minimum distance of 1,000 miles.

At the present time some thirty-seven of the U. S. Veterans Hospitals have been equipped, many by private agencies, and it is expected that the remaining institutions will have their equipment installed by July 1st of this year.

The plans for the installation of radio equipment in the U. S. Veterans Hospitals are necessarily varied and conform to the type of hospital and the class of patients in the hospital. Loud speakers will be installed in many wards of various hospitals while in others, particularly the institutions caring for tuberculosis patients who are bed-ridden, head sets will be provided with bedside terminals.

"I found many radio sets in quite a few of the hospitals during my inspec-

tion trips," declared General Hines, "and many of these were made by the patients themselves. At Mt. Alto Hospital in Washington, there are many types of radio receiving sets ranging all the way from the small crystal receiver to a huge super-heterodyne which is being completed by one of the patients at the present time. Radio has brought entertainment to these men in our hospitals who need diversion and I expect very shortly to have all of our hospitals with complete equipment to care for the veterans' needs.

"I feel sure that the installation of radio sets will be a boon not only to bed-ridden patients, but to all of the disabled men in the hospitals."

Ernest Jeffery, a patient at the U. S. Veterans Hospital No. 32, Washington, D. C., "builds his own"



Amplifiers

A complete review of the principles of correct design

By Louis Frank

PART III

Transformer Coupled Amplifiers

Part I appeared in the May issue and treated single stage amplifiers; resistance and inductance amplifiers, tuned circuit amplifiers and tuned radio frequency. Part II in the June number continued this subject with multi-stage amplifiers; resistance coupled, impedance coupled, audio and radio frequency and choke coils.

IN our treatment of the subject of amplifiers we now come to the final type of amplifier, the transformer coupled amplifiers. The transformer coupled amplifier has one great virtue over all other types, namely it gives more amplification for your money. With properly designed circuits the transformer coupled stage will give from three to five times as much as any other type of amplifier. The reason for this will be seen from the following.

Audio Frequency Amplifiers

Figure 1 illustrates the circuit diagram for a two-stage audio frequency amplifier. Each stage is coupled to the following one by means of an audio frequency amplifying transformer. In such an amplifier there are really two amplifying processes taking place in each stage. In the first place the signal is amplified by the audio frequency transformer because the voltage is stepped up in the secondary. A transformer having a ratio of three to one raises the signal three times, while one with a ratio of four to one raises the signal four times. In the second place amplification takes place in the tube itself, just as it takes place in the other amplifiers previously described in *THE WIRELESS AGE*. It is the added amplification of the transformer which makes this type of amplifier superior to all others. Now the amplification of the tube itself inevitably takes place if the tube has no defects. But unless the transformer is properly built, not only may amplification not take place in the transformer, but if it is not properly fitted to the tube the amplification of the tube itself may be destroyed.

Most transformers as built today give quite good amplification characteristics. This is because they are built to match the properties of standard vacuum tubes such as the UV-201A and UV-199 tubes. For maximum amplification to be obtained from the tube it is necessary that the transformer inductance be very great as compared with the tube resistance and the transformers marketed meet with this requirement to a considerable extent.

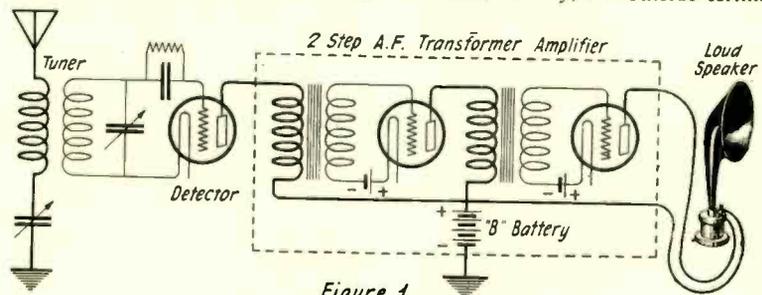


Figure 1

Circuit diagram of a two-step audio frequency amplifier

If the builder of a receiving set buys one of the standard, well-advertised makes of transformer he will secure satisfactory results. It is not recommended that he try to build the transformer himself, as there are so many factors to take into account that it is not likely a home-made transformer will prove very successful.

But assuming that the transformers are secured, what makes for success or failure in an audio frequency amplifier are the small details. First there is the manner of connecting the secondary of the transformer to the grid circuit of the tube. The correct way to connect it is as shown in figure 2, the outside turn being connected to the grid, the inside turn which is nearest the core of the transformer to the fila-

ment side of the tube. It will help to understand why. The grid element of the tube is the most sensitive of all parts of the tube. Nothing should be connected to it which would produce any extraneous effects other than those desired or required. Now if a capacity is connected to the grid side of the tube some of the speech currents will be shunted or by-passed through the capacity to the loss and detriment of the amplifier. Now the turns of the secondary winding of the transformer which are nearest the iron core have a greater capacity to earth than the turns which are on the outside of the winding. Thus the inside turns should be kept as far from the grid as possible. This requires connecting the outside terminal of the secondary to the grid. While transformers are not marked this way it is very easy to tell which terminal is the outer terminal by simply examining the transformer and noting which terminal comes from inside the winding and which from the outside. This precaution in connecting transformers is really quite important and determines to a considerable extent the tone and loudness of the signal. A similar precaution holds for the connection of the primary winding. The terminal nearest the transformer core, namely, the inside terminal, should be connected to the plus side of the plate battery, and the terminal farthest from the core, namely, the outside terminal

of the primary, should be connected to the plate. These proper connections are shown in full detail in figure 2.

C Battery Voltage

We now come to an important detail which is very largely overlooked by broadcast listeners building their own, namely, the use of a negative "C" battery on the grid of the audio frequency amplifiers. This is absolutely necessary if the quality of speech and music received is to be good. It is best to accept this statement as gospel truth and build on that basis. For those readers who are skeptical and like to know the why and wherefore, figure 3 shows the reason. This figure gives a

characteristic curve of the vacuum tube, and the curve simply shows the response of the tube for different values of grid voltages. When a speech voltage is applied to the grid of a tube it swings equal distances on either side of the average grid voltage. Thus figure 3 (a) shows an alternating speech voltage applied to the grid when the grid voltage is zero. But the response of the tube or plate current does not swing equal distances on either side of the average plate current, because the characteristic curve is really curved in the neighborhood of zero grid volts, as shown by the heavy part of the curve. This unequal response of the tube for equal voltages on either side of the zero grid voltage mark results in distortions and very poor quality. Suppose, however, that we put a negative voltage on the grid of $4\frac{1}{2}$ volts and now apply our speech voltage to the grid. The situation now has the appearance shown in figure 3 (b). This time the response of the tube, or plate current, varies equally on both sides of the average plate current when a speech voltage is applied. The reason is that we are working on the straight line portion of the characteristic curve where maximum amplification and distortionless amplification are secured. The exact value of negative grid voltage to use depends upon the plate voltage used and the tube manufacturers generally state these values. A safe value for almost all audio frequency amplifiers is about $4\frac{1}{2}$ volts negative.

There is yet another advantage, and an important one, to be gained by using a negative voltage on the grid. The life of the plate battery is thereby increased two to three times. Figure 3 shows that the plate current at zero grid voltage is much greater than when the grid voltage is negative. The more negative the grid voltage the less the plate current. The greater the plate current, however, the sooner is the plate battery used up, resulting in increased maintenance. Hence by using a negative grid voltage on the amplifier tube the added advantage is se-

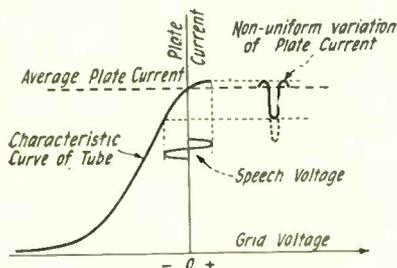


Figure 3a

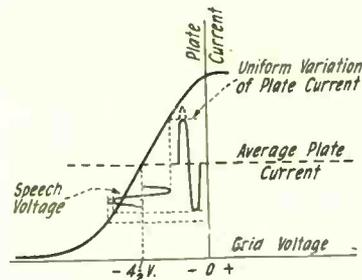


Figure 3b

Graphic curves illustrating the action of vacuum tubes under different values of grid voltage

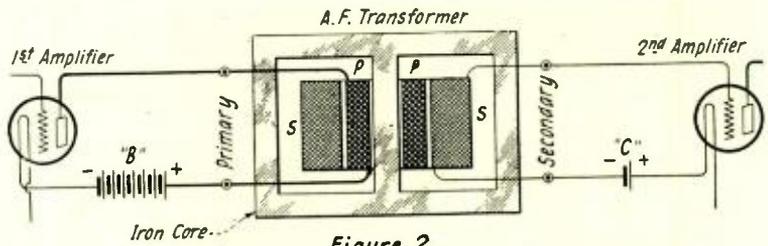


Figure 2

Diagram illustrating the proper connections of the A. F. transformer

cured of increasing the life of the plate battery considerably.

The use of transformer coupled amplifiers enables the maximum effect to be secured from the plate battery. For the amplification increases as the effective voltage on the plate increases. Inasmuch as the resistance of the primary winding is relatively small compared to the resistance of the tube practically the entire voltage of the plate battery is effectively applied to the plate, hence the maximum amplification possible with the given plate voltage is secured.

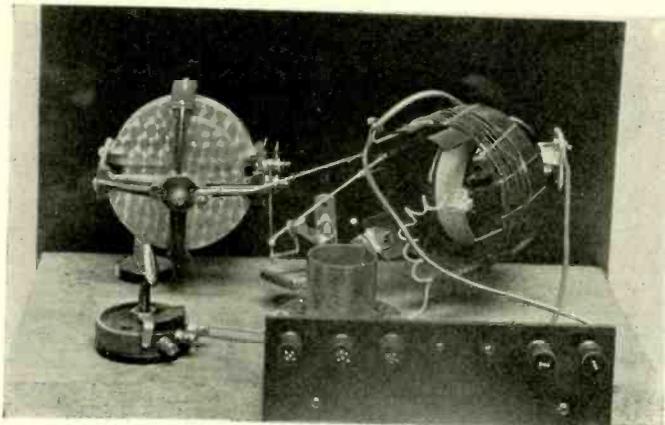
While it is entirely possible to use three or four stages of resistance coupled amplifiers without much or any difficulty it is not possible to do this stunt with the transformer coupled audio amplifier. In the first place when the amplification is made very great there is a tendency on the part of transformer coupled amplifiers to howl; that is, they generate audible signals which interfere with reception and produce distortion. In the next place other tube noises are introduced which also interfere with reception. There are always present certain irregularities in tube operation, as for example irregularities in the filament, which become evident as a change in plate current, which ultimately causes a noise or signal in the telephones. These changes are very minute and are not very noticeable when the amplification is kept below a certain point. As

Limit to Two Stages

the amplification increases these noises become more and more evident. It is therefore not recommended that more than two stages of audio frequency transformer coupled amplification be used. This number is the equal of three or four stages of resistance or reactance coupled amplification and is quite sufficient to give good loud speaker operation.

Unless the best type of transformer is used distortion is very likely to result. Transformers do not respond equally well to all the frequencies in speech and music. They may exaggerate some frequencies or diminish others in varying proportions. Hence the signal output may be very much different from the signal input into the amplifier. No advantage is therefore gained in the long run by buying transformers whose only virtue is cheapness. The best audio frequency transformer when it comes to the reception of speech and music is none too good.

In conclusion it would be desirable to make a brief comparison of the three types of audio frequency amplifiers, namely, the resistance, reactance and transformer coupled types. The resistance coupled amplifier is, without doubt, the best from the point of view of quality of reproduction. When properly built it is distortion free. However, it gives the least amplification of all three types, hence will require more tubes for the same signal strength than the others. The reactance coupled amplifier, if properly built, also can give practically distortionless quality, but generally it will be found that the resistance is superior to it. As between the two the resistance coupling is best. The transformer coupled amplifier, though not up to the standard of the resistance coupled amplifier as far as quality goes, nevertheless gives quite good reproduction. It has the advantages of giving the maximum amount of amplification per tube, and therefore requiring the least amount of apparatus. For those who are extremely fastidious or desire to make speech comparisons the resistance coupled amplifier will commend itself. For good all-around results the transformer coupled amplifier is without comparison.



THIS tuner constitutes a somewhat new development along receiver lines and has shown its efficiency in the results obtained. The station of the well known French amateur Leon Deloy, call letter f-8AB has been copied with excellent audibility without any amplification attached. Stations KDKA and WGY were received on their low wave lengths with sufficient signal strength to operate a loud speaker in New York.

We attribute the excellent results entirely to the construction and apparatus used.

A Low Loss, Short Wave Tuner

Reception on the 100-meter wave is better than on the broadcasting bands. Three powerful stations are transmitting on short waves already, and others will probably do so. It is a simple matter to make a receiver to get this super-broadcasting

By R. A. Bradley

TO begin with we are going to brag about this tuner. It really has delivered the goods and we are rather proud of it despite the fact that we have not tacked our name on it or informed the world that we have discovered something new and that the circuit employed is as old as the hills. In the May issue of *THE WIRELESS AGE* we presented Mr. Bourne's article on a short wave tuner, originally designed to cover the wave length range of 80 to 225 meters, with several modifications that made it possible to be used for the broadcasting wave band. The discovery of a new variable condenser led us to believe that we could improve upon Mr. Bourne's tuner, which in itself is quite an assumption since Mr. Bourne's tuner was exceptionally well designed.

Another addition to 100-meter broadcasting stations has lately been made. At present KDKA at East Pittsburgh, Pa., WGY at Schenectady, N. Y., and KFKX at Hastings, Nebraska, have inaugurated the ultra low wave broadcasting by retransmitting their higher wave programs through a specially built low wave transmitter. Up to a year ago little was known of the regions below 150 meters and due to the difficulties in making transmitters oscillate at this low wave and due to the lack of apparatus that would work efficiently at such very high frequencies, not much work was carried on until recently. A few months ago QST, the official organ of the American Radio Relay League, came out with four or five low wave low loss tuners.

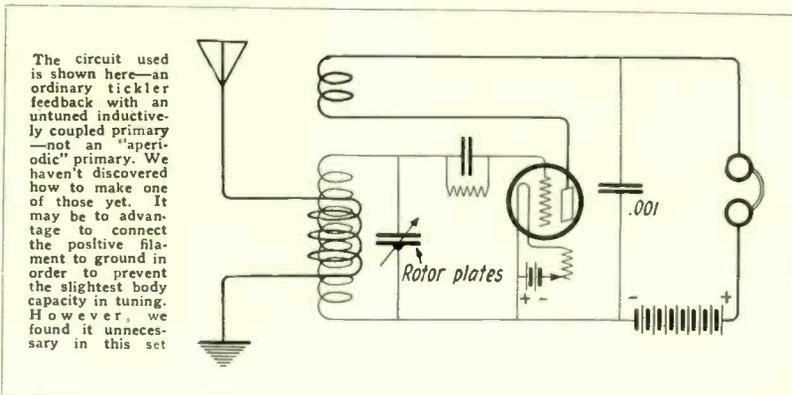
Since that time a great deal of interest has been shown by the amateur field in the general downward trend.

For various economic reasons this country has paid more attention to perfecting transmitters than it has receivers. This is probably due to a large extent to the very liberal regulations which our Department of Commerce has given us. In England and France conditions are quite the reverse. They have been very closely restricted in transmission of radio signals and in some countries there is no amateur experimental work carried on in the transmitting field. As a direct result they have specialized in receivers and have developed them to a high degree of efficiency. It is a very common occurrence in the British Isles to hear Pittsburgh, Schenectady and Troy on a detector with one stage of radio frequency amplification on ahead of it.

While in this country we venture to say that the London station, 2LO, has not been heard by more than a dozen people in the whole United States with its army of broadcast listeners. So it is apparent that we have much to learn in the receiving line.

Some of us have just awakened to the fact that it is possible to build a better receiver by the incorporation of low loss tuners and low loss variable condensers. So when we ran across the "Bruno" ultra-vario condenser we decided to make a good tuner to go with it.

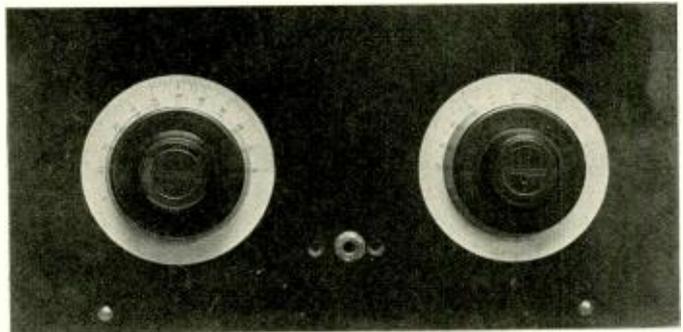
Realizing the difficulty in the spider-web method of winding coils, we endeavored to discover some means of securing practically the same results with apparatus which the experimenter and home builder had at hand. The circuit shown in the accompanying diagram is the ordinary tuned second



dary tickler feed back with the addition of an untuned primary. For the tuning unit an old variocoupler was used. After removing the windings which were on the variocoupler, the circumference of the stator coil was divided into 21 segments. The form was then slotted at these markings with a hack-saw and the alternate segments cut out. The stator coil was approximately three inches long and the slots were made two and one-half inches deep. The rotor coil was slotted and treated in a similar form. A half-inch at the bottom of the coil was left to give strength to the form. A pound of No. 16 double cotton covered wire was then secured and the winding started. Two stator coils were made up in this fashion. The one was wound in a straight ordinary fashion and the other was wound in and out of alternate segments in a spider-web star shaped winding. The advantage of the first was a minimum of dielectric in the magnetic fields of the windings and the advantage of the latter was the lower distributed capacity. The former method was easier to wind and proved quite as satisfactory as the more complicated method of winding. The primary coil consisted of six turns on the end of the coil nearest to the panel. To the end of the six turns a tap is taken off which later goes to the ground and filament side of the circuit as shown in the accompanying diagram. The winding is continued with 15 more turns which form the secondary coil. The end of this winding then goes to the grid condenser. This keeps the high potential part of the tuner as far away from the hand of the operator as possible.

Now we will have to tell you some more about the variable condenser. One of its good features is that it actually covers the capacity range which its manufacturers claim—from .0005, or .00025, or .000125 maximum to .000006 mfd., which is going down some. Did you get the "or" in the last sentence? Well, that is the prize feature in this condenser. That word "or" means that either the capacity of a 23-plate, 11-plate, or 7-plate variable condenser may be had at any time by cutting in or out half of the stationary plates. This means that when you get down to wave lengths below 100 meters where a degree on the condenser means a tremendous change in frequency, you may, by turning a switch employ the whole 180 degrees of the dial in tuning from 75 to 120 meters. If you have had any experience with a short wave tuner the value of this will be readily seen. Tuning on these extremely low wave lengths is an art, and unless you have an excellent vernier on your variable condenser, or unless you use this

The panel layout shows but two controls and the phone jack. This keeps all high potential leads and parts of instruments as far away from the hands as possible. It also simplifies adjustment. The rheostat, once set, does not need to be moved nor is a vernier necessary on it



type of condenser you will probably pass over the station without knowing it.

After going to the trouble of securing a really good tuning unit, don't spoil it all by using a paper grid condenser and a "guess-at-it" grid leak. In the fixed condensers use only ones that are mica insulated and know that you are getting the best. Porcelain sockets are to be recommended in connection with this set, and for lowest

losses at these high frequencies they should be used. Do not bring the battery and aerial and ground leads out to the front of the panel to binding posts, but mount the posts on a small sub-panel in the rear of the set. This keeps them away from the hands of the person operating the set, and keeps low any hand capacity effects. And one thing more, remember that any old kind of a variable condenser will not make this set function.

Super-Ducon

New Device for Utilizing Electric Light Current

AN invention by Harry W. Houck, the radio inventor who was associated with Major E. H. Armstrong during the World War and worked out with the latter the "Second Harmonic" principle now employed in the superheterodyne, brings nearer the realization of a very general hope to obviate the necessity for batteries in connection with radio receiving sets. This invention, which is termed the

"super-ducon," consists, according to report, of a transformer to step down the voltage of the alternating current house electric supply, with Fleming valves as rectifiers and a filter system of iron core choke coils and high capacity condensers.

It will only be necessary for the radio fan to plug in to the electric light line and receive immediately the power for the operation of his set.



Mr. Dubilier (left), radio manufacturer, and Harry W. Houck (right), radio inventor, with the original and the perfected models of the super-ducon, the new device which is designed to replace the batteries used in the operation of radio receivers



Workshop & Laboratory



A New Type Coupler

By ERNEST H. REYNOLDS

A PATENT has just been granted on a coupler or tuner, the design and functioning of which are somewhat out of the ordinary. Spark or code interference is eliminated and local broadcasting stations are tuned out to a marked degree for the reception of distant points. Tuning in general on all wavelengths is very sharp. The construction in general of this coupler follows absolutely new lines, there being a rectangular frame, flat sided and hollow in the center. In this center is pivoted a ring-shaped secondary. The windings of this secondary are placed in spiral formation around the ring. The ring in turn is mounted on a divided shaft, the two ends of winding thus connected to shaft. This core rotates inside the primary winding. Around the rectangular framework is wound the primary.

The method in which this coupler is used is quite similar to that followed with other types of variable inductances, namely, that the number of turns of primary, the angular position of the secondary, and the capacity in circuit therewith are mutually adjusted until a condition of resonance exists in the secondary circuit which corresponds to the wavelengths of the signals sought to be received. The apparent advantages of the coupler seem

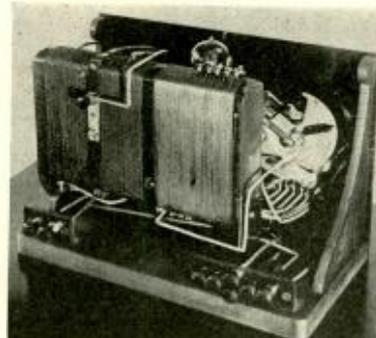
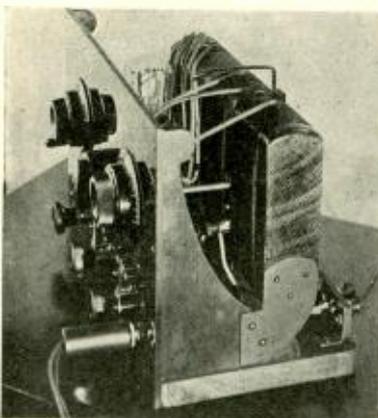
LOUD SPEAKER RESULTS.

Many fans have used a Baldwin Receiver in the bottom of some type of horn for loud speaker results. A drop or two of shellac on the pin in the center of the mica diaphragm, as shown in this picture, will prevent the rattle and resultant distortion frequently encountered.



to be the close relation of the primary and secondary which produces induced currents of greater strength and the fact that the adjustment follows approximately a linear law rather than a sine curve which causes the adjustment ratio to be substantially uniform throughout the entire range of adjustment of the secondary. As a result of these two conditions the tuning becomes very accurate and enables the selective reception of signals which vary by comparatively narrow wavelengths and also the elimination of

All windings on the coupler are No. 22 single silk. The frame and rotor are of soft wood, hard rubber being used wherever possible



wireless and other interferences to a high degree.

Mounting Meters

THE ease with which the state of charge of the filament battery may be determined with a voltmeter rather than through use of a messy hydrometer syringe has led many amateurs to install voltmeters on the panel of their receiving sets.

The majority of these measuring instruments are of the "panel mounting" type: i. e., a large hole has to be drilled into which the body of the meter fits, leaving only a thin flange on the surface of the panel.

However, these flanges are rather large, being between 2 and 3 inches, so that often this method of mounting destroys the symmetry of the panel layout.

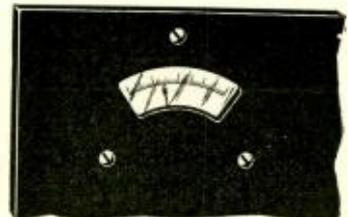
A much better method of mounting panel meters is suggested in the sketch. Here a hole, identical with the observation window in the meter, is cut from the panel—the meter is then mounted entirely behind the panel.

The hole may be cut by drilling a close series of small holes along a scratch outline. The center section may be knocked out and a half or quarter round file used to straighten the edge.

Incidentally in the use of meters for this purpose, one should take a reading only when the battery has been under normal load for at least five or ten minutes.

Battery manufacturers will gladly give a list of average voltage readings for all battery conditions.

Meter mounted behind the panel



AFLOAT AND ASHORE WITH THE OPERATOR



By W. S. Fitzpatrick

“WE read the honor roll of wireless operators, and thrill to their exploits in guarding ocean travel. Their record of distinguished service stands through the years unmarred by failure of men or equipment.”

Thus a writer expresses in different words that old unbroken tradition familiar to us all: “Wireless men never fail.”

Many are the men who have gone down with their ships in upholding this tradition. To them is due the greatest mark of honor and respect.

While contemplating the bravery of these men who have passed from our ranks we should not forget, however, the many who performed similar heroic deeds though they did not lose their lives. These men merit applause, and to present a few of the names and deeds of such heroes is our present purpose. They are still radio men and might be called upon at any time to repeat, even at the sacrifice of life.

* * *

OTTO E. CURTIS, operator on the S.S. *Sugillenco*, was copying press

on the *Kershaw* at 10:30 p. m., March 12, 1918, when with a terrific jolt the vessel went ashore at Montauk Point. The transmitter was so badly shaken that it was necessary for the other operator, Muldoon, to hold the coupling handle while Curtis sent SOS.



When a response was obtained he tied the coupler with rope and continued his watch steadily for nineteen hours, during which he was able to bring two coast guard cutters which, upon arrival transferred the passengers to safety.

After his trying ordeal Curtis lay down for a much needed sleep which was broken a couple of hours later by a cry of “Get up quick” from Muldoon. Jumping out of his bunk Curtis landed in eight inches of water.

A few minutes later a wave about fifteen feet high flooded the radio cabin, knocked Muldoon to the floor and left enough water in the place to put the apparatus out of commission. It was necessary to drain the water from the room, wipe the salt from the

set and rub it with vaseline to dry. Just as they had the set in operation they were ordered to life boats, in which they were taken ashore.

* * *

FRED C. DICKELY, chief operator of the United American Line passenger steamer *Resolute*, performed heroic work when fire broke out aboard the S. S. *Sudbury*, December 7, 1920, when over two hundred miles off the California coast. The fire was in close proximity to the vessel's fuel oil tanks and there was additional danger of it reaching a deck load of highly inflammable material. Dickely not only did his radio work, getting in touch with a naval vessel and having a fire boat come out to meet the ship, but also assisted on deck in cutting holes in the hatch and handling fire hose.



Thick smoke going down the ventilators to the engine room made working there extremely hazardous, and with steam being used to check the fire, the vessel's speed was cut to less than five knots an hour. Dickely was in the radio cabin and on deck twenty-seven hours and won through his courageous work much praise and admiration.

* * *

GORDON G. MACINTOSH, senior operator on the *Calvin Austin*, did good work when the *City of Rockland* ran ashore on the coast of Maine in September, 1923. He stood by in the radio cabin until the apparatus was rendered useless by water reaching the generator. During this time he was in peril as the guys to the smoke-stack and masts had snapped, which meant that the radio cabin was likely to be smashed in at any moment.



Macintosh had two previous experiences; once when the Shipping Board freighter *Cedar Springs* sprang a serious leak in 1920, and again when the tanker *J. E. O'Neil* caught fire in 1921.

WILLIAM F. C. HERTZ, who has been running between New York and European ports on the S.S. *Editor* for the past three years, showed his sticking qualities when the *Munairies* was rammed by a British ship on August 29, 1919. After sending out SOS calls he remained at his post while all on board, with the exception of the captain and ten of the crew, took to boats, from which they were rescued by the other ship. One quartermaster lost his life.



When asked why he had not gone with the others Hertz replied that he was so busily engaged in sending out the distress calls and listening to answers that it had not occurred to him. Help came through his work and the ship was towed into port.

This was the second time Hertz acted the hero part. On February 22, 1919, he sent SOS when the *Paloma* went ashore off the coast of Cuba. At that time also he remained on duty making no preparations to leave and with thoughts only of attracting help in the interest of the ship and the crew, rather than thinking of his own safety.

* * *

WILLIAM H. BARRY, a well known operator running out of New York, was on the S.S. *Aledo* enroute from Falmouth, England, to Jacksonville, Fla., during January, 1921, when the vessel encountered a hurricane which lasted a week. The mountainous seas shifted the cargo keeling the ship almost to her stability point. Water poured into the port holes and the pumps were going continuously. To add to the difficulties the vessel began to leak and several life boats were smashed. Barry kept a watch for fifty straight hours with only a package of hard-tack and a can of condensed milk to sustain him.

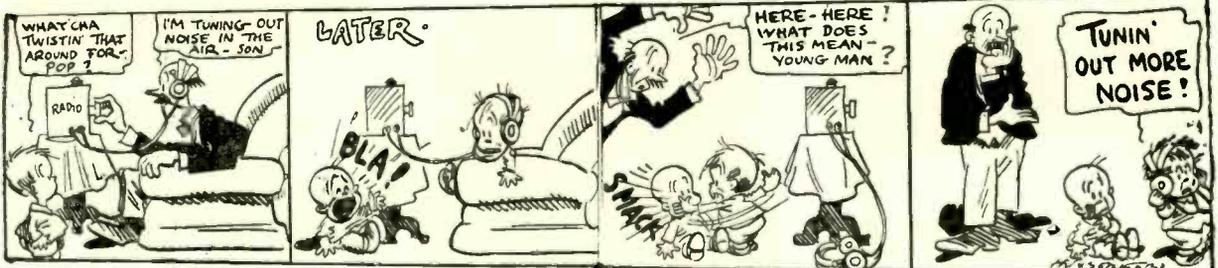


(Continued on page 77)

Best Bets in Humor

SNOODLES—HE MAKES A FEW RADIO ADJUSTMENTS

BY HUNGERFORD



—N. Y. Evening Mail

Dear Mr. EDITOR—I am a little 10 year old girl, poor but honest. My father made me a radio mashine which theys always a squeel and howl into it. I think my radio mashine aint all there. Please where can I get a ohm or a ampere what want cost to much?

Last nite a grass hopper build a spider web on my condenser and I dont no what to do? Its bad luck to bust a spider web.

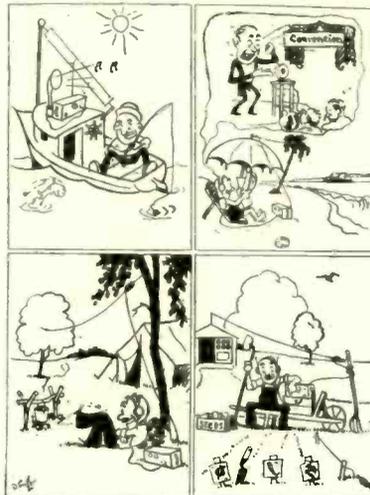
MARGOLD CARDILLO.

P. S. Whats cats whiskers got to do with radio?

* * *

Fortunately, Margold cleared the way for a complete understanding of her social batting average. Poor, but none the less honest. We are not certain whether she meant to imply that being poor and honest all at the same time was rather a remarkable achievement, or simply that she is poor because she is honest. However, it is our

RAY D. O'FAN MAKES THE MOST OF SUMMER



—Federal Telephone & Telegraph Co.

opinion that she has qualified for an honest answer to her questions. It might be—but we apologize—that she made a point of honesty for our benefit.

To begin with, the radio market has been inexplicably depleted of slightly used ohms or amperes. Since THE WIRELESS AGE does not encourage price-cutting we must virtually insist that Miss Cardillo purchase these two commodities at list price.

As to the spider-web, we confess that at last we are at a loss to know what to advise. Our experience in "busting" spider webs is limited. We'd prefer to bust the grasshopper one in his antenna.

MR. EDITOR.

P. S. It just occurred to us that Margold's inquisitive nature may have prompted her to pull the cat's whiskers. If so, the howls in her radio machine would be accounted for. It sounds to us like the "cat's meow" anyway.

CICERO SAPP

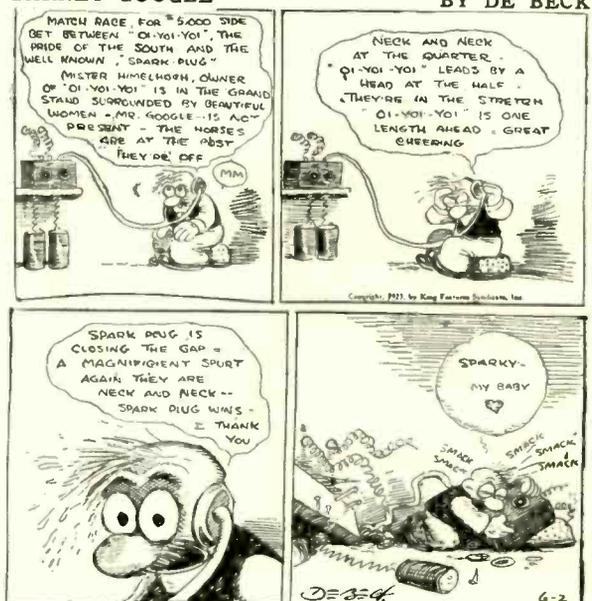
BY FRED LOCHER

BARNEY GOOGLE

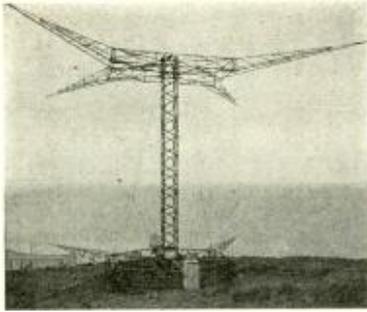
BY DE BECK



—N. Y. Evening World



—N. Y. American



The antenna system of the beam transmitter at Inchkeith

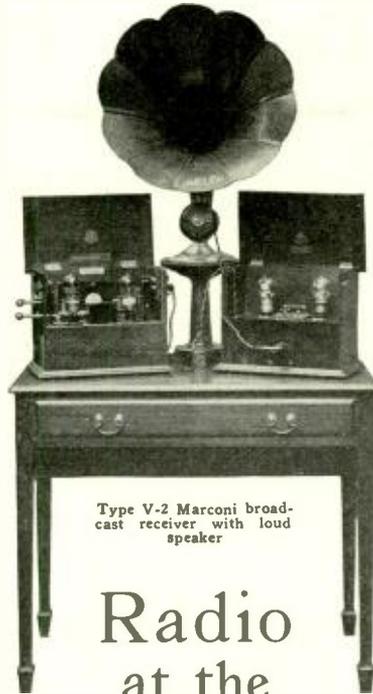
THE Marconi stand in the Electrical Engineering Section of the Palace of Engineering at the British Empire Exhibition, contains a great variety of exhibits representing the latest developments and appliances in all branches of wireless science.

The most prominent feature of the stand is the model of a wireless beam transmitter which is mounted on the roof and rotates slowly when in action. This apparatus represents one of the latest developments in applied radio work and is intended to enable all classes of coastal shipping fitted with an appropriate receiver, including vessels which do not carry wireless operators, to obtain bearings during fog when in the neighborhood of dangerous points. As it revolves, it signals to every two points of the compass a different Morse letter. These signals are transmitted on a very short wavelength, and are picked up by special receiving apparatus which is kept permanently tuned. By observing the Morse letters which his instrument receives the navigator is able to tell the direction of the transmitter, and by taking a succession of readings at intervals he can accurately chart his course.

In practice, the arc covered by the



The Marconi microphone used in British broadcasting stations. With this instrument it is possible to speak in a natural voice more than 30 feet away and get perfect transmission



Type V-2 Marconi broadcast receiver with loud speaker

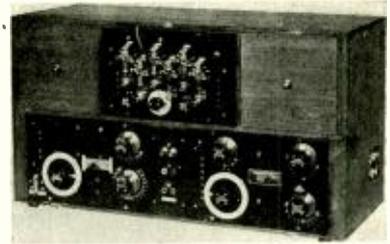
Radio at the British Empire Exposition

The Marconi Company Exhibit at Wembley

beam emanating from the transmitter is about 20 degrees at full strength, with a 10-degree fringe of about half strength each side. "Long" letters are transmitted at every two points of the compass, and "short" letters such as T or I at the intermediate points and half points. The navigator will therefore receive a range of letters such as —I Q I T I L I T. Since the letter Q stands for East-North-East, the first sound heard—the first I—will be a half point to the northward of East-North-East, and the last sound heard—the last T—will be a point to the southward of East. Halfway between these two will be the exact bearing, which is thus obtained within a quarter of a point.

At the present time one of these projectors is operating on the Island of Inchkeith in the Firth of Forth, and another is being erected at the South Foreland.

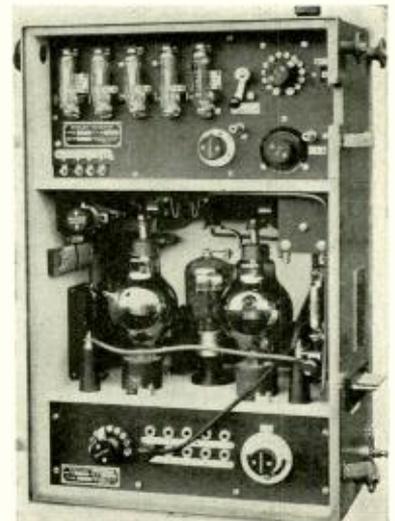
After the beam transmitter, the most striking exhibits are two "valve pillars." The "valve pillar" is the latest design of electric oscillation generator which has been developed by the Marconi Company for use in high-power wireless stations.



A portable receiver. The Marconi R. P. 1 set

The Marconi magnetic drum recorder is an instrument operated on a new magneto-mechanical principle. It is primarily a recording and relaying instrument for high-speed commercial wireless reception, but it can also be used for recording the time intervals between electric impulses, and can be made to rectify and oscillate and so perform electro-mechanically the same operations that a thermionic valve does electrically. It is extremely robust and many times more sensitive than any other form of electro-magnetic recorder. Its performance is unaffected by the rolling of a ship, shocks or vibrations, and it is therefore especially suitable for use at sea.

Other exhibits include the Marconi Wireless bell for use in wireless telephone apparatus designed to reduce the number of operators required in communication with lightships; aircraft transmitters and receivers of several types and a new airplane direction finder; field sets and pack sets for military use; a "popular" radio set suitable for the colonial farmer isolated from the centers of population; many kinds of marine wireless installations including the new Marconi wireless installation for ships' lifeboats. This set has been specially designed to be used under the most adverse weather conditions and in a very confined space.



150-watt telephone or telegraph aircraft apparatus in the Marconi exhibit

To Reanimate a Dead Receiver

What to Do When Your Set Goes Dead

This is the third of a series of articles on radio troubles and their remedies by the author. The first of this series dealt with set noises and the second with squeals

By R. A. Bradley

IN the past two issues we have endeavored to give the reader a general outline of procedure in eliminating various sources of trouble in a radio receiver. In most cases the receiver in question gives forth some noises or squeals which can be identified and which can be traced to the disturbing source by the character of the sounds. But most of us are completely stumped when no sign of life can be heard from the receiver. In other words, when the set goes dead the indications of trouble are scarce and less definite. In this instance the owner of the set must go through a series of experiments in order to determine the fault.

FIRST of all the natural question is, "Do the tubes light?" and analogous to that is the question, "Do they light to their proper brilliancy?" As we suggested before this cannot always be determined by the eye unless one has had much experience in this particular method of testing. Right here is where the pocket voltmeter plays its most important part. The average pocket meter on the market has two contacts, one on a short piece of insulated wire, the other, the case of the instrument. We have found it particularly helpful to solder, or fasten by some other means, a length of insulated wire, preferably stranded and flexible lamp wire, to the case of the voltmeter so that the two leads can be tucked into corners and cramped spaces in the process of testing out your circuits.

FIRST of all trace out the filament circuit from the battery to the binding posts on the set. From there follow the circuit through the rheostats to the socket terminals. Do not stop here, but make the test on the very contacts of the socket itself, that is, where the tube prongs touch the spring contacts. If you happen to have a blown-out tube a handy way of immediately determining this is to break the glass in the tube, place the remnants of your \$5 in the socket, turn on the "A" battery switch and take your voltmeter reading across the two filament leads protruding through the glass stem of the tube. If the trouble is in your filament circuit somewhere on this route it will be clearly indicated by the voltmeter. If this circuit indicates that the voltage has reached the terminals of the tube and the tube still fails to light, the one answer is—a defective tube.

This is a most conclusive test and any trouble in the filament circuit will be indicated by the failure to obtain a reading on the voltmeter or a subnormal reading. In making the test be sure the contact with the voltmeter and the circuit is good and firm as otherwise the circuit may be complete and yet the reading on the voltmeter will show to the contrary.

FROM the "A" battery connections we go next to the "B" battery. On any set an instant indication of a properly hooked up "B" battery circuit is a pronounced click in the receivers when the plug is inserted in, or removed from, the phone jack. A click here indicates that the "B" battery circuit is complete, but it does not indicate the voltage of the "B" battery. Again our voltmeter comes into use. The "B" battery may be dead or in the last stages of exhaustion and this can be readily determined by the reading of your voltmeter. The most prominent "B" battery manufacturers recommend that when a 45-volt "B" battery drops below 37 volts, it should be discarded, as its effective life is exhausted. Likewise when a 22½-volt "B" battery has dropped to 17 volts it is time to junk it. Too low a detector "B" battery will, in some cases, prevent any signal from coming through the set. Some hard tubes on the market require a "B" battery in tip-top condition in order to function at all. Likewise an audio frequency amplifier or radio frequency amplifier will not function when the "B" battery voltage has dropped much below 45 volts. So you see, your voltmeter in both the case of the "A" battery and "B" battery is an important factor and a very necessary part of any radio owner's equipment.

FOR some reason the manufacturers of voltmeters have added an ammeter attachment to read direct current amperes. This is of absolutely no use to the owner of any radio set. In most cases this volt ammeter reads from 0 to 10 volts and 0 to 30 amperes. The chief delight of the "consulting radio engineers" whom we find in the corner radio store seems to be to place the ammeter across your prospective purchase of a dry cell or "B" battery. This tells nothing, does no good and a great deal of harm. An ammeter is a direct short in any circuit. In other words, it is a continuous circuit. A voltmeter is not, and for that reason a voltmeter reading may be obtained from your "B" battery or "A" battery and mean something. An ammeter reading across a new dry cell will generally give a reading of from 20 to 30 amperes. This means nothing, as the life of the battery is directly dependent upon the usage, the frequency of the drain and the amount of the drain. If both of these are small amounts, the life of the battery is then practically equal to its shelf life. It has been shown by actual test that to short a No. 6 dry cell (which is the same as putting an ammeter on it) for two minutes has an effect on its life equal to approximately two weeks continuous drain at one-quarter ampere. Hereafter when you buy your dry cells, just before the clerk puts his ammeter test on the battery, take a well aimed swat at him.

TO get back to our dead set, in testing out the "B" battery leads follow them through the circuit as you did the "A" battery leads and through the audio and radio frequency transformers. If the current does not pass beyond any one of the transformers in turn, you can generally be sure of an open circuit in that transformer. To be sure of this put your phones on and connect one side of the phones to a dry cell and then run leads from the other side of your phones and other side of your dry cell, first to the terminals of your primary transformer and then to the terminals of the secondary winding. In doing this never use more than $1\frac{1}{2}$ volts as it is both detrimental to your phones and to the transformer. A loud click should be heard in the phones if the circuit is complete. In the case of the secondary winding, however, the click is not so marked. But any click at all here means a complete circuit.

TESTING THE TUBE SOCKETS

Now place your voltmeter with one terminal on the plate and the other on the negative lead of the "B" battery. If the circuit is complete a reading should be obtained on the voltmeter equal to, or nearly so, the voltage of your "B" battery. In any receiver except a neutralized tuned radio frequency set or a reflex set signals should not be heard after one tube is removed from the socket and when we say one we mean any one, detector or amplifier. If the tubes make poor contact with the prongs in the socket or do not make contact at all, the tube may light up, but the grid and plate connections may not be made. This must be remedied by placing the fingers in the socket and bending the prongs up so that they make good, firm contact. As we mentioned last month, a socket can cause a lot of trouble. It pays to have good ones in your set with good stiff springs making the contacts.

In a multi-stage audio frequency amplifier trouble may often arise which can be definitely located by plugging in the various jacks. For instance, if you have a two-step audio amplifier and you get no signals out of the second step jack, plug in the first step and detector. If you get signals in the first step, the trouble is in the second step and likewise if you plug in the first step and get no signals and the detector is working all right then the trouble is in the first step of amplification. Now this trouble may be in the jacks or in the transformers. Most generally it will be in the jacks. Sometimes the springs wear out and refuse to close the circuit through the transformer, in which case the signal in the detector tube never reaches the output

of the second transformer. Good jacks do not give this trouble and have good stiff springs that always make contact. When you purchase a jack in a store, test the springs with your finger tips and be sure that there is plenty of life in them. It is hard to understand why people will put six or seven dollars into a stage of amplification and connect to the output of the detector with a ten-cent V&X jack. A jack is a delicate instrument and the best are none too good for the purpose.

If the trouble does not lie in the jack then it is bound to be in the transformer. There are some makes of transformers on the market which use very fine wire in both the primary and secondary and which are very easily blown out. These are very good transformers, as a rule, so far as amplification is concerned, but are not very rugged. In removing or connecting the "B" battery to your set it is always well to have the tubes turned off, otherwise the condenser formed by the transformer windings accumulates a charge which upon the removal of the "B" battery discharges or back-surges. This discharge generally has a voltage much higher than the voltage of a "B" battery and is injurious to the windings in some cases. Of course, the only remedy is to buy a new transformer as it is practically impossible to repair a blown out winding.

Another thing which can make an audio frequency amplifier go dead is the reversal of the "A" battery connections. This can generally be indicated by plugging in the detector and various amplifier jacks. It will be noticed that the normal amount of signal strength is present, but when you plug in the first jack the signal is greatly diminished instead of amplified. In the second stage no signals will be heard at all. The remedy for this, of course, is reversing the "A" battery connections.

Trouble in the tuner proper or in the detector circuit can be readily recognized by the sound in the phones when plugged into the detector jack. A hum in the phones like a motor generator indicates an open in the grid circuit that is somewhere between the grid of the detector tube and the filament return lead. An open in the plate circuit is indicated if there is no click present when the phones are inserted or removed from the jack. This click should be heard as the phone plug tip touches the contact spring of the jack. An open in the antenna or ground system, providing the detector circuit is O. K., can be noticed by the removal of the antenna wire from the binding posts and its replacement. When the antenna is disconnected from the ground it acts as a condenser with

respect to the ground and, in fair weather especially, accumulates a charge of electricity. When the antenna is then grounded to the set it discharges at the moment of making contact and a slight click should be heard. In this test for an open circuit in the primary, the click indicates either poor aerial or ground connection.

In case this click is not heard one must also suspect a grounded aerial. This very often happens through cheap and unreliable lightning arresters. In purchasing a lightning arrester for your receiver, the fact that the Board of Underwriters has O. K.'d it is sufficient guarantee that it will operate satisfactorily for you.

Phone cords are another source of trouble in this line. Never allow your phone cords to come near the storage battery. A drop of acid on the phone cords will introduce a short circuit which will render the phones dead. This will not be denoted until after the acid has had a chance to eat well into the cords and the cotton or silk has started to become frayed.

In conclusion, when your set goes dead, stop a moment and think things over. Don't rush around, turning knobs and rheostats. That generally results in more trouble. If the set has been operating O. K. up to the present, consider that, in your search for the trouble. If the set has been idle look over your batteries first. Remember this, that if the set has worked the correction of whatever trouble exists will put the set back into operation again. Don't junk it first and then reconsider.

Marconi Suggests Medical Diagnosis by Radio

MEDICAL diagnosis by wireless telephony is the prophecy made by Senatore Guglielmo Marconi.

"Is it too much to suggest," Senatore Marconi says, "that at no distant date a doctor will be able to diagnose by wireless? The necessity for that may arise very naturally. A man in London, let us say, may require urgently the services of a particular doctor who at that moment is hundreds or perhaps thousands of miles away. To get the doctor to the bedside would involve delay that might be fatal.

"Who can say that in the future some means will not be perfected to permit the doctor, in certain circumstances, to study his patient and diagnose his complaint by wireless? Now that it is demonstrably practicable to send the sound of heart-beats through the ether so clearly, one cannot regard such developments as mere imagination.

"The achievements already recorded are probably only a tithe of what will be accomplished in the future."

Radio Without Batteries

A New Development of Thermo-Electric Transformer to Make Possible Operation of Radio Receivers From Electric Light Current

THE problem of replacing batteries, especially storage batteries and rechargers by means of drawing directly upon the electric light current is one that has engaged the interest of many experimenters and engineers. Until recently results have not been specially encouraging. The hum resulting from the generator in producing electric lighting current was difficult to eliminate and there have been other obstacles.

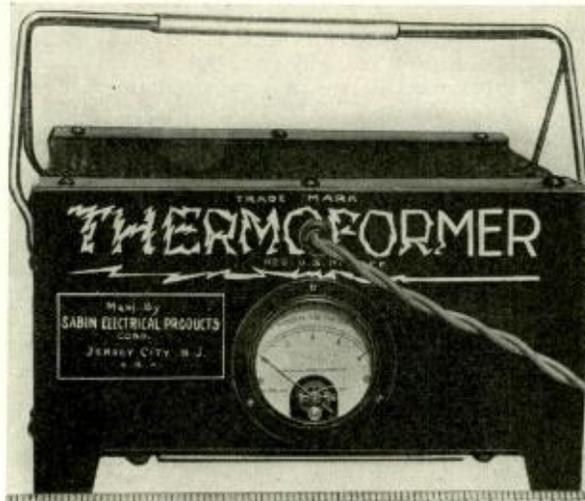
R. E. Sabin, chemical engineer, of Somerville, N. J., with the co-operation of Mr. L. G. Pacent, radio manufacturer and engineer of New York City, seem to have worked out the practical solution of harnessing commercial electric light current to the usual radio receiving set. They have worked out an indirect method of harnessing commercial lighting current, in which such current is merely used as a source of heat, rather than as electrical energy.

Each bimetallic unit comprises a specially shaped casting of special metal for the hot member, and a channel-shaped piece of metal sheeting in contact with the upright leg of the hot member. The end of the horizontal leg of the hot member is in close thermal relationship with, but yet neutrally coupled electrically with, an electric resistor element which is operated directly on the commercial lighting current. To make the utmost use of the electrically-produced heat, the heating unit is made in the form of a flat unit placed between two rows of thermo-couple members. It requires about eight thermo-couple units connected in series to produce one volt of potential, so that for the type UV-199 tubes, requiring about $3\frac{1}{2}$ volts for the filament, the "Thermoformer" comprises 32 units heated by two heater strips.

The entire assembly of thermo-couple units and heater strips is mounted in a metal case with perforated top and bottom plates, so as to provide the proper circulation of air. The thermoformer for six UV-199 tube filaments, which is the number for the present-day superheterodyne sets, occupies less room than the standard 6-volt storage battery.

The "Thermoformer" can be arranged to operate the filaments of a number of vacuum tubes, which is the more difficult task, as well as the high-voltage plate circuits which usually call for the so-called "B" batteries. Even the grid-biasing or "C" battery

much the same manner as the heating element of an electric iron. This heat is brought to bear, without any substantial electrical coupling, on special electrode castings, while the other end of each of these special castings is in contact with a strip of metal which comprises the other member of the thermo-couple. The thermo-couple units are all joined together so that their individual electrical outputs are combined for the desired output. Furthermore, the container is provided with screened top and bottom to permit the passage of air to carry away the undesired heat.



The Thermoformer that makes possible the operation of tubes on A. C. or D. C. lighting circuits

energy can be supplied by the "thermoformer." There is no hum or buzz or other indication of the lighting current used to operate the tubes.

Their thermoelectric power transformer consists of a number of pairs of dissimilar metals in contact, one junction being in close thermal relationship with, but neutrally coupled electrically from a resistor element in the power or lighting circuit. The difference in temperature between the metal members causes the flow of current, and while the potential of a single thermo-couple is quite low, any desired potential may be obtained by using a battery of bimetallic units connected in series.

Novel adjustments of the electrical resistances, thermal conductivities, emissivities, radiation, etc., of the various parts have been made, all contributory to the final perfected result.

The perfected thermoelectric transformer device, which has been given the significant name of "Thermoformer," consists of a neat pressed metal container in which are placed the several rows of bimetallic units, as well as the electrical resistor element. The lighting current is led directly to the resistor element, which operates in

Radio Generation of Inaudible Sounds

THE generation of "inaudible sounds" or, more accurately, super-audible vibrations, has been found recently to present decided possibilities in the realm of safety at sea. These vibrations are those of over 6,000 per second, just above audibility by the human ear, and their use has enabled the measurement of the depth of the sea and the distance of obstructions. The method used is to project these vibrations in water in a definite direction and measure the time elapsing before an echo returns, this being the scheme proposed to the French government by Mr. Chilowsky. This has even been used for the detection of submarines.

Recently Mr. Langevin has developed a new method, making use of a high frequency generator similar to that used in radio. His apparatus, when immersed in water, transforms the high frequency electrical energy into super-audible waves in the surrounding water, in the form of a beam that may be directed at will. The part of the apparatus that transfers the vibrations to the water corresponds to the antenna of a radio station, and may be used for both sending and receiving.

In operation, a ship in motion may send out a beam of these waves at will in any desired direction, and within an instant the return of the echo will announce the presence of an obstacle, if there is any. The speed of these waves is relatively slow, and measurement of the time is therefore easy and accurate.

BROADCASTING STATION DIRECTORY

The Most Authentic, Up-to-the-Minute List of Stations Broadcasting in the United States, Canada, England, France and Cuba

United States Stations

KDKA	Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.	326	KFIO	Windisch Elec. Farm Equip. Co., Louisburg, Kans.	234	KJQ	C. O. Gould, Stockton, Calif.	273
KDPM	Westinghouse Elec. & Mfg. Co., Cleveland, O.	270	KFIO	North Central High School, Spokane, Wash.	252	KJR	Northwest Radio Service Co., Seattle, Wash.	283
KDPT	Southern Electric Co., San Diego, Calif.	244	KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.	242	KJS	Bible Inst. of Los Angeles, Los Angeles, Calif.	360
KDYL	Newhouse Hotel, Salt Lake City, Utah	360	KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska	226	KLS	Warner Bros. Radio Supplies Co., Oakland, Calif.	360
KDYM	Savoy Theater, San Diego, Calif.	280	KFIX	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.	240	KLX	Tribune Publishing Co., Oakland, Calif.	509
KDYG	Oregon Institute of Technology, Portland, Ore.	360	KFIZ	Daily Commonwealth and Oscar A. Huelmans, Fond-du-Lac, Wis.	273	KLZ	Reynolds Radio Co., Denver, Colo.	360
KDZX	Star Bulletin, Honolulu, Hawaii	360	KFJB	Marshall Electric Co., Marshalltown, Iowa	248	KMJ	San Joaquin Light & Power Corp., Fresno, Cal.	248
KDZB	Frank E. Siefert, Bakersfield, Calif.	240	KFJC	Seattle Post-Intelligencer, Seattle, Wash.	270	KMO	Lore Electric Co., Tacoma, Wash.	360
KDZE	Rhodes Co., Seattle, Wash.	270	KFJF	National Radio Mfg. Co., Oklahoma City, Okla.	252	KNT	Walter Hemrich, Kukat Bay, Alaska	263
KDZI	Electric Supply Co., Wenatchee, Wash.	360	KFJJ	Liberty Theatre, Astoria, Ore.	252	KNX	Electric Lighting Supply Co., Los Angeles, Calif.	360
KDZQ	Nichols Academy of Dancing, Denver, Colo.	360	KFJK	Delano Radio & Electric Co., Bristol, Okla.	233	KOB	New Mexico College of Agriculture & Mechanic Arts, State College, N. Mex.	360
KDZR	Bellingham Publishing Co., Bellingham, Wash.	281	KFJL	Hardsag Manufacturing Co., Ottumwa, Iowa	242	KOP	Detroit Police Department, Detroit, Mich.	286
KFAD	McArthur Bros. Mercantile Co., Phoenix, Ariz.	360	KFJM	University of North Dakota, Grand Forks, N. D.	280	KPO	Hale Bros., San Francisco, Calif.	423
KFAE	State College of Washington, Pullman, Wash.	330	KFJN	Electric Construction Co., Grand Forks, N. Dak.	280	KQP	Apple City Radio Club, Hood River, Ore.	360
KFAF	Western Radio Corp., Denver, Colo.	360	KFJR	Ashley C. Dixon & Son, Stevensville, Mont.	258	KQV	Doubleday-Hill Electric Co., Pittsburgh, Pa.	273
KFAJ	University of Colorado, Boulder, Colo.	360	KFJV	Thomas H. Warren, Dexter, Iowa	224	KQW	Charles D. Herrold, San Jose, Calif.	360
KFAN	The Electric Shop, Moscow, Idaho	360	KFJX	Iowa State Teachers College, Cedar Falls, Iowa	229	KRE	Berkeley Daily Gazette, Berkeley, Calif.	275
KFAR	Studio Lighting Service Co., Hollywood, Calif.	280	KFJY	Tunwall Radio Co., Fort Dodge, Iowa	246	KSD	Post-Dispatch, St. Louis, Mo.	548
KFAU	Boise High School, Boise, Idaho	270	KFJZ	Texas Nat'l Guard, 112 Cav., Fort Worth, Tex.	234	KTW	First Presbyterian Church, Seattle, Wash.	360
KFAW	The Radio Den., Santa Ana, Calif.	280	KFKA	Colorado State Teachers' Coll., Greeley, Colo.	273	KUU	Examiner Printing Co., San Francisco, Calif.	360
KFAY	Virgin's Radio Service, Medford, Ore.	283	KFKB	Brinkley-Jones Hospital Assn., Milford, Kans.	286	KUY	Coast Radio Co., El Monte, Calif.	258
KFBB	F. A. Buttry & Co., Havre, Mont.	360	KFKC	Conway Radio Laboratories, Conway, Ark.	250	KWG	Portable Wireless Telephone Co., Stockton, Calif.	360
KFBC	W. K. Azrill, San Diego, Calif.	278	KFKD	F. F. Gray, Butte, Mont.	283	KWH	Los Angeles Examiner, Los Angeles, Calif.	360
KFBE	Reuben H. Horn, San Luis Obispo, Calif.	242	KFKX	Westinghouse Elec. & Mfg. Co., Hastings, Nebr.	341	KYQ	The Electric Shop, Honolulu, Hawaii	270
KFBG	First Presbyterian Church, Tacoma, Wash.	360	KFKZ	Nassour Bros. Radio Co., Colorado Springs, Colo.	234	KYW	Westinghouse Electric & Mfg. Co., Chicago, Ill.	536
KFBK	Kimball-Upson Co., Sacramento, Calif.	283	KFLA	Abner R. Wilson, Butte, Mont.	283	KZM	Preston D. Allen, Oakland, Calif.	360
KFBL	Leese Bros., Everett, Wash.	224	KFLB	Signal Electric Mfg. Co., Menominee, Mich.	248	KZN	Cape & Johnson, Salt Lake City, Utah	268
KFBS	Trinidad Gas & Electric Supply Co. and The Chronicle News, Trinidad, Colo.	360	KFLC	Paul E. Greenlaw, Franklinton, La.	234	KZV	Wendel Hat & Motor Co., Wenatchee, Wash.	360
KFBU	The Cathedral, Laramie, Wyo.	283	KFLD	National Education Service, Denver, Colo.	268	WAAB	Valdemar Jensen, New Orleans, La.	268
KFCB	Nielsen Radio Supply Co., Phoenix, Ariz.	238	KFLE	Ericksen Radio Co., Salt Lake City, Utah	261	WAAC	Tulane University, New Orleans, La.	360
KFCF	Frank A. Moore, Walla Walla, Wash.	360	KFLH	Everette M. Foster, Cedar Rapids, Iowa	240	WAAD	Ohio Mechanics Institute, Cincinnati, Ohio	360
KFCG	Electric Service Station (Inc.), Billings, Mont.	360	KFLI	Rizzell Radio Shop, Little Rock, Ark.	261	WAAP	Chicago Daily Drivers Journal, Chicago, Ill.	286
KFCV	Fred Mahaffey, Jr., Houston, Tex.	360	KFLJ	University of New Mexico, Albuquerque, N. Mex.	234	WAAM	I. R. Nelson Co., Newark, N. J.	263
KFCW	Western Union College, Le Mars, Iowa	252	KFLK	Rio Grande Radio Supply House, San Benito, Tex.	236	WAAN	University of Missouri, Columbia, Mo.	254
KFCZ	Omaha Central High School, Omaha, Neb.	258	KFLM	A. T. Frykman, Stockford, Ill.	229	WAAP	Omaha Grain Exchange, Omaha, Neb.	360
KFDA	Adler's Music Store, Baker, Ore.	360	KFLN	Missoula Electric Supply Co., Missoula, Mont.	234	WABA	Lake Forest College, Lake Forest, Ill.	268
KFDP	Ralph W. Fyars, Ordan, Utah	360	KFLW	George R. Clough, Galveston, Tex.	240	WABB	Harrisburg Sporting Goods Co., Harrisburg, Pa.	266
KFDD	St. Michael's Cathedral, Boise, Idaho	252	KFLX	Fargo Radio Supply Co., Fargo, N. Dak.	231	WABC	Parker High School, Dayton, Ohio	283
KFDE	University of Arizona, Tucson, Ariz.	288	KFLY	Atlantic Automobile Co., Atlantic, Iowa	273	WABE	Y. M. C. A., Washington, D. C.	283
KFDF	Oregon Agricultural College, Corvallis, Ore.	360	KFLZ	Christian Churches of Little Rock, Little Rock, Ark.	254	WABF	Arnold Edwards Plano Co., Jacksonville, Fla.	275
KFDO	H. Everett Cutting, Bozeman, Mont.	248	KFMQ	University of Arkansas, Fayetteville, Ark.	283	WABG	Lake Shore Tire Co., Sandusky, Ohio	240
KFDR	Bullock's Hdw. & Sporting Goods, York, Neb.	360	KFMR	Morningside College, Sioux City, Iowa	281	WABI	Bangor Railway & Electric Co., Bangor, Me.	240
KFDV	Gilbrecht & Stinson, Fayetteville, Ark.	360	KFMS	Freimuth Department Store, Duluth, Minn.	275	WABL	Connecticut Agricultural College, Storrs, Conn.	283
KFDX	First Baptist Church, Shreveport, La.	360	KFMT	George W. Young, Minneapolis, Minn.	231	WABM	F. A. Doherty Automotive & Radio Equipment Co., Saginaw, Mich.	254
KFDY	South Dakota State College, Brookings, S. Dak.	230	KFMU	Stevens Bros., San Marcos, Tex.	240	WABN	Ott Radio (Inc.), La Crosse, Wis.	244
KFEC	Melzer & Frank Co., Portland, Ore.	248	KFMV	M. G. Sater, Houston, Mich.	266	WABP	Robert F. Welzig, Dorer, Ohio	266
KFEL	Winner Radio Corporation, Denver, Colo.	360	KFMW	Carleton College, Northfield, Minn.	283	WABQ	Haverford College Radio Club, Haverford, Pa.	261
KFEQ	J. L. Serogin, Oak, Neb.	360	KFMX	Roy Scouts of America, Long Beach, Calif.	229	WABR	Scott High School, Toledo, Ohio	270
KFER	Auto Electric Service Co., Fort Dodge, Iowa	231	KFMY	Roswell Broadcasting Club, Roswell, N. Mex.	230	WABS	Essex Mfg. Co., Newark, N. J.	244
KFEV	Felix Thompson Radio Shop, Casper, Wyo.	263	KFNB	Alonzo Monk, Jr., Corsicana, Tex.	234	WABT	Holiday-Hall, Washington, Pa.	222
KFEK	Ausburg Seminary, Minneapolis, Minn.	281	KFNC	Henry Field Seed Co., Shenandoah, Iowa	266	WABU	Victor Talking Machine Co., Camden, N. J.	258
KFEY	Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho	360	KFND	Wooten's Radio Shop, Coldwater, Miss.	254	WABV	College of Wooster, Wooster, Ohio	234
KFEZ	Associated Engineering Societies of St. Louis, St. Louis, Mo.	248	KFNE	State Teachers College, Springfield, Mo.	236	WABW	Henry B. Joy, Mount Clemens, Mich.	270
KFFB	Jenkins Furniture Co., Boise, Idaho	240	KFNF	Warrensburg Electric Shop, Warrensburg, Mo.	234	WABX	John Masaldi, Jr., Philadelphia, Pa.	242
KFFE	Eastern Oregon Radio Co., Pendleton, Ore.	360	KFNG	Radio Broadcast Association, Paso Robles, Calif.	240	WABY	Coliseum Place Baptist Church, New Orleans, La.	263
KFFO	E. H. Smith, Hillsboro, Ore.	229	KFNL	L. A. Drake, Santa Rosa, Calif.	234	WABA	Purdue University, West Lafayette, Ind.	360
KFFQ	Markshel Motor Co., Colorado Springs, Colo.	360	KFNM	Peabody Radio Service, Peabody, Kans.	240	WABB	The Dayton Co., Minneapolis, Minn.	417
KFFR	Nevada State Journal, Sparks, Nev.	226	KFNV	Montana Phonograph Co., Helena, Mont.	261	WBBN	Wireless Phone Corporation, Paterson, N. J.	244
KFFS	Graceland College, Lamoni, Iowa	360	KFNW	Royal Radio Co., Burlingame, Calif.	231	WBAO	James Millikin University, Decatur, Ill.	360
KFFX	McGraw Co., Omaha, Neb.	278	KFOA	Rhodes Co., Seattle, Wash.	455	WBAP	Wortham-Carter Pub. Co. (Star Telegram), Fort Worth, Tex.	476
KFFY	Pineus & Murphy, Alexandria, La.	275	KFOC	First Christian Church, Whittier, Calif.	236	WBAV	Erner & Hopkins Co., Columbus, Ohio	390
KFFZ	Al. G. Barnes Amusement Co., Dallas, Tex.	226	KFOD	The Radio Shop, Wallace, Idaho	224	WBAX	John H. Stenger, Jr., Wilkes-Barre, Pa.	360
KFGD	Louisiana State University, Baton Rouge, La.	254	KFOE	Rohrer Electric Co., Marshfield, Ore.	240	WBAY	Western Electric Co., New York, N. Y.	492
KFGH	Chickasha Radio & Elec. Co., Chickasha, Okla.	248	KFOF	Radio Bungalow, Portland, Ore.	283	WBBA	Newark Radio Laboratories, Newark, Ohio	240
KFGI	Leland Stanford University, Stanford Univ., Calif.	360	KFOJ	Moberly High School Radio Club, Moberly, Mo.	246	WBBD	Barbey Battery Service, Reading, Pa.	246
KFGJ	Snell & Irby, Arlington, Ore.	224	KFOL	Leslie M. Schabach, Marengo, Iowa	234	WBBE	Alfred R. Marcy, Syracuse, N. Y.	270
KFGK	Crany Hardware Co., Boone, Iowa	236	KFON	Echophones Radio Shop, Long Beach, Calif.	234	WBBF	Georgia School of Technology, Atlanta, Ga.	270
KFGB	Heldreder Radio Supply Co., Utica, Neb.	224	KFOP	Wilson Construction Co., Dallas, Tex.	268	WBBG	Irvine Vermilya, Mattapoisett, Mass.	240
KFGC	First Presbyterian Church, Orange, Tex.	250	KFPB	Edwin J. Brown, Seattle, Wash.	224	WBBI	J. Irving Bell, Port Huron, Mich.	246
KFGD	Emmanuel Missionary Coll., Berrien Spgs, Mich.	286	KFQE	Dickenson-Henry Radio Laboratories, Colorado Springs, Colo.	278	WBBL	Neel Electric Co., West Palm Beach, Fla.	258
KFHA	Western State College of Colo., Gunnison, Colo.	252	KQFQ	Edo A. Boulton, Minneapolis, Minn.	278	WBBL	Grace Covenant Church, Richmond, Va.	283
KFHB	Rialto Theater, Hood River, Ore.	280	KQFG	Donald Park Evangelistic Assn., Los Angeles, Calif.	278	WBBS	Frank Atlas Produce Co., Lincoln, Ill.	226
KFHC	Central Christian Church, Shreveport, La.	266	KGB	Hailcock Watson Radio Service, Portland, Ore.	360	WBBS	A. B. Blake, Wilmington, N. C.	275
KFHD	Ambrose A. McCue, Neah Bay, Wash.	261	KGG	Northwestern Radio Mfg. Co., Portland, Ore.	360	WBBO	Michigan Limestone & Chem. Co., Rogers, Mich.	250
KFHE	Fallon & Co., Santa Barbara, Calif.	360	KGO	General Electric Co., Oakland, Calif.	312	WBBP	Potoskey High School, Potoskey, Mich.	246
KFHF	Star Electric & Radio Co., Seattle, Wash.	283	KGU	Marion A. Mulroyn, Honolulu, Hawaii	360	WBBC	Frank Crook, Pawtucket, R. I.	252
KFHH	Robert W. Nelson, Hutchinson, Kans.	229	KGW	Portland Morning Oregonian, Portland, Ore.	492	WBBS	Peoples Pulpit Association, Rossville, N. Y.	244
KFII	Esrie C. Anthony (Inc.), Los Angeles, Calif.	469	KGY	St. Martins College, Lacey, Wash.	258	WBBS	First Baptist Church, New Orleans, La.	250
KFID	Ross Arbuckle's Garage, Iola, Kans.	246	KHJ	Times-Mirror Co., Los Angeles, Calif.	395	WBBS	Lloyd Bros., Philadelphia, Pa.	234
KFIF	Benson Polytechnic Institute, Portland, Ore.	360	KHQ	Louis Wassmer, Seattle, Wash.	360	WBBS	Janke Motor Sales Co., Monmouth, Ill.	224
						WBBS	Johnstown Radio Co., Johnstown, Pa.	248
						WBBS	Ruffner Junior High School, Norfolk, Va.	222

Table listing various radio stations and their locations, including WBBY Washington Light Infantry, WBBZ Noble College, WBL T. & H. Radio Co., WBS D. W. May (Inc.), WBZ Southern Radio Corporation, etc.

Table listing various radio stations and their locations, including WIZ Radio Corporation of America, WKAA H. F. Paar, WKAD Charles Looff, WKAF W. S. Radio Supply Co., etc.

Table listing various radio stations and their locations, including WTAG Kern Music Co., WTAH Carmen Ferro, WTAL Toledo Radio & Electric Co., etc.

Canadian Stations

Table listing Canadian radio stations, including CKCL Wilkinson Electric Co. Ltd., CIGD T. Eaton Co. Ltd., CFCL Jack V. Elliot Ltd., etc.

British Stations

Table listing British radio stations, including 210 London, 510 Birmingham, 51W Cardiff, etc.

French Stations

Table listing French radio stations, including YN Lyon, FL Paris (Eiffel Tower), 8AJ Paris, etc.

Cuban Stations

Table listing Cuban radio stations, including PFX Cuban Telephone Co., 20W Pedro Zayas, 2AB Alberto S. de Bustamante, etc.

RADIO ENGINEERING

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

By John R. Meagher
Circuits

THE other day we were talking to a radio manufacturer about circuits, at the same time illustrating our point with quickly sketched diagrams. Some of these were simple one-tube layouts; others were more complicated, ranging from four-tube reflexes to eight-tube "supers." The manufacturer after agreeing with our views expressed surprise at the rapidity with which the diagrams were sketched. Merely to show him there "was nothing to it" we spent a half hour teaching him the correct way of sketching diagrams—and at the end of that time he surprised even himself with his speed and accuracy in drawing up a five-tube radio "freq" circuit. And what was still more pleasing to us, he was able to talk more intelligently about the circuit—for the lesson had not been so much in sketching diagrams as it had been in understanding what's what in circuits.

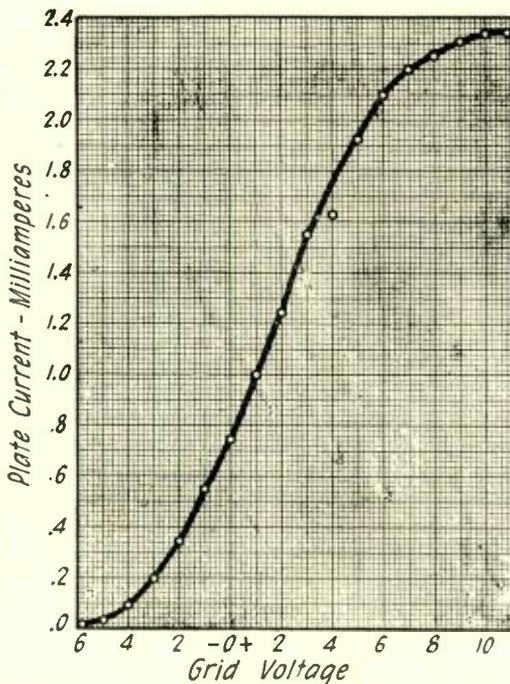
The thought occurred to us—why not try the same thing in "Radio Engineering" for if the students can acquire this knack it will place them at a distinct advantage over other radio men.

So, instead of Vacuum Tubes or Inter-Tube Coupling we will devote this sheet to circuits—how to know them and how to sketch them.

Start always with the filament circuit if the diagram must be complete. In general there is only one type—a filament or A battery shunted by one or more filaments, each filament having an extra resistance of some sort in series with it. Imagine a step ladder with the leads from the battery or the "battery lines" forming the sides; one rung forming the battery itself and the other rungs representing separate filaments and their extra resistances. That is rather a simple picture; and is it any more difficult to conceive of each rung being twisted out of shape? Then why is it more difficult to understand the simple parallel circuit (remember the rungs of the ladder are in "parallel") with real battery lines and "rungs" of filaments bent and twisted up somewhere above the lines? By way of illustration follow through any of the circuits published in this issue.

Make it an invariable rule to place the rheostats in the negative side of the circuit. Thus if we start from the negative battery line we should go through the rheostat first, then the filament, and finally return to the positive side of the line.

Sketch out some plain parallel filament circuits; make the battery lines heavy for distinction. Nothing to it, is there? Now put a filament battery switch in. It should be between the battery and everything else so the battery is really disconnected. Place it in the negative lead so it will be at the



This is how the curve should appear as drawn from the data in last month's Radio Engineering. Note that the point at the intersection of 1.65 (plate current) and 4 (grid voltage) is out of line. If the figures were secured in an experimental set up it would be probable that this measurement was incorrect in some way. In drawing curves the idea usually is to follow the general trend and have a smooth rather than an erratic curve

lowest potential—ground potential if the negative A battery is grounded. Insert a potentiometer—yes, it can go anywhere along the battery lines just so long as one end of the resistance touches the negative line and the other end the positive line. It should of course be on the filament side of the battery switch.

Now draw plate and grid symbols near the filaments: put the grids between the filaments and the plates.

If we are going to draw a straight transformer coupled amplifier let us complete either the plate or grid circuits first.

Starting from each plate go through the RF section first (if there is any RF section in the plate circuit) then through the AF section and through the plate battery to the filament. The circuit from filament to plate is completed by the electronic flow between the

filament and plate when the filament is heated. When the filament is cold and there is no flow of electrons the circuit is opened.

Each plate is the same and we can show separate plate batteries if desired merely to show the similarity, but as the impedance of the plate battery to any frequency is very low it has been found possible to use a common plate battery as there is no noticeable coupling between the circuits. But understand that the common plate battery may be thought of as separate batteries for each plate and it is at once evident why any voltage of the total plate battery may be used on any plate. Thus with a five-tube set, say we had a 100-volt battery and each plate went to a different tap, say 20V, 40V, 60V, 80V and 100V. We could think of this arrangement as being five separate batteries with all the negative leads connected to the filaments and the positive lead of the 20V battery going to one plate, the positive lead of the 40V battery going to another plate and so on. Or we can think of the plate with 20V as having an effective voltage of 20 and a "dead end" of 80.

Now for the grid circuits: from the grids go through the secondaries of the coupling devices and down to the filament. With AF amplification these "return leads" from the grid should go to the negative filament battery line or else to a grid battery which may be separate for each grid or common for a number of grids. The reasoning of this is the same as for the plate battery as given above.

The grid return leads from short wave RF amplifiers are sometimes connected to the slider of a potentiometer connected across the A battery so the grid voltage can be controlled, and sometimes to the negative filament battery line either direct or through an adjustable resistance. The grid return of a detector with a grid condenser and shunt leak is almost invariably brought to the positive filament battery line.



A Contest for All Radio Sets

This is an opportunity every
Every contestant can earn radio
The element of chance has been
on individ-

THIS is a contest that every live youngster will want to enter. And this is why:

During the summer months you can earn what you want in radio as a full-fledged salesman on THE WIRELESS AGE Sales Staff. Every boy who enters this contest automatically becomes a member of our organization and is paid well for his time. This is a contest in which you are being paid for the time you devote to winning a prize.

You will very likely have more than enough—enough more to get a voltmeter or some other instrument you would like to have.

Supposing, for another example, that you won the second or third prize?

enough boys still able to continue with the work. * * *

I want 10,000 young men to join the sales staff of THE WIRELESS AGE. Each one will be well paid.

I will teach you how to sell subscriptions, supply you with samples, give you a calling list, and then send you out as a full-fledged salesman. I will then establish a credit account in your name. You can draw from that



First Prize—Paragon RB2
\$135.00 Receiver.

Second Prize—Thompson Magnaphone \$35.00 Loud Speaker.

Third Prize—N&K Imported
\$8.50 Headset.

The contest closes September 15th. All subscriptions for the contest must be in this office not later than that date. The rules of the contest will be found on this page.

In the event of ties, each tying contestant will be awarded a prize identical in character with that tied for.

This contest is open to all live youngsters who wish to earn their own radio sets.

For example, suppose you won the Paragon RB2 \$135.00 receiver. You would have a radio set that you could well be proud of. In the first place, you would have one of the finest receivers manufactured by the Adams-Morgan Company. In the second place, you would have earned that set, and could appreciate its value far better than another youngster who must depend upon his parents.

And what happens to the subscriptions you have secured in order to win the RB2 receiver? Just this:—they bring to you the aerial, and batteries, and loud speaker that you must have before the set is complete. Providing, of course, you have secured enough subscriptions for the additional parts.

You would then have a Thompson Magnaphone \$35.00 loud speaker, or an imported N&K \$8.50 headset. You would also have enough subscriptions to bring to you other parts as explained for the first prize.

Even though you did not win one of the three prizes, you would still have a job that would provide you with the things you want most in radio. It is a job that you can still have through the winter. When this contest is over, another one will be offered if there are



account just as you like. It will enable you to buy radio parts at wholesale prices.

You will receive from a list of 35,000 names of people who own radio sets, those who live in your district. Some of them have been taking this magazine, but have forgotten to renew their subscriptions. All of them own radio sets, and, of course, will want to know more about THE WIRELESS AGE. I have sent letters to these people so that they will know about this magazine even before you call on them.

You will have my guidance at all times. You may depend upon me for instruction and encouragement. Those who are now on the staff have all made good. The reason is that I have

Boys Who Want or Parts

lively youngster will welcome parts while trying for the prizes removed, thus offering rewards ual merit



wanted to make good myself and I now intend to see all the others make good.

Write to me NOW. Address your letter to the Boys' Editor, THE WIRELESS AGE, 326 Broadway, New York City.

If you have a pal or two, write together. Sometimes team work is better than working alone. But write to

me at once, without delay.—Boys' EDITOR.

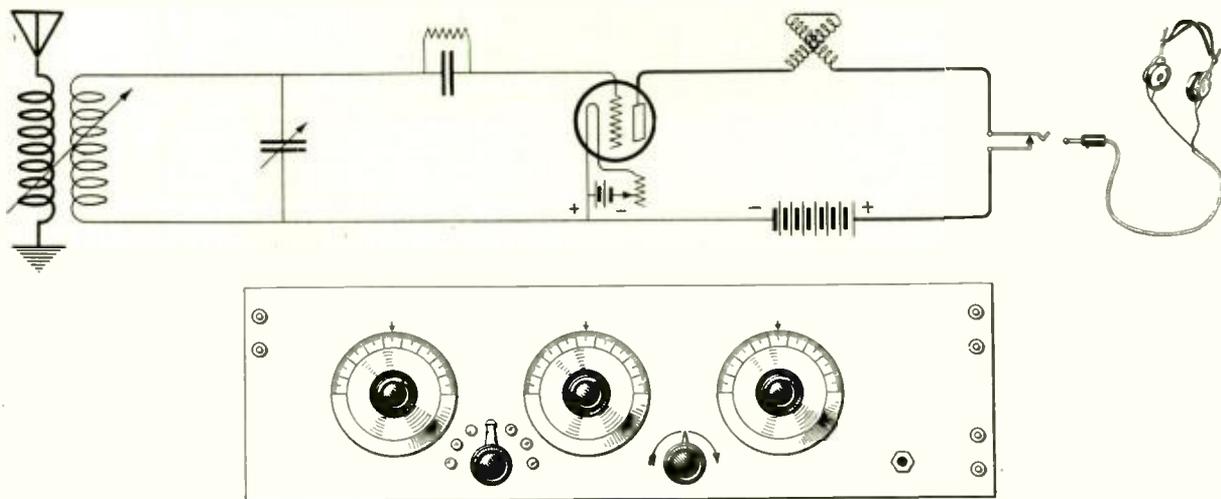
* * *

THE diagram below, illustrates ONE set you can earn during the summer months. If you now have some of the parts, the remainder can be earned with fewer subscriptions. But this is only ONE of the many sets you can

earn. Perhaps there are other hook-ups you like better, or perhaps you prefer a set completely assembled. Whatever you do want, you can earn under our careful guidance.

Simply write to us:—tell us what you want, and we will show you how to get it.

Is there anything below you would like? It is yours if you want it.



LIST OF PRIZES

	List Price		List Price
Aerial Outfit	—Storm King Complete....	Vacuum Tube	—RCA—WD-12
Vario Coupler	—Pall Mall	Dials (3)	—Na-Ald 3"
Variometer	—Pall Mall	Panel	—Radion 7" x 21" x 3/16" ..
Condenser	—Pacent—21 Pl. Variable.	Jack	—Pacent single circuit.....
Phones	—N&K Imported	Rheostat	—Pacent
"B" Battery	—Eveready 22½ V.....	Plug	—Pacent Duoplug
"A" Battery	—Eveready 1½ V.....	Socket	—Na-Ald Bakelite
Grid Condenser	—Dubilier Ducon .00025...	Binding Posts (8)	—Eby
Grid Leak	—Pacent 3 Megohm.....		

\$37.50

Selected Radio Hook-Ups

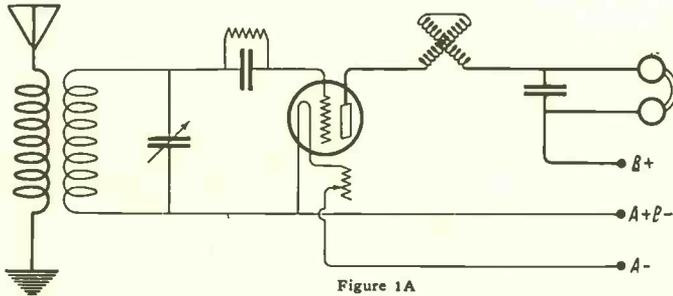


Figure 1A

FEW of us are content or satisfied with any one set or circuit for a length of time. We make a set, play with it, take it apart and put it together again. When we have reached the limit of its possibilities, we turn to another circuit. When you have become initiated into this you have approached the amateur fever. Valuable experience which can be obtained in no other way may be had by the constant

construction and operation of various types of receivers.

Since the decrease in popularity of the regenerative set everyone seems to want to convert his receiver into a tuned radio frequency set. The hook-up of the average regenerative set is shown in figure 1A. This consists of the ordinary variocoupler whose secondary is shunted by a variable condenser and a variometer in series with the plate circuit. In the next diagram it is shown how this same set may be converted into a tuned radio frequency amplifier using all the apparatus which you had in the original set. With only the addition of a potentiometer and a different sized grid condenser this may be very easily accomplished as shown in the diagrams figures 1A and 1B.

In order to do this remove the grid condenser and grid leak from the tube in figure 1A, shunt the "A" battery with a 400-ohm potentiometer and connect the grid return lead from the secondary of the coupler to the arm of the potentiometer. The grid condenser is omitted since no condenser is used in a radio-frequency amplifier. The grid receives a natural bias by means of the potentiometer adjustment.

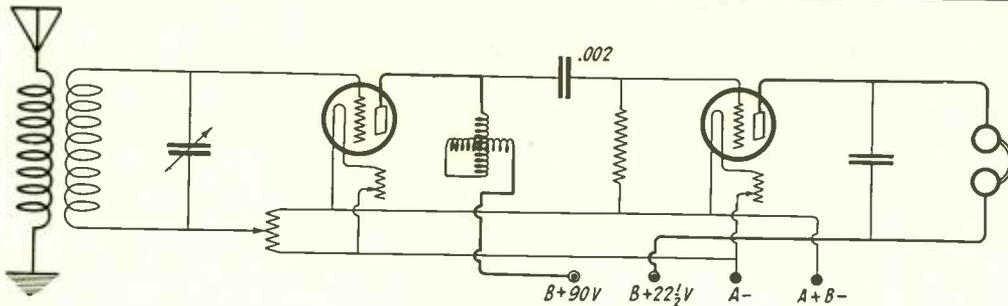


Figure 1B

IN figure 1B we have the changed hook-up. This constitutes one stage of tuned grid and plate or tuned impedance radio-frequency amplification ahead of the detector. As the diagram shows ninety volts is applied to the plate of the radio-frequency tube and 22½ volts to the plate of the detector tube. Of course audio-frequency amplification

may be added to this circuit without affecting it. The primary of an audio-frequency transformer being substituted for the phones in the circuit, it is quite essential that the grid leak be placed as shown in the diagram from grid to positive filament. A two-megohm grid leak will generally be found to be satisfactory.

FIGURE 2 is a new adaptation of the old two variometer variocoupler set. The plate variometer instead of being inserted between the plate and the phones is part of the grid tuning circuit as well as the plate. The path of the radio-frequency current is then from plate to the plate variometer to the secondary of the coupler to the grid variometer and so on back to the grid. The phones or primary of the amplifying transformer generally form enough of a radio-frequency choke to prevent the RF current from flowing through them. This circuit is very smooth in its operation and the control of regeneration is remarkably stable. Any type of tube can be used with this circuit and the batteries should correspond with the tube used. If the circuit does not oscillate it may be helped along by the insertion of a radio-frequency choke between the point where the plate variometer is inserted in the plate circuit and the

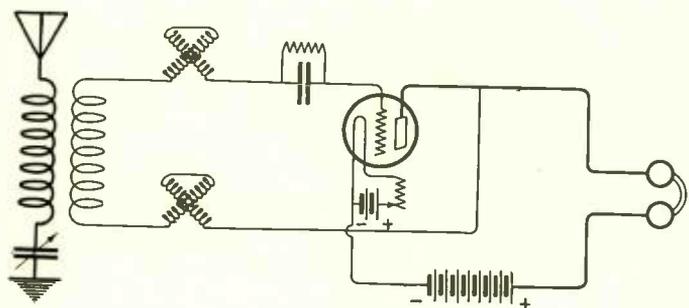


Figure 2

phones. A .00025 mfd. variable condenser will serve as well as any.

The grid leak will depend upon the type of tube used. For the UV-200 no grid leak was used at all.

For the Home Builder

HERE we have the hook-up of the old Aeriola Sr. probably the best compact vacation set yet manufactured. The two variometers have forty turns on their rotors and stators each. The two coils between the left hand variometer and the ground consist of 10 turns, each one is placed in inductive relation to the grid variometer and the other in inductive relation to the plate variometer. The 2 antenna series condensers are a .001 and a .00025 mfd. respectively. The tap switch shown is connected in series with the antenna and may be thrown from one condenser to the other. The .0001 mfd. will serve for short wave stations, that is 220 to 350 meters, and the .00025 mfd. for long waves, 350 to 500 meters. This can be made into a very small set which can be taken along on trips to the country. A seven by ten panel will be sufficient and the two variometers may be fastened to the panel together with a rheostat and tap switch and phone-jack. There need be no other controls on the panel. As dry cell tubes are used the set may be entirely self-contained except for the aerial and phones. The incorporation

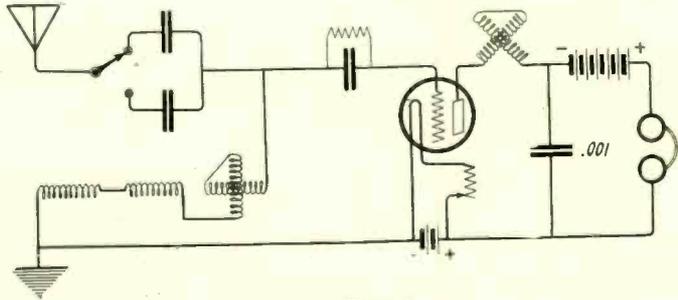


Figure 3

of the small sized "B" batteries and dry cell "A" batteries and the addition of a carrying strap fastened to the top of the cabinet make this truly a portable receiver. Care should be exercised in the purchase of parts and all metal surfaces should be nicked to prevent oxidation from dampness.

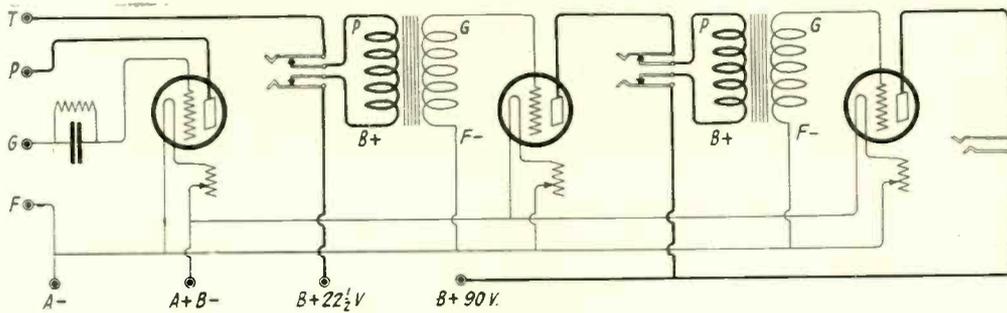


Figure 4

THE handiest thing we know of around an experimenter's laboratory is a two-step amplifier with detector complete in a separate unit by itself. To this may be added all sorts of tuners and various hook-ups tried. Figure 4 shows such an arrangement. There are eight binding posts on the set, three rheostats, two transformers, three tube sockets

and three jacks. All this can be arranged on a standard seven-inch by ten-inch hard rubber panel fastened onto a baseboard six inches by nine inches. The transformers may be mounted on the extreme rear of the baseboard and the three sockets placed between the transformers and the panel. Three small rheostats are mounted on the panel.

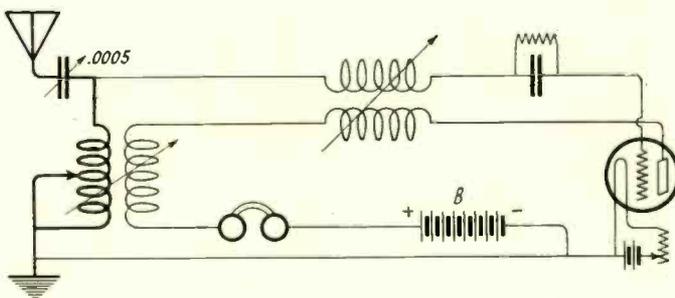


Figure 5

FIGURE 5 is a very sensitive regenerative set. The two pairs of coils are two variocouplers or two variometers with their windings split. A very fine degree of regeneration is obtained and the tuning is very selective. The .0005

mfd. variable condenser in the antenna circuit is not essential, but is of assistance in tuning. It may be found helpful to shunt the phones and "B" battery with a .0005 mfd. or a .001 mfd. variable condenser. The tube used may be a WD-11, or 12, or UV-199, 201A or 200. The "B" battery voltage and "A" battery voltage will depend upon the tube used, of course. If a variocoupler is used in the right hand pair of coils the taps need not be used. However, it is desirable to tap the primary winding of the left hand pair.

The action is quite simple. The stator windings of the two couplers comprise the grid and antenna circuits while the rotor coils are double ticklers with feedback in the antenna circuit and the grid circuit. This permits close regulation of the degree of regeneration and is consequently extremely sensitive to broadcast transmitters.

Warp & Weft of Radio Minds

VARIETY IN VIEWPOINTS

DOES R-A-D-I-O spell *finis* to the burlesque theater reeky with smoke, the pool parlor, and Dinty's? Is restless Out-At-All-Hours to be caught and anchored safe in Home Bay—by Radio? Is *paterfamilias* to be restored to its ancient definition by the magic of condensers and coils and telephone jacks?

Mr. Thompson, a regular reader and a "regular feller," he who does such clever cartoon-postals on which to correspond with his friend THE WIRELESS AGE that they get published now and then—says that, for his part—

"I believe that it is essential for every business man to have a hobby. I wanted a hobby that my family could share in, a hobby that would give me diversion, but also the companionship of my family, and especially my boys. Radio seemed to fill the requirements. I started with a one bulb set and in a few weeks got my first DX station. Then I was a semi-Fan. Then came the three bulb set, and more DX stations. Then I was a real fan. Then came the five bulb set, and the thrill of hearing the announcer say, 'This is Station KHJ, Los Angeles, California.' Now my wife says I am not a radio fan—but a 'BUG.'"

THE companionship of his family—especially "my boys!" Just let that thought wriggle through the wrinkles of your cerebrum—if a wave of that glorious sea can get through.

Mr. Thompson having become a "Bug," apparently settled down to serious operation of his set. He sends the following for the benefit of others who have experienced similar difficulties:

"For several weeks each night, after nine o'clock, a cracking noise, so loud that it would drown out all other reception, would come on my set. After testing and making sure it was not the fault of the set I called in the Electric Light Co., and in order to further prove that the trouble was on their lines they, one night after midnight, turned out all the town lights. The cracking stopped at once. This proved that the trouble was either on their lines or was coming in on their lines. Several tests were made and nothing could be found that would cause such a noise on the power lines. Finally I had a loop made and tested with that. This being a directional loop it showed the direction from which the noise was coming. The Electric Co. delegated a man to work with me and we set up my set in an automobile and since the loop gave us the direction we started in the car towards the noise. After riding around in circles for an hour

we finally came in front of a house where the noise seemed the loudest. The electric light man climbed the pole and cut the lighting wires running to this house and at once the noise stopped. We then found that the only thing turned on in the house was an electric heating pad. As soon as the wires had been connected up again, we tested the pad and found two

with a tree. Radio as an electric leak detector!

RADIO ENGINEERS OF THE FUTURE

A LETTER was received from Mr. A. R. Snyder letting us about the radio activities of the Chicago Boys' Club. Knowing what is being done for our boys is surely worth while. Mr. Snyder writes:

"Boys of today are going to be the radio engineers and experts of the future. The Chicago Boys' Club knows that the little chaps have keen minds and is doing all it can to encourage them in the study of radio. At Club No. 2, 1725 Orchard St., there is a complete radio laboratory and workshop, where the young fellows are given an opportunity to build and test receiving sets and experiment with various parts.

"Remarkable results have been obtained in this workshop. Quite a number of the boys have developed un-

usual ability in their new craft. Be it a crystal set, four-circuit tuner or neutrodyne, you will find anywhere from one to dozens of them being constructed in the radio department of the club.

"The club has now fostered the radio department for two years and has not only turned out hundreds of radio fans, but the sets made would make a real radio show all by themselves if they could be got together. All the way from crystal sets, which cost less than \$1.00—complete without phones—to massive outfits.

"An experimental department is conducted for testing hookups. This part of the work is under the direction of A. E. Haase, the club's radio expert. Classes in wireless telegraphy are being given so that radio fans turned out by this department can read code as well as listen to the voice over the radio phones. The club is hoping to have an amateur station in the near future through which it can transmit news items to the 4,000 boys who are members of the five branches of the Chicago Boys' Club."

Even boys who are fortunate enough to have a daddy like friend Thompson need to work and play with their own kind. Boys' clubs have a precious opportunity, which radio has come to improve many-fold.

THE Boy Scouts of America have a membership enrollment of five hundred thousand. Of this number a large majority have adopted radio—construction, operation and experimentation—as a very important part of their activities. The same thoroughgoing procedure marks their activities in radio as it has in all other subjects.



Radio School in the Chicago Boys' Club

OLD-TIME KEY-POUNDER'S RECOMMENDATION

"BEING an old timer in telegraphy (commenced in 1879), my favorite pastime in the evening is to tune in one of those copper plate senders working one of the New York control trans-atlantic stations, or 'K E T' at Bolinas, and sit in and copy him for an hour or so. It is a real pleasure to copy their stuff, as they are all beautiful senders; steady, smooth and fast.

"I went through the usual spasms of assembling, tearing down and re-arranging different kinds of hook-ups for long distance reception, and finally settled upon the ordinary regenerative tickler circuit with honey-comb coils (primary, secondary and tickler), as the best all around arrangement for long wave, high power stations."

GEO. H. HAZELTINE,
Fort Stockton, Texas.

bad connections. These connections were fixed and we have had no more cracking."

BEFORE you blame your radio receiver, and the broadcast stations and atmospheric conditions, better snoop around and spot the bad connections. Don't concentrate on heating pads; there are curling irons and egg-cookers and carpet sweepers, not to mention a million others more or less.

A short time ago a radio club sent out members on a hunt for trouble and found it where a bare electric wire came in contact

Radio Activities Broaden in Scope

THIS MONTH

- Permanent Radio Exposition—
- Radio Enthusiasts in India—
- Origin of Applause Cards—
- Evolution of Carboniferous Deposits—
- Saint-Gauden's "Diana" an Aerial—
- Honeycomb Coils Patent Award—
- Importance of Serial Numbers on Sets

RADIO is to be an important feature of the Permanent Industrial Exposition of Newark, N. J. The main structure will contain seven floors, including the basement, and will be surmounted by a tower rising to a total height of 235 feet, the tallest structure in New Jersey. Illuminated by special electrical devices, this tower will be a conspicuous landmark for the thousands who pass through the city daily on seven railroad trunk lines.

It is planned to install in the building a powerful transmitting station, to be used for the dissemination of price quotations and exposition news among the buyers of the country.

Radio will be featured as a department of the exposition by giving as much space as may be desired to manufacturers of equipment of all kinds. Newark's importance in the radio field is one reason why the exposition plans to develop radio as one of its prime activities. These activities are, however, national in scope and exhibits will be received from manufacturers anywhere in the country.

* * *

CATALOGS and price lists for American receiving sets and parts for amateur assembling are wanted by radio enthusiasts in India. Firms interested are requested to send such literature to the American Trade Commissioner, James E. Miller, Esq., Room 29, Grosvenor House, 21 Old Court House Street, Calcutta, India, who will be glad to make it available to those interested.

* * *

THE man who invented "Applause Cards" emerges from the shadows at last. Mr. Percy W. Andrews, Manager of the Radio Division of the Dictograph Products Corporation, and the man responsible for this revolutionary radio invention, has at last



Percy W. Andrews, manager Radio Division of the Dictograph Products Corp.

consented to tell the world how he landed the "big idea."

"It happened on the 8.14," answered Mr. Andrews. "I was sitting in the smoking car on this particularly bright morning, not so many months ago, musing over the Philharmonic concert I had heard via radio, the night before. The concert had been wonderful. My wife and I had enjoyed it immensely.

"Mentioning the fact to my neighbor across the aisle, brought a sympathetic response. He, too, you see, had been listening in, and like myself and probably thousands of other fans, he had neglected to go to the trouble of writing in his appreciation.

"If we only had some sort of printed cards to just sign and drop in the box," I ventured to him. "Sort of applause cards."

"That's it!" he chimed in, "applause cards!" And that was it.

"Study of the proposition, conversation with dealers, jobbers and other



A. M. Joralemon, sales manager of The Crosley Radio Corporation

fans assured me that the idea was sound; that applause cards would fill one of the greatest needs of broadcasting today.

"Well, everybody knows the rest. 'Applause Cards' are being given away free by thousands of radio dealers all over the country. The fans are taking and using them as fast as we can print them." * * *

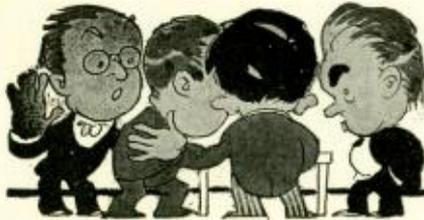
THE Robert L. Stillson Company has just published "The Story of Bakelite" by John Kimberly Mumford. It is an impressionistic piece of writing in Mr. Mumford's best style. Beginning with the genesis of Bakelite in the morning of the world, it carries the reader through its gradual evolution down to present day developments and uses.

While not in any sense a text book or technical presentation of the subject, it contains much serviceable information presented with accuracy and simplicity of statement. Altogether, it makes a readable little volume.

* * *

IT is barely possible that the famed bronze statue, "Diana," which surmounts the tower of Madison Square Garden and which is universally acclaimed as one of the finest pieces of sculpture in existence, may soon adopt a more useful profession than that of a beautiful weather vane. In other words, Saint-Gaudens' masterpiece may go into the radio business and establish herself as the world's most exquisite antenna.

(Continued on page 90)

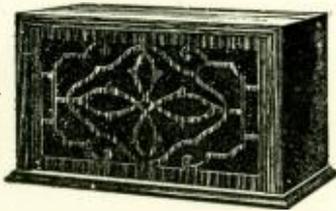


NEW APPLIANCES AND DEVICES



Sonora Radio Speaker

THE Sonora Radio Speaker is the same patented all-wood horn used in the Sonora Phonograph, with a Sonora tone arm and radio reproducer, encased in a typical Sonora cabinet. This is the tone passage which enabled Sonora to win highest award for tone quality at the Panama-Pacific Ex-



position and to be recognized as the sweetest toned phonograph. Embodied in the Sonora Radio Speaker, it imparts the same clarity, sweetness and volume to radio reproduction.

The Sonora Radio Speaker is the creation of experts in tone production—their contribution to the advancement of radio science.

It is a beautiful article of furniture. Its small size enables you to place it on top of your set, or on the table alongside. It is equipped with cord and connection, ready to be attached to your set.

Crosley 51-P

UNLIKE most portable receivers, the case of the Portable 51—known as the Crosley 51-P—has ample room for a real power plant of batteries instead of a limited space for flashlight batteries, which have a short life, even on dry cell tubes. The Crosley 51-P has ample space for three full-sized, six-inch No. 6 dry cells to furnish the filament current for either UV-199



or WD-12 tubes, giving economical life and not necessitating frequent renewal of "A" battery. There is also room for three

Eveready No. 764 vertical, intermediate 22½-volt "B" batteries, or the equivalent No. 5158 Burgess or No. 1153 French batteries, thus giving 67½ volts for the plates of the tubes, which means ample loud speaker volume under proper conditions. There is also room for a "C" battery, and provision is made for connecting in a "C" battery if desired. There is also room for one or two coils of insulated flexible wire to be used as an antenna and ground wire, as well as a compartment for head phones.

The Kellogg Universal Panel Radio Kit

THE Kellogg Switchboard & Supply Company have placed on the market a universal radio panel kit with audio amplification apparatus. This universal panel enables the buyer to mount three tuning units in any combination that he desires—that is, either two condensers or one coupler; two variometers and one coupler; two variometers and one condenser; one coupler, one condenser; or one variometer; or three condensers, covering practically every type of hook-up.

The size of the panel and apparatus per-



mit of the widest selection of circuits. The contents of this kit are as follows:

One panel drilled Kellogg Bakelite, 8½ inches high, 23¼ inches long, 3/16 inch thick; one mounting bracket, zinc, heavily enamel insulated; one shield, aluminum, eliminates body capacity; one insulator, bakelite panel strip for insulating rheostat mountings; one binding post strip, bakelite; seven No. 504 binding posts, with tinned terminals; three No. 502 dials, 4 inch diameter, ¼ inch holes, bushings for 3/16 inch and ¼ inch shafts; two No. 501 transformers, ratio 4½ to 1; two No. 502 switch contacts, silver plated, for decreasing resistance; nine No. 501 switch stops, silver plated; one No. 545 switch lever, silver plated; two No. 505 jacks, standard; one No. 504 jacks, standard; one No. 501 hardware, machine screw nuts, terminals, spring washers; one No. 501 S. plug; one bottle liquid spaghetti, for insulating the wiring; two No. 506 miniature condensers; one No. 503 mounting 4½ in. bakelite base, spring clip for two fixed condensers, takes all standard sizes; one No. 501 rheostat, 6-ohm resistance, for detector control; two No. 502 rheostats, 25 ohms resistance for amplifiers; three No. 2 tube sockets, bakelite reinforced

slot, tinned terminals and double lock washers; one set Elco transfers, for labeling the controls; one 3 foot length spaghetti, maroon, for insulating parts of wiring as desired; one-eighth lb. Kester resin core solder, the right kind to use; 30 feet No. 16 bare tinned copper wire.

Na-Ald Super-De Luxe Dial

THE Alden Manufacturing Company of Springfield, Massachusetts, have just placed on the market a new dial called the Na-ald Super-De Luxe Dial. This product



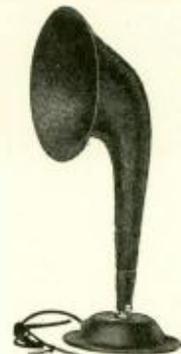
rounds out the very complete line of dials manufactured by the Alden Manufacturing Company. It is manufactured in the 3¾-inch size.

Like the other Na-ald Dials the Super-De Luxe is manufactured from black Bakelite with uniform back ribbing. Graduations and numbers are placed on the bevel of this dial and are marked with a permanent, brilliant white. The dial is provided with a large positive grip set screw. No special screw driver is required for setting.

The Addition to the Audiophone Line

THE Baby Audiophone is the latest addition to the Bristol family of loud speakers, and the one which is pictured above is now finished with a fiber horn.

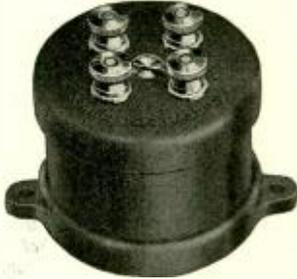
This loud speaker like all the other Bristol products, may be used on two or three



stages of amplification. It is of the same high grade construction and material as the rest of the line. A metal horn and fifteen-inch bell is optional equipment, if desired in place of the fiber horn.

"Eldredge" Ironclad A. F. Transformer

THE "Eldredge" Iron Clad Audio Frequency Transformer made by the Eldredge Electric Manufacturing Company, Springfield, Mass., is said to give uniformity of tone reception throughout the whole scale with maximum amplification and



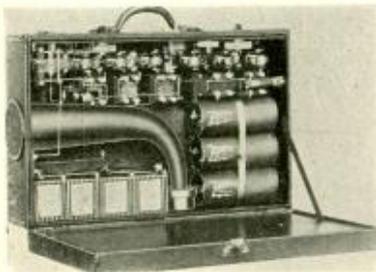
elimination of distortion. Long distance reception in sets using these transformers from London, England, and Catalina Island, California, has been accomplished.

Tops and bases are of best quality bakelite. Laminations and shield containing coil are of high silicon steel. The shield is one continuous strip of seven complete turns of unique construction. The core is of combined air and specially treated iron. The workmanship and material is guaranteed free of all defects when shipped from factory.

The New Zenith Super-Portable

THE new Zenith Super-Portable is a six-tube radio set complete with tubes, "A" batteries, "B" batteries, loud speaker and loop antenna, entirely self-contained. It is fitted into a small, beautifully finished traveling case—a most compact set giving clarity, quality, volume and distance.

In the case are included all the essentials of an efficient six-tube receiver employing three stages of transformer-coupled radio frequency, a detector, and two stages of



audio frequency. The set is dry-cell operated. A loop antenna is permanently mounted inside the case, and the three controls—(1) A rheostat for regulating the battery current; (2) Tuning control for selecting stations; (3) Volume control—are mounted close to the handle in three recessed dials.

The Zenith Super-Portable weighs only twenty-four pounds and may be carried about like an ordinary small suit-case.

No external aerial is required for operating the Zenith Super-Portable, nor is it necessary to open the case. The set is operated by means of two controls, both on

top of the case. Having tuned in the station you want, volume can be further regulated by swinging the case so that the loop is pointed in the direction of the station broadcasting. A station may be tuned and the Super-Portable placed in full operation while it is being carried down the street, in an automobile or otherwise transported.

Footo Variotector for Reflex Panel

THE Footo Variotector is especially designed, with its accompanying binding posts, for mounting back of the panel, in



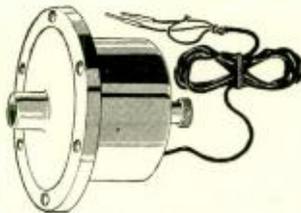
tube sets, as its micrometer rod allows the necessary adjustments for reflex circuits. Only one 1/4 inch hole in the panel is required for mounting. There is a solder connection to front terminal lug while the other connection is made to a binding post in the rear.

The variotector is equipped with a lock nut permitting permanent adjustment of the cat whisker with maximum audibility. It is very rugged in construction and will last indefinitely. The gold cat whisker provides two non-corrosive non-vibrating contacts.

These various features, combined together with ease of mounting on the panel and simplicity of construction recommend the variotector for reflex work.

K-E Phonograph Unit

A SPECIAL phonograph unit is now being made by the Kirkman Engineering Corporation of New York City, manufacturers of the K-E Loud Speaker.



This Phonograph Unit—like the Loud Speaker—incorporates the unique K-E 4-inch diaphragm. The 4-inch diaphragm is the secret of the clearness with which the K-E Loud Speaker, and now the Phonograph Unit, deliver their great volume.

A control knob on the back permits the volume to be increased or diminished by a twist of the wrist. The terminals of the standard length phone cord are completely enclosed.

Probably the most important feature of the K-E Phonograph Unit is that it will fit all makes of phonographs! This point will make the economy of a phono-attachment available for the thousands of radio enthusiasts possessing phonographs which cannot be fitted with ordinary attachments.

New Magnavox Reproducer

THE Magnavox Company is now distributing to the trade an entirely new model reproducer designated, M4.

This instrument makes use of the semi-dynamic operating principle developed by Magnavox engineers and first employed by them in the M1 Reproducer brought out a little less than a year ago. The M4 repre-



sents a further perfecting of this principle, especially the new magnetically balanced armature, the improved type of diaphragm supported by hollow rubber gaskets, and an extremely high resistance winding which makes M4 unusually sensitive.

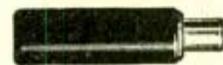
It is said that by eliminating moving parts, joints and other mechanical connections, the semi-dynamic operating principle makes possible a consistently higher quality of musical tone than any other instrument not requiring a battery for its operation.

Some of the other important features incorporated in the semi-dynamic mechanism are: a special large permanent magnet obviating use of field battery; a sound chamber designed on true acoustic principles, and a correct balance between size of diaphragm and vibrating air column in horn—this last being the factor which insures reproduction in high pitch. In the design of this model, much attention has been given to the matter of finish and general appearance. A new and very beautiful effect has been obtained by a gold trim applied in contrast with the dark blue enamel of the curvex horn and base.

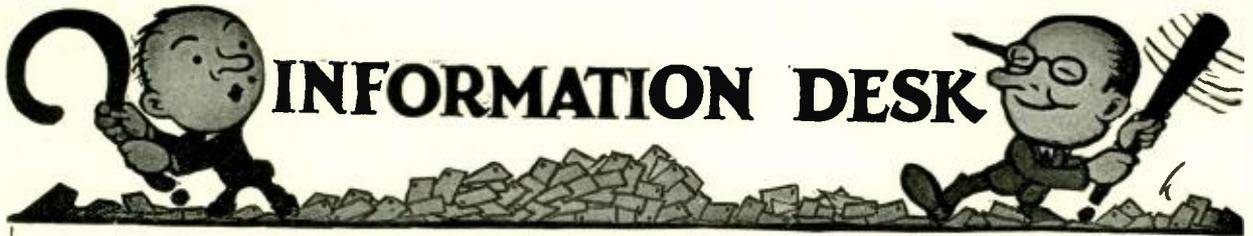
The Magnavox line of radio reproducers, by this addition, now includes models of both the electro-dynamic and semi-dynamic types—R3 and R2 electro-dynamic, and M1 and M4 semi-dynamic—prices ranging from \$25.00 to \$50.00. It is possible to select from these four Magnavox models a reproducer perfectly adapted for use with any type of receiving set.

Carter Portable Jack

THE Carter Radio Company has developed a portable jack for head phone and loud speaker and extension cord. It permits



the loud speaker or phones to be extended to an adjoining room or porch. It has been found of great convenience in camping and touring. The cord may be attached to the set with a plug or to the binding posts. The portable jack will accommodate any standard radio plug.



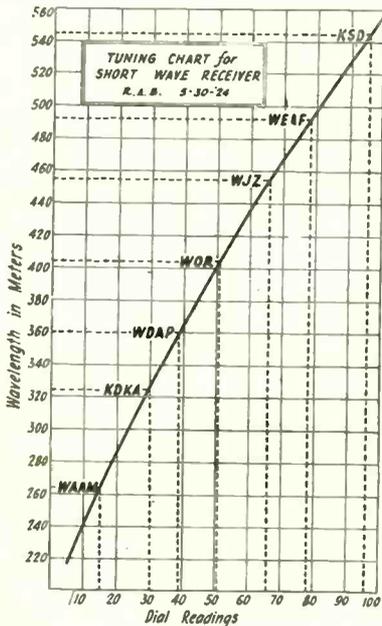
INFORMATION DESK

CONDUCTED BY R. A. BRADLEY

Due to the great volume of correspondence which this department entails we are forced to remind our readers on the following points: Be sure to enclose a self-addressed stamped envelope with your letter. Make your questions clear and concise. If you wish information on your set please enclose a rough sketch or hook-up if possible. Do not ask us to make comparisons between different makes of apparatus or sets.

F. J. Perce, Allentown, Pa.—I have been told that a tuning chart will aid me in finding distant stations. Will you please tell me how to make one of these?

A tuning chart or curve can be easily made by the owner of a radio set and is of great assistance in finding stations when only the wave length of the stations is known. A sheet of cross-section paper divided into 10 sections to the inch should be secured and arranged as shown in figure 1. As you see, this is marked on one axis with numbers ranging from 0 to 100 by



10's. This represents degrees on the dial of your wavelength control, whatever it may be, a variometer or a variable condenser. The numbers on the other axis represent the wavelength range. Now in order to make the curve you must plot a few points to begin with of the stations which you receive readily and whose wavelengths are known. There should be four or five stations plotted at least. After you have found the points on the graph for these stations draw a smooth curve through the various points. If this curve is carefully drawn it will be quite accurate enough to be of valuable assistance to you in tuning in stations which you have not heard before. On a tuned radio frequency set having two or three wavelength control dials it will be necessary sometimes to make three separate graphs, one for each dial. On the other hand if the set is well made

and the leads short the chances are that the dial readings on at least two of them are the same and one graph can be used for the two of them. Of course this curve cannot be strictly accurate because broadcasting stations as a rule do not adhere to the licensed wavelength which they have been assigned. For instance there is one station in New York City licensed to operate on 360 meters and on a precision wave meter this station was found to vary from 358 to 366 meters in a month's time. Stations KDKA and WGY maintain their constant transmitting wave at all times, varying less than 2 per cent.

Mr. S. E. Murdock, Washington, D. C.—I have been using a three honeycomb coil detector and two-stage amplifier with much satisfaction, but after reading the June issue of THE WIRELESS AGE, page 64, I thought that it was a good plan to re-build my set using one stage of radio frequency. I would like to have a diagram showing

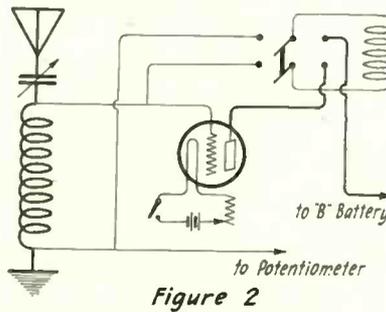


Figure 2

how I may switch off the radio frequency tube when receiving local stations.

The switching arrangement is shown in figure 2. This incorporates an anti-capacity switch, three-pole, double throw. When the switch is thrown to the radio frequency side the filament of the radio frequency tube is lit and a primary honeycomb coil is connected to the plate and "B" battery of the radio frequency tube. When the switch is thrown the other way the filament on the radio frequency tube is turned out and the primary coil connected to the aerial and ground.

Mr. T. P. Vaughan, Alexandria, Va.—I am very much interested in the article by R. B. Bourne in the May issue of THE WIRELESS AGE on short wave reception. What is the tube voltage and the audio frequency transformer ratio?

This receiver used a UV-200 as a detector which of course takes five volts at one ampere. A 201-A will probably work as well in this connection. The ratio of the audio frequency transformer was 10 to 1.

Mr. Joseph Schenckel, Hasbrouck Heights, N. J., asks.—What is meant by the mutual conductance of a tube? Also what effect has it on the operation of a tube?

The mutual conductance of a tube is the rate at which the plate current changes with respect to the grid voltage. In other words the mutual conductance is the slope of the plate current grid voltage curve. In figures 3 and 4 we have two such curves for two different tubes. It will be seen in figure 3

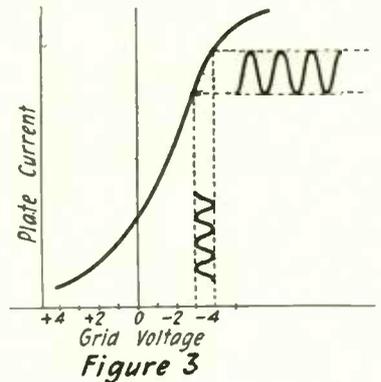


Figure 3

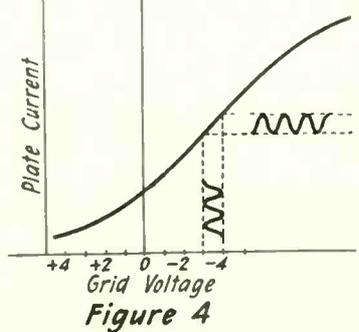


Figure 4

that for very slight changes in grid voltage on the steep part of this curve there are very great changes made in the plate current and consequently a loud signal is produced in the phones. In figure 4 we have a curve of another tube whose amplification factor is much lower and the slope of the curve is much more gradual. Let us now impress a grid voltage varying from three volts minus to four minus and see what we get in changes of plate current. You will note that the changes in plate current in this tube compared with the changes in the other tube are very small. In other words, the first tube had a higher amplification factor or mutual conductance than the second tube. The first curve closely resembles that of the UV-201A or 301A. The second is an approximate curve of the WR21A.

(Continued on page 77)

Afloat and Ashore With the Operators

(Continued from page 59)

Being at the point of exhaustion he was about to go to the adjoining sleeping room when he thought it best to remain in the room near his apparatus. He was napping but a few minutes when awakened by a crash. The bow of a steel life boat had smashed into the sleeping quarters and struck the bunk on which he would have laid.

The antenna carried away twice and each time Barry assisted in reconstructing it. There was eleven feet of water in the hold and the seas were so high it was impossible for other ships to approach and effect a rescue. The vessel finally made St. George, Bermuda.

* * *

DWIGHT HOWLAND passed through a thrilling experience during which he proved his bravery when the *Moreni* sank after a two-hour fight with a submarine on June 12, 1917. Throughout the fight Howland continued his radio communications until a shot through the radio cabin knocked the chair from under him and blew the phones off his head. This caused wounds about his face, hands and legs and happened a few minutes before the fatal shot which sank the ship. Howland was obliged to jump into the sea and swim a long distance to a boat. He was then made a prisoner of war by the submarine, but later released.

His junior operator, James J. Curran lost his life. Howland at the time was nineteen years old and upon his return to America further showed his bravery by immediately shipping on another vessel for the war zone.

* * *

HARVEY R. BUTT, who recently became district manager of the Radio Corporation's Norfolk office, was operator on the *S.S. Alamance* when that vessel sank February 5, 1918. After a torpedo struck the vessel Butt reported to the captain who informed him there was no need of sending out a call as another ship was then in sight. He stood ready, however, to stick should there be work for him to do. Later from the deck of the rescuing ship he witnessed his own vessel stand up on her end with the stern under water, pose a minute then drop quickly from view carrying along his clothes and effects.



HENRY T. MUNROE, an operator running out of Boston, gained recognition in 1918, when the *S.S. Currier* ran aground and stuck fast six days and twenty hours, during which Munroe worked incessantly. After the third day the provisions became exhausted, adding to the discomforts.

Just previous to the accident Munroe received an SOS call from another ship and later after sending his own SOS received two more; one from a ship in distress off New York an another from a ship on fire off Maine. The *Currier* was one of four ships in trouble that night.

* * *

Few know that Edwin A. Nicholas, who was recently promoted from the post of superintendent of the Great Lakes Division of the Radio Corporation of America, to assistant to the general manager, once played the role of hero. In January, 1916, his ship the *M. and B. No. 1*, was caught in an ice jam on the lakes. Although a large cake of ice smashed into his room it did not prevent him from using the key.

* * *

HERBERT L. McCENEY, running between New York and France on the *Englatine*, is often referred to as the hero of the sinking of the *Lake Frampton*, a vessel which was rammed and sunk by the *S.S. Comus* early in July, 1920. McCeney owes his life to the fact that he was a good swimmer. He had lost his life belt and the boats had cleared by the time he was ready. It was necessary to run down the side of the vessel, already laying over, and swim fast to get away from the suction. He was picked up on the opposite side of the *Comus* and for some time was thought missing.



Information Desk

(Continued from page 76)

Mr. Jacob Anderson, Los Angeles, California.—Will you please tell me how a resistance coupled amplifier works? It is apparent to us B.C.L.'s how a transformer will step up a given voltage. But the resistance amplifier is a mystery.

First of all in a resistance coupled amplifier there is a resistance of about 100,000 ohms placed in the plate circuit of the first tube. The variation of the plate current flowing through this resistance causes a variable voltage drop across it, which is impressed on the grid of the next tube, by means of the coupling condenser which may be .002 mfd. or thereabouts. This coupling condenser serves to prevent the grid of the next tube from operating at the normal D.C. positive plate voltage and permits its operating at the most favorable point on

its own characteristic curve. This is the second tube we are speaking of now. Then to prevent this condenser from assuming too much of a charge and "blocking" we insert between the grid of the second tube and the filament an ordinary grid leak. This grid leak allows part of the charge to leak off so much at a time and prevents the "blocking" of the tube. In a resistance coupled amplifier the plate voltage required is generally much higher than that of a transformer coupled amplifier. This will be at once seen when one stops to consider the resistance inserted between the source of supply and the plate. A resistance coupled amplifier when working properly is absolutely distortion proof and forms an ideal amplifier. Resistance coupled amplifiers are treated very thoroughly in Mr. Frank's article on Amplifiers running in this and the two preceding numbers.

Mr. S. H. Newell.—I am writing you to find out what the characteristic curve and amplification curve of a tube mean. I have seen this repeatedly in radio magazines and no attempt to explain it has been given.

We refer you to the answer to J. Anderson's question.

Ernest A. Reynolds, Monroeville, Indiana.—Is there any device which can be substituted for my "A" and "B" battery which will eliminate the trouble of purchasing new ones and having them recharged?

Such a device was presented recently at a luncheon of radio editors at the Hotel Pennsylvania by the Sabin Electrical Products Corp. of Jersey City, N. J. This instrument incorporates both "A" and "B" batteries. A model is also made for just the "A" batteries. This consists of a thermo-couple device which includes the transformation of electrical energy supplied by your house mains into heat then the transfer of heat to another thermo element which in turn produces the six volts or the 45 to 90 as may be required. At the tests where the instrument was used with alternating current there was absolutely no hum noticeable when used with a sensitive radio frequency set. The substitution was made of dry cells for the thermo instrument and no change was observed in the character of the signals nor their audibility. Further information on this instrument may be obtained from the above manufacturer.

Rafael Bordenave, Havana, Cuba.—Some of the intermediate frequency transformers now on the market are sharply tuned to 3,000 meters, others to 6,000, others to 8,500 and some to 10,000 meters. Some of these have air core, others iron core. Which is the most efficient type to use for my purposes?

The 10,000 meter iron core shielded will probably be found best for your purposes. The shielded type permits closer mounting than the unshielded and provides a more stable amplifier. The higher you go in wavelength, the lower you go in frequency and the lower the frequency the greater the amplification. The input transformer or filter can be made by using two 1,500-turn honeycomb coils with their windings shunted by .0005 fixed micadon condensers. These two honeycomb coils should be mounted three or four inches apart and this distance made greater if the set tunes too broadly.



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Name

Street

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

Mr. A. Zuntwalt, Durant, Oklahoma.—In your May issue of THE WIRELESS AGE you showed a new superdync. I would like to know where I can get complete blue prints of this circuit and where the curkoid coils are manufactured.

The blue prints for this circuit may be obtained from the C. D. Tuska Co., Hartford, Conn., together with parts. The curkoids may be obtained from the Rieger Research Laboratories, 100 Charles Street, New York City.

J. E. Eckles.—Is there any way of determining what the proper charging rate of a storage battery is when used for lighting a UV-200 and 2 UV-201A's? My battery is a 3LxL9.

There is no particular way of determining just what your charging rate should be and most makes of chargers on the market today do not have a variable charging rate. The type of battery which you have has a 100 ampere-hour capacity and its manufacturers recommend that it be charged at six amperes until nearly up to charge and then reduced to three amperes. The slower the charge the better for the battery. Be sure that your battery is filled with water before starting the charge. A very good charging arrangement was shown in Mr. Ward's article in the May issue of THE WIRELESS AGE.

H. M. Nestor, Dayton, Ohio.—In accordance with the article in the February issue of THE WIRELESS AGE I made up one of your three-tube sets, one stage of tuned radio frequency crystal detector and two stages of audio frequency. I cannot make the set oscillate and the tuning is very broad.

The reason the set will not oscillate is that the crystal detector is not doing its share of the work. As we outlined in the May issue a good adjustable crystal is superior in this particular case to a fixed one. The fixed ones at best are none too good for this purpose, and a rough surface mineral will in general be more satisfactory than a smooth one. The reason your set tunes so broadly is the fact that your radio frequency tube is doing the detecting instead of your crystal and since it is not functioning as it should what results you have obtained have been obtained in spite of your set and not because of it.

J. E. Taylor, Columbus, Ohio.—In experimenting with different radio sets, I have had occasion to wind numerous coils of inductance. I would like to know if there is any given ratio between the number of turns or the length of the winding and the diameter. It seems to me that a certain ratio should be the most efficient.

This ratio as given by Professor Morecroft is as follows: The maximum inductance for a given length of wire is had when the diameter is 2.45 times the length of the coil. This represents the ideal inductance, but can be varied to an appreciable extent without a serious loss in efficiency. An example of the above formula is as follows: a coil of wire 5 inches in diameter would have the maximum inductance if it was wound in a space 2 inches long or 5 inches equals 2.45x2 inches.

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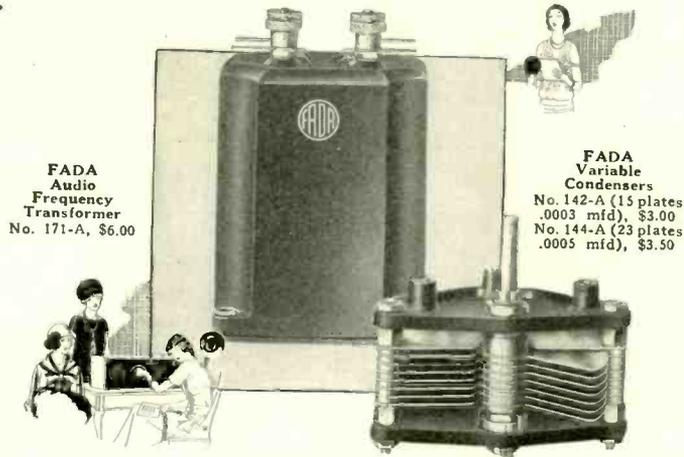
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FADA

Transformers and Variable Condensers



More volume—finer tuning

POOR condensers absorb radio power—that cuts down volume. Poor condensers add resistance—that broadens tuning. You can sharpen your tuning, increase selectivity and get greater volume with the new FADA “low-loss” variable condensers. Use them. The low power factor and low equivalent series resistance prove their superiority. FADA “low-loss” condensers are more efficient than many of the so-called precision condensers and have a capacity ratio of 40 to 1 as compared with 30 to 1 which is usually encountered. Two sizes—No. 142-A (15-plate .0003 mfd) at \$3.00 and No. 144-A (23-plate .0005 mfd) at \$3.50.

Performs as well as it looks

The new FADA Audio Frequency Transformer is encased in bakelite with nickeled binding posts and soldering lugs. It looks “quality” all over. And it performs up to its appearance. It has a high average amplification over all the broadcasting wave-bands and reproduces voice and music with a volume and tonal fidelity that is surprising. A wonderful addition to the audio frequency stages of Neutrodyne receivers and equally efficient in other types. This new transformer, No. 171-A, is made possible by correct FADA engineering principles and by uniform production methods. Ratio 4 to 1. Price \$6.00.

Ask your dealer for FADA Transformers and Variable Condensers

F. A. D. ANDREA, INC., 1581 Jerome Avenue, New York



When writing to advertisers please mention THE WIRELESS AGE

Transradio

(Continued from page 29)

which forks halfway along, twelve pairs going to Villa Elisa and six to Monte Grande. In the central office, in the midst of the rococo-fronted bank and office buildings of Buenos Aires are situated the controls that launch into space the 500 kilowatts from the transmitter, and here too the speeding wave-fronts from Europe and North America finally reach their journey's end. According to conditions, both head-phones and automatic ink-receivers are used for reception. All north-bound traffic is sent by means of perforators and automatic transmitters.

The tumult and the shouting connected with the first few months of service have died away, and throughout Transradio things have settled down to normalcy in the economic, efficient and accurate handling of commercial traffic. Obstacles still exist, it is true—many of them—but the personnel from the highest to the lowest are already possessed of that *esprit* bred of having accomplished things, and its existence always means that still greater progress lies just ahead. Argentina, the first South American country to establish high-power commercial service, has her hat in the ring, and it is there to stay.

Scouts Who Have Made Good in Radio

(Continued from page 25)

heard radio-equipped airplanes racing toward Norfolk and exchanging messages with the Naval Air Station at Anacostia.

The following winter he was once more the operator at the scout camp, this time at Cold Spring. Again his receiving outfit was the only means of securing up-to-date news. Using a vacuum tube receiver, he copied the amateur broadcasts, and the national office could reach him with broadcasts transmitted by NAH, the Navy station at New York, which has been transmitting official scout messages for a number of years. The weather reports that he received and posted were of considerable value to the winter campers.

In July, 1922, Barry went with Manhattan Troop 503 to their summer camp at Redding, Connecticut. He was in charge of the camp. He carried a radio set with a two-stage amplifier. Every night he copied such information from Government stations as was of value to the people of the community, and every morning he sent an orderly to post the weather report and other items in the village post-office. It

RATHBUN SUPERIOR CONDENSERS "Extremely Low Losses"

Tests by "Lefax" and other recognized laboratories report losses in Rathbun Condensers "negligible." Mechanically and electrically as perfect as fine engineering can make them. See these Rathbun "points of superiority"—single hole mounting, self-wiping contacts, anchored stator plates, non-magnetic materials and other advantages.

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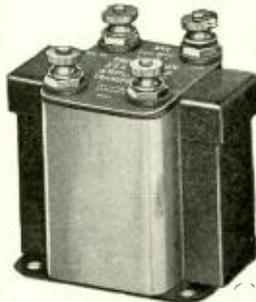
Radio
"Applause Cards"

"— Station W-J-Z signing off. If you have enjoyed the artists' program, won't you write in and tell them?"

By all means! Quickly and easily with "Applause Cards". They're handsomely printed mailing cards. All ready for you to fill in with your comments, sign, and drop in the mail box. Keep a pack of them near your receiving set. You can use "Applause Cards" liberally because they are FREE AT YOUR RADIO DEALER'S.

("Applause Cards" were originated by this Company, makers of the popular Dictograph Loud Speaker and the Aristocrat Dictograph Headset. The only "Applause Cards" are Dictograph Copyrighted "Applause Cards".) A big FREE package of them awaits you at your dealer's. Or, if he has not yet stocked, we will send you a large package of "Applause Cards" prepaid direct to you, providing you will furnish us with your dealer's name. Dept. F-7.

**DICTOGRAPH
PRODUCTS CORPORATION**
220 West 42nd Street New York City
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**SUPER
TRANSFORMER**
(audio frequency)

"Simplest thing in the world, Mary. The boys at the office have been talking Thordarson Amplifying Transformers so hard that I decided to install them in place of my old ones. I see now that it was a wise move."

* * *

The Super Transformer is indeed the mirror of the Broadcasting Studio. It was designed with one primal aim—perfect reproduction. It has the same function in a radio set that the reproducer has on your phonograph. Install a pair—it will take you but a few minutes—and you will marvel at the rich musical quality obtained.

Kennedy, Zenith, Radiodyne and many other leading set manufacturers use the Thordarson Super Transformer in their apparatus. That's irrefutable proof of Thordarson superiority.

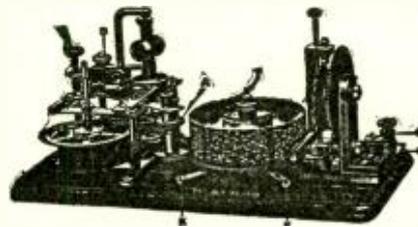
THORDARSON
ELECTRIC MFG. CO.

Huron and Kingsbury Streets

Chicago, Ill.

Learn the Code at Home with the Omnigraph

"Just Listen—The Omnigraph will do the teaching"



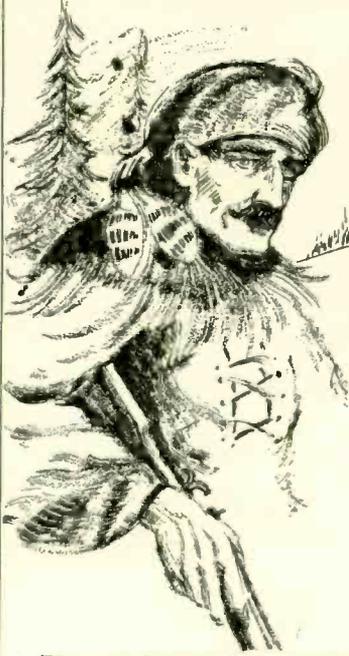
THE OMNIGRAPH Automatic Transmitter will teach you both the Wireless and Morse Codes—right in your home—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or Sounder, it will send you unlimited messages, at any speed, from 5 to 50 words a minute. THE OMNIGRAPH is not an experiment. For more than 15 years it has been sold all over the world with a money back guarantee. THE OMNIGRAPH is used by several Depts. of the U. S. Govt.—in fact, the Dept. of Commerce uses THE OMNIGRAPH to test all applicants applying for a Radio license. THE OMNIGRAPH has been successfully adopted by the leading Universities, Colleges and Radio Schools. Send for FREE Catalog describing three models. DO IT TODAY.

THE OMNIGRAPH MFG. CO.
16B Hudson St. New York City

If you own a Radio Phone set and don't know the Code—you are missing most of the fun

JEFFERSON TRANSFORMERS

Pioneers

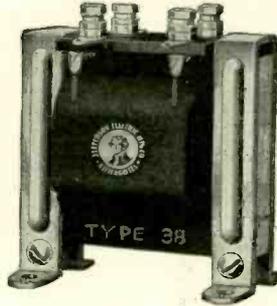


The trail blazers through their untiring efforts are always the pioneers of Industry.

The present day perfection of Radio Transformers is due in no small measure to the faithful and persistent efforts of Jefferson Engineers who designed and experimented with Audio Amplifiers long before Radio reached its present day popularity.

TRANSFORMER SPECIALISTS

These extra years of experience are reflected in the quality and performance of Jefferson Transformers.



The name Jefferson is associated by both professional and amateur Radioists as regards Radio, Intermediate and Audio frequency Amplification with extremely high quality.

The installation of Jefferson transformers in your set will assure you of a quality of Reception that is unparalleled. There's a Jefferson Transformer for every circuit.

*Send for our latest Bulletin "Putting Quality Into Radio."
The name Jefferson is known wherever Transformers are used.*

JEFFERSON ELECTRIC MANUFACTURING CO.
431 SO. GREEN ST. CHICAGO, ILLINOIS

- | | |
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| RADIO TRANSFORMERS
BELL RINGING TRANSFORMERS
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AUTOMOBILE IGNITION COILS | MANUFACTURERS OF
JUMP SPARK AND MAKE AND BREAK COILS
TOY TRANSFORMERS
AUTO TRANSFORMERS
FURNACE AND OIL BURNER TRANSFORMERS
TESTING INSTRUMENTS |
|--|--|



happened that the weather for the two weeks was almost exactly what the forecasts predicted, and Barry was soon considered a wizard at radio.

After having progressed through the various degrees of scoutcraft, Barry became a scoutmaster. His scouts, naturally, became interested in radio. Nine of them in one year made their own receiving sets, and four of the sets were good tube outfits. Several meetings were held for special instruction in radio. When they went on a hike they always carried one receiver, at least, and by stringing an aerial from a tree they kept in touch with the world.

One member of the troop is now an operator at WBZ, the big Westinghouse broadcasting station at Springfield, Massachusetts. Another made an extended trip to Europe, where he was saluted and greeted by scouts and scout officials in many countries. He reported that even the shopkeepers recognized the scout badge and respected it. Still another of Barry's scouts worked his way on a ship to Sweden, the birthplace of his parents, and from there made a tour of Europe alone.

Last year Scoutmaster Barry took unto himself a wife. Of course, he married the nicest girl in the world, for all such a good scout has to do is to have the line form on the right and take his choice. Under similar conditions some scout officials have found less and less time for scouting; but Mrs. Barry is too good a scout herself to deprive her husband's scouts of his leadership. Instead, she pitches in and works as hard as any assistant scoutmaster.

Beside attending to business and keeping the scout work going, Barry keeps up with the correspondence courses conducted by the Army for its officers. He received 86% in the examination in administration and 100% on organization of the Army. He is in command of the 2d Platoon, Company I, 307th Infantry, 77th Division.

Aside from an armful of merit badges, Scoutmaster Barry now has a ten-year veteran's badge; but this is what he says:

"It seems a long time since I first passed my tenderfoot test. As I look back on it, I think I cared more for that badge than I did for almost all the rest."

But suppose Scout Barry had stopped after he had won his tenderfoot badge. Would there have been as much pleasure in looking back after ten years and realizing that he had made no further progress in all that time?

What are you, who read this account of a remarkable scout career, going to look back at ten years from now?

GOOD INSTRUCTION IN A SHORT TIME



can only be given in a completely equipped laboratory under expert instructors. We have both. Correspondence and Resident Courses.

Write for illustrated booklet.

Y. M. C. A. Radio Institute

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It's Capacity that Counts!

Good condensers are designed according to microfarads, not number of plates alone. U. S. Tool Condensers are designed for correct capacity.

100% GUARANTEED
End Plates of CELORON

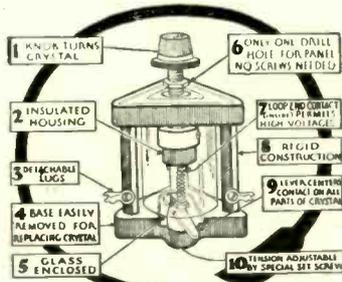
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Condensers of recommended capacity for all known circuits are also carried in stock by leading radio retailers.

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B-Metal for volume and for distance. Ask your dealer.
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Best Crystal Ever Designed!

FRESHMAN

Double Adjustable crystal Detector for panel or base use. complete **\$1.50**

Freshman Super-Crystal with Non-Metallic Housing 50c.

At your dealer's or send purchase price and you will be supplied postpaid

FREE! Write for building plans and hook-ups of Super-Heterodyne, Reflex, and other popular circuits. Ask for list L-113.

Chas. Freshman Co. Inc.
Radio Condenser Products

106 Seventh Avenue New York City



Licensed by Independent Radio Manufacturers, Inc., under Hazeltine Patent Nos. 1,450,080 dated March 27, 1923, and 1,489,228, dated April 1, 1924. Other patents pending.

The Eagle *Balanced Neutrodyne*
"King Of The Air"

THE skill and painstaking care maintained provide a balance comparable, figuratively, with the poise of the soaring eagle. Demands upon quantity production are forgotten in the untiring effort to provide the perfect balance of tube capacities that has made the Eagle the peer of Neutrodyne.

Eagle Neutrodyne cannot reradiate nor regenerate. Its remarkable ease of operation makes certain the reception of any station, once logged. As wonderful in simplicity as the phonograph; more wonderful in its volume—clear, loud, actual in tone.

QUALITY FIRST characterizes the Eagle—and prompts the unreserved guarantee.

We Soar Above

EAGLE RADIO COMPANY
24 BOYDEN PLACE NEWARK, N. J.



Give Your Loud Speaker To the Ash Man

The Rhamstine* Needlephone has made the conventional loud speaker as out of date as a single circuit blooper. It sets a new standard, which no radio loud speaker has been able to meet.

It eliminates mechanical noises by removing the cause. It has no diaphragm, so cannot produce metallic sounds. Its limitations are only those of your receiving set.

Utilizes Phonograph Perfection

Everyone recognizes the perfection of the present day phonograph as an amplifier. The correctly proportioned tone-arm, the wood tone chamber contribute to this; but the greatest single factor is the mica reproducer.

Only the Rhamstine* Needlephone can bring the clarity, mellowness and cello-like beauty of tone of the phonograph to the radio, because it alone uses the phonograph reproducer.

It is not an attachment—not an adapter. There is nothing to change on your phonograph. The illustration shows how it operates. For any phonograph except Edison without Victor attachment.

Money-Back Guarantee

Don't take anyone's word for it. Try it out. Test it beside the loud speaker you think best. Compare tone volume, convenience, with any loud speaker at any price. See for yourself how much noise the diaphragm is to blame for.

You take no risk. If it isn't all—and more—than claimed, return it. Your money will be cheerfully refunded. Don't be content with less than Needlephone perfection. Send the coupon today.

J. THOS. RHAMSTINE*
504 E. Woodbridge, Detroit, Michigan

Send me the Needlephone. I'll pay the postman \$10 upon its arrival. It is distinctly understood I may return it if I desire, within 5 days and receive a refund in full.

Name
Address

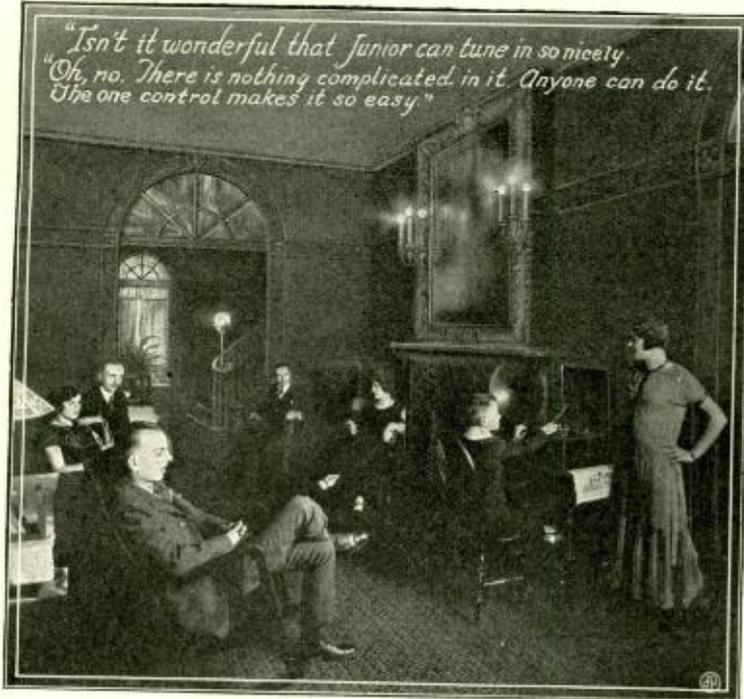
*Radio and Electrical Products.

\$10 Complete with Cord
RHAMSTINE*
Needlephone

Transfers the electrical energy of your radio into vibrations which, through the phonograph needle, are transmitted to the reproducer of your phonograph. It makes your phonograph the world's finest loud speaker.

The same high quality as Rhamstine* Transformers, Victrola and Electric Soldering Iron.

If your dealer hasn't Rhamstine* Products, send for details and prices.



Bristol Single Control Radio Receiver

Complicated combinations are eliminated when tuning in with Bristol Single Control Radio Receiver—every station is on the one dial. It gives the joys of radio with technicalities left out.

The well-known Grimes Inverse Duplex System (non-reradiating) is utilized in this Receiving Set. Because of the reflex, only four tubes are required to give power equivalent to six. The price, without accessories, \$190.00.

You forget the radio equipment when listening thru the Audiophone Loud Speaker. The tone is full, clear and pleasing. It gives a true reproduction of the original. Made in three models—Senior \$30.00, Junior \$22.50, and Baby \$12.50.

Ask for Bulletins Nos. 3014 and 3015-V.

Made and Sold by

THE BRISTOL COMPANY
WATERBURY CONNECTICUT

AUDIOPHONE Loud Speaker

The Wireless Age Portable Reflex

(Continued from page 49)

as near to where you wish the set to be placed as possible, and run the other end in the direction away from which you wish to receive the most stations. That is if you are located on Long Island and wish to receive the New York stations you will erect the antenna so that its free end is pointed east and the set is located on the west end. This will give your antenna a westerly direction effect and will prove most efficient in that direction. When you are ready to pack up and come home, simply wind the wire back on the spool and it will not take up more than the space of a kodak in your suitcase.

It is altogether impractical to use an immense loud speaker for use with this set. In the first place they are in general, awkward to handle and will not pack well. The best we have found in this line is a single sensitive phone unit in connection with an ordinary 10-inch by 12-inch hand megaphone such as the one we used to use when we saw a 60-yard run for a touch-down, through a broken field. We fastened the phone unit onto the mouth piece of the megaphone with friction tape. It will be found that a few turns of this tape will hold the instrument together surprisingly well. Of course as it stands now it has no support and is not very efficient. A broom handle stuck upright into the ground near the camp will fill the bill great. Use some more of the friction

(Continued on page 90)

Antennas and Grounds

(Continued from page 52)

The grounding conductor may be run either inside or outside the building. The protective grounding conductor and ground, installed as prescribed in the preceding paragraphs may be used as the operating ground. It is recommended that in this case the operating grounding conductor be connected to the ground terminal of the protective device.

If desired, a separate operating grounding connection and ground may be used, the grounding conductor being either bare or provided with an insulating covering.

WIRING

Wires inside buildings shall be securely fastened in a workmanlike manner and shall not come nearer than 2 inches to any electric light or power wire not in conduit unless separated therefrom by some continuous and firmly fixed non-conductor, such as porcelain tubes or approved flexible tubing, making a permanent separation.

Built up to a high standard, not down to a low price

CARTER Portable Jack



Just the thing to use for extending the loud speaker into the hall, onto the porch or out into the garden, without moving the set. Takes any standard plug.

Portable Jack \$1.50

Carter quality throughout

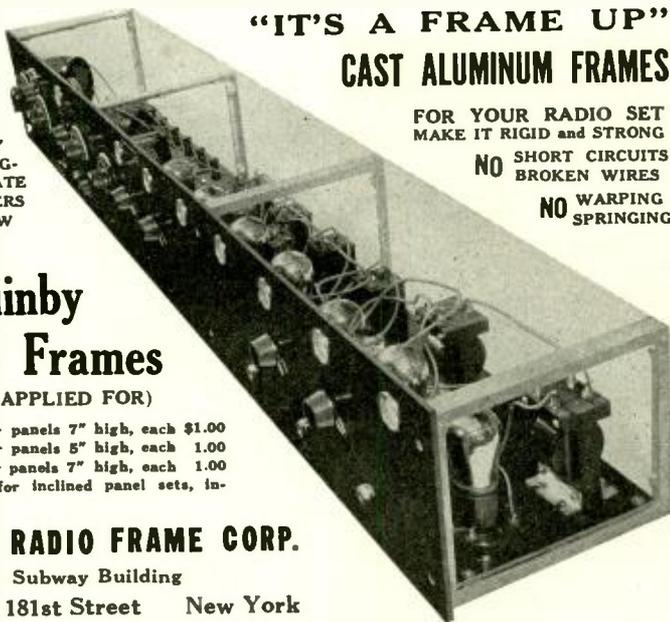
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JUST APPLY
FLAT MAHOG-
ANY OR PLATE
GLASS COVERS
TO THE NEW



**"IT'S A FRAME UP"
CAST ALUMINUM FRAMES**

FOR YOUR RADIO SET
MAKE IT RIGID and STRONG

NO SHORT CIRCUITS
BROKEN WIRES

NO WARPING
SPRINGING

**Quinby
Radio Frames**

(PATENT APPLIED FOR)

SIZE "A" for panels 7" high, each \$1.00
SIZE "B" for panels 5" high, each 1.00
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(SIZE "K" for inclined panel sets, in-
quire)

QUINBY RADIO FRAME CORP.

Subway Building

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Guglielmo Marconi, as he appears today.
Signor Marconi is Honorary Chairman
of the Radio Institute of America

**Train for the big
Jobs in Radio**

There are big radio jobs wait-
ing. Over 6,000 operators
have already graduated
from the Radio Institute of
America. But the radio in-
dustry is just in its infancy.
There are more demands for
operators than there are
trained men to meet the de-
mand.

Conducted by the Radio Cor-
poration of America, the
Radio Institute offers the
soundest instruction and the
most logical means of em-
ployment after graduation.
Write for information con-
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If you have the January, February, March,
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WIRELESS AGE send them to us and we
will extend your subscription one month
for each issue.

DEPT. "M"

THE WIRELESS AGE

326 BROADWAY

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J. C. McQUISTON

Advertising Director of Westinghouse Co.

says:—

"More people listen in to religious services than
to any other feature on the radio program."

You can reach this market through

CHRISTIAN HERALD

Home Study Courses

Conducted from New York City.
Full instruction for those who
cannot attend the San Francisco
resident school.

- A. Complete Home Study Course.
From beginnings of magnetism
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For the advanced radio student
and experienced amateur. Spe-
cializes in C. W., I. C. W., tele-
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Send the coupon for full information

Radio Institute of America

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Established 1909

Western District Resident School
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HOME STUDY COURSE

326 Broadway, New York City

Indicate by a cross X the course you are interested in:

Radio Institute of America,
326 Broadway, New York

Please send me full information about
radio opportunities today, and your

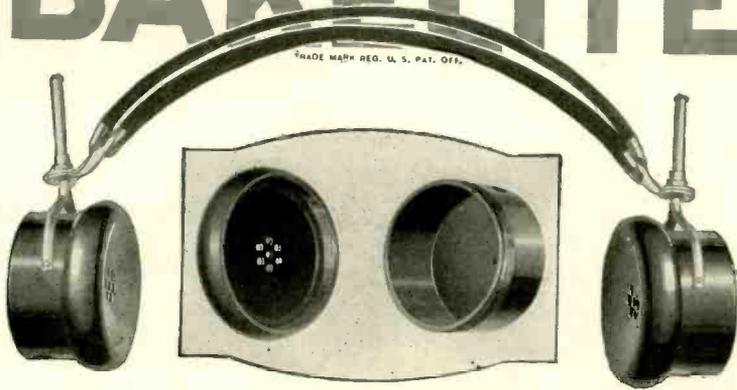
COMPLETE RADIO COURSE

ADVANCED RADIO COURSE

Name.....

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BAKELITE



Baldwin and Bakelite

The clear tone of this popular headset, made by Nathaniel Baldwin, Inc., of Salt Lake City, has been developed by careful experimentation in every phase of its manufacture, from the selection of raw materials to the final testing of the completed instrument.

Bakelite is used for the receivers because it is strong, and light in weight. After years of service

under varying atmospheric conditions, Bakelite shows no signs of deterioration. Its color does not fade and its fine finish is impervious to oils, acids and moisture.

"The Material of a Thousand Uses" possesses many valuable properties which make it peculiarly suitable for use in radio equipment.

Send for a copy of our Booklet A.

B

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Send for our Radio Map

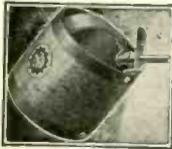
The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.
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THE MATERIAL OF A THOUSAND USES

PALL MALL PRODUCTS



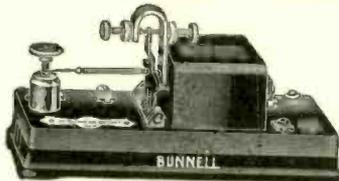
Pall Mall 180° Variocoupler, Pall Mall Variometer, tune 150-650 meters. Small - wound with Green Silk Wire. Pall Mall Products

make a good set better. List Price \$2.00 each. Jobbers, Dealers write for discounts.

ESSEX MFG. CO.

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GHEGAN RADIO RELAY



Tape permit tubes of various impedances to be used. With Bunnell Rectifier this Relay will copy telegraphic signals at a speed of 60 to 90 words per minute. With Siphon Recorder speeds up to 200 words per minute have been obtained. Normal operating current is 1/2 to 2 milliamperes. Send stamp for catalogue No. 45 W.

Ghegan Radio Relay.....\$40.00
Special Price to Dealers
J. H. BUNNELL & CO. 32 Park Place, New York City

Sound

(Continued from page 35)

is so great as to cause pain in the ear. This is also shown in the upper curve of the accompanying figure, 4, and is seen to vary with the pitch of the sound.

5. Between the lower and upper pitch sensation limits and the upper and lower intensity limits is a region known as the auditory sensation region. This region roughly covers all pitches from about 20 to 20,000 cycles and pressure changes from about 0.0008 dynes to about 8,000 dynes, or a range in sound pressure of 100 million times the minimum pressures required for audition. This range in sound pressure corresponds to a change in the sound energy or intensity of 10,000 trillion times the minimum audible intensity. These numbers are far more awe-inspiring than were the calculations of the dollar in terms of German marks! It simply shows that the range of usefulness of the ear in every day use is astounding.

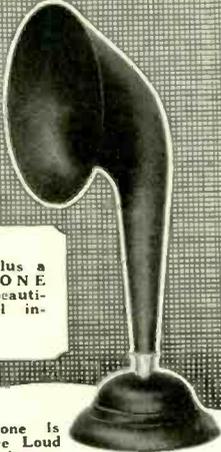
6. At any one pitch the ear can detect a number of different intensity increments. That is, if the intensity is some given value, then when it is suddenly increased to a slightly greater value the ear can detect the increased loudness. The ear has the power, therefore, of loudness discrimination. At low frequencies the increase in intensity needs to be greater than at the higher frequencies. Also at weak intensities the increase in intensity needs to be greater than at higher intensities, figure 5 shows this characteristic. For example, at intensities near the lower intensity limit of audition the intensity has to be increased about 25 per cent. in order to detect a change in loudness, whereas at normal intensity the increase needs to be about 10 per cent. In the figure, for example, 10⁴ means 10,000 times the minimum audible intensity, 10⁸ is 100,000,000 times, etc.

7. We find also that the ear possesses the power of pitch discrimination as illustrated in the accompanying figure 6. At low frequencies the ear can detect a difference in pitch of about one per cent. in the neighborhood of fifty complete vibrations. From 500 to 5,000 cycles the ear can detect difference in frequency of about 0.3 per cent.; that is, at 50 cycles, the ear can detect a change in pitch of 50.5 cycles, at 1,000 cycles it can detect a change of 3 cycles, etc., at high frequency the percentage has increased again.

8. If we take into account upper and lower frequency limits of auditory sensations, the minimum audible sound intensity, the maximum pressure changes which cause pain and the ability of the ear to detect changes in intensity and pitch of a single tone, we

When writing to advertisers please mention THE WIRELESS AGE

\$8⁰⁰



A phone plus a FIBERTONE makes a beautiful musical instrument.

The Fibertone is used by more Loud Speaker Manufacturers than any other one horn. It follows that these manufacturers have made scientific tests and find Fiber to be best for true tonal reproduction. This is a significant endorsement to those who want the best reproduction for the least investment. The base is designed to fit the phone from any head set. Use your own unit which you know is good. If your dealer cannot supply you, write to us direct.

FIBER PRODUCTS COMPANY
36 Orange Street Bloomfield, N. J.

FIBERTONE
RADIO HORN

Music Master Corporation
10th & Cherry Sts. 1005 Liberty Ave.
Philadelphia Pittsburgh

Special service to dealers on Radio Corporation of America products in Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, Virginia, West Virginia and Ohio.

Radio Safeguards

STORM KING LIGHTNING ARRESTER

Approved by the National Board of Fire Underwriters



\$1⁰⁰ at all dealers



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SCIENTIFICALLY CORRECT RADIO RHEOSTAT
with Battery Switch Attached

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at no extra cost. Still \$2.00. Still the filament control of proven supremacy. The only rheostat and battery switch in one. If you want perfect control of any type tube in any hook-up—if you want DX stations you never heard before—if you want silent tube operation—maximum signal regeneration—longer tube and battery life—then you must use FIL-KO-STAT, the Filament Control of Infinite Adjustment. The Battery switch (patent applied for) attaches to regular mounting screws. No extra holes to drill.

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This arrester with its bell-shaped shield will positively keep dry and not gather dust or other conductive matter which causes short-circuits from aerial to ground. This makes certain that all radio impulses reaching the aerial pass through your set, insuring maximum reception. Insulation is of polished Bakelite—the best, most moisture-proof dielectric. It is hermetically sealed—no dirt or moisture can reach the gap. Rugged mounting bracket keeps FIL-KO-Lightning Arrester rigid under all conditions.

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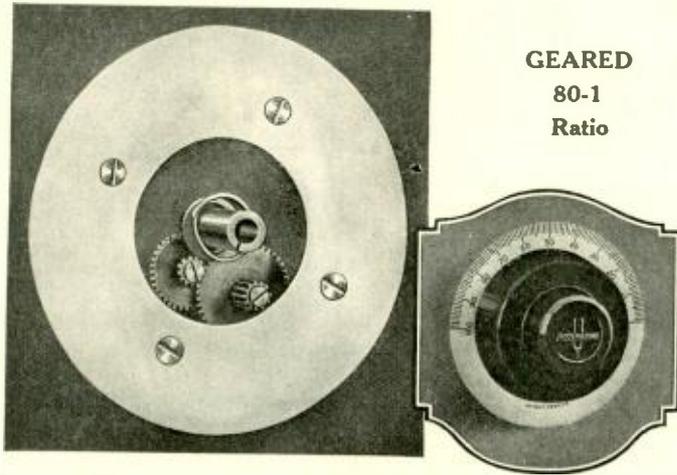
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MICROMETER CONTROLS

find that the normal ear can detect the enormous number of over 300,000 separate tone sensations. That is, the area between the two curves of upper and lower intensity limits can be divided into over 300,000 little rectangular areas within each of which constitutes a single tone which can be distinguished from the tones in all the remaining areas. It seems to me, then, when we grasp the full significance of these numbers we can then appreciate the wonderful performance of the human ear when called upon to analyze the beautiful combination of complex sounds which exist in the realm of music.

Reference may be made to the following treatises by Dr. J. P. Minton for a more comprehensive study of the characteristics of the ear:

"Physical Characteristics of Normal and Abnormal Ears," The Physical Review, February, 1922.

"The Sensitivity of Normal and Defective Ears for Tones of Various Frequencies," Proceedings Institute of Medicine, Chicago, 1921.

"Some Physical Characteristics of the Ear," Proceedings National Academy Sciences, August, 1921.

"Some Cases of Nerve-Deafness and Their Bearing on Resonance Theory of Audition," Proceedings National Academy Sciences, September, 1922.

"Correlation Between Physical and Medical Findings on Normal Ears," Proceedings National Academy Sciences, August, 1923.

"Physical Measurements of Minimum Audibility," The Journal of Laryngology and Otology, England, August, 1923.

"Tinnitus and Its Relation to Nerve-Deafness with an Application to the Masking Effect of Pure Tones," The Physical Review, November, 1923.

Approved Portable Receiver

(Continued from page 39)

line and on the A.F. amplifiers to the negative terminal of the filament heating supply.

It should be noted that only three battery leads are necessary; two are for the 4½-volt filament battery and the other is the positive plate battery connection. The negative "B" and positive "A" are joined together. No tap is used for the detector plate as with 70 volts plate battery the UV-199 works quite well.

Control is through the condenser vernier, the knob for which protrudes through the suitcase under the handle; the potentiometer or volume regulator is seen mounted to the left of the condenser vernier.

Two 12-ohm rheostats are shown in the photograph, but one 20-ohm rheostat will suffice.

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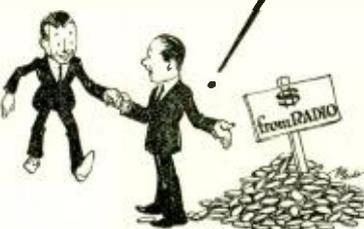
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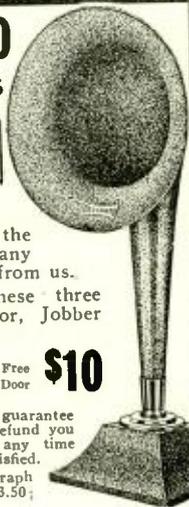
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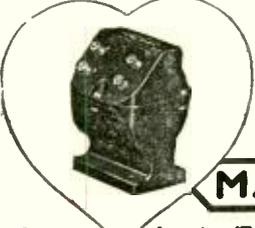


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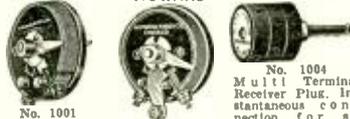
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By **ELMER E. BUCHER**

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See page 6.

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Look for the socket board

In leading radio stores you will find the Na-ald Socket Board, displaying the five standard Na-ald Sockets. For the 200 and 201 tubes, the De Luxe at 75c, and also the Small Space at 35c: For the UV-199, No. 499 at 50c and adapter at 75c: For W. D. 11, No. 411 at 75c.

Ask your dealer to show you the self-cleaning arrangement of contacts in Na-ald De Luxe, No. 400. These dual-pressure contact strips cut into the sides of tube terminals, keeping their surface clean and bright, and resulting in perfect contact.

These sockets have the highest dielectric properties, obtained by the thorough cure of the Bakelite used, and made possible by uniform cross-section.

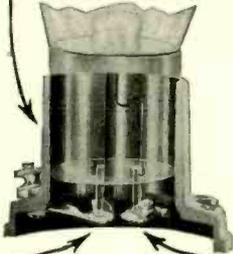
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Gentlemen:

You will be interested to hear of the results obtained from the type 11-A 1000 volt, 300 watt motor generator set purchased from you thru the Chase Co. Jacksonville.

This little generator operating at Radio 4XE, has furnished the plate current for 2-way communication with amateur stations in Canada, Porto Rico, France and Holland. When you consider that such a distance of over 5000 miles can be spanned with a power supply of actually 230 watts, (10% overload) and that this motor generator set does the work in first class manner, it seems quite remarkable.

We believe the Esco generator to be the best and most conservatively rated of any we have used to date.

You may use this letter if you please.

Yours truly,

Cooper and Lee
Owners of Experimental Station 4XE

By W. J. Lee

WJL/MP

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ELECTRIC SPECIALTY COMPANY
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Wireless Age Portable Reflex

(Continued from page 84)

tape and tape the megaphone and phone against one side of the broom handle and then you are all set. This serves its purpose admirably and is easy to make and handle and very convenient and will not take up much space.

THE OPERATION OF THE SET

The operation of your receiver is exceedingly simple, there being but two controls if the set is once approximately tuned. The main tuning control is the Cardwell condenser, the coarse tuning being done with the tap switch connected to the primary taps. Do your rough tuning with this tap-switch and then tune in with the variable condenser for maximum results. If the set tunes broadly decrease the coupling between the primary and secondary coils of the vario-coupler by rotating the secondary of the coupler. Move the potentiometer toward the squealing point and leave it just this side of that point. Now your receiver is in its most sensitive condition. The potentiometer adjustment will vary somewhat with the wave length but generally, once set, it will be found to cover quite a range of wave length. The Filkostat should then be adjusted for maximum audibility consistent with the proper temperature of the tube which can be determined with a pocket voltmeter, across the terminals of the socket. This should be three volts. On the whole this will be found a very satisfactory set and we are very much pleased to recommend it to you for your summer's enjoyment.

Radio Activities Broader in Scope

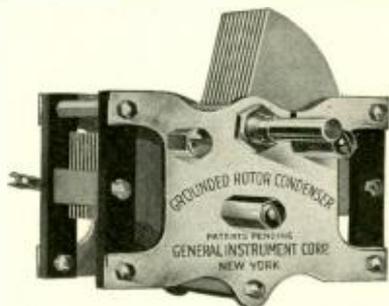
(Continued from page 73)

James F. Kerr, General Manager of the First Radio World's Fair, is of the opinion that the huge nude figure can be used to a fine advantage in conjunction with broadcasting, both sending and receiving, and three wireless authorities are now conducting experiments which may result in "Diana" playing a prominent part in the important trans-oceanic and transcontinental tests which are to be staged during the big international exposition in New York, next September, under the supervision of the leading European and American radio scientists.

* * *

A RECENT issuing of patents by the U. S. Patent Bureau clears up a situation that has stopped most radio manufacturers from investing any money in sets containing honeycomb coils or adaptations of the honeycomb space wound principle. For five years litigation between pioneers in the radio industry has been going on. No one

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He arranges in orderly fashion the mass and jumble of Broadcasting Stations that are seeking entrance to your set and brings 'em in, one at a time, so you can enjoy them! Never reduces, but nearly always increases volume. Add a Ferbend Wave Trap to your set and "Police" your reception. Regulate the Traffic!

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Here is YOUR chance to add a Loud Speaker to your set and let the whole family really enjoy listening in.

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LOUD SPEAKER will reproduce perfectly and with plenty of volume. In fact it is adjustable so the volume can be regulated to your requirements.

A \$15 Loud Speaker for only 12 subscriptions. You can earn this in part of your spare time. Besides—

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Amateurs can get practically every station on this continent with a one Myers Tube Set. We have records on file to prove it. For instance a New Zealand amateur tuned in Alabama, 10,000 miles on one Myers Tube. No bunched leads—hence no noise, tube hiss or interference—make

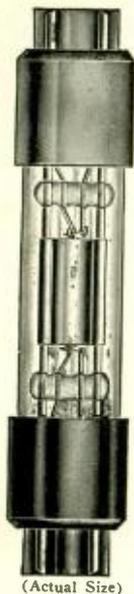
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supreme for clarity of reception of long-distance stations. Two types: Dry Battery and Universal (for storage battery). Put the world on your dial with Myers Tubes and tune in Canada, England, Havana, Hawaii, Porto Rico, etc., as others are doing. Write for free circuit diagrams.

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(Actual Size)

has known what the outcome would be. The present owners of the two patents just issued were stopped from even describing their product as honeycomb coils. The wonder then is that the use of honeycombs has become world wide in scope because of sheer merit.

Honeycomb coils were developed during the World War and widely used in the signal services of allied armies and navies. The NC-4 seaplane of the U. S. Navy which first crossed the Atlantic was equipped with radio coils from the Coto-Coil Co. of Providence, Rhode Island, and it is to these pioneer radio coil winders that the honeycomb patents No. 1,490,040 and 1,490,041 are awarded. * * *

At a recent meeting held in the Hotel Pennsylvania by the New York City Radio Association, the subject of serial numbers on radio receivers was thoroughly discussed. One of the members explained that the number is really the manufacturer's guarantee of the set and its removal makes it impossible to trace inefficient workmanship should the set, for any reason, be returned to the factory; also, the scratched-out number puts the set in a class with damaged and illegitimate merchandise.

Alexander Eisemann of the Freed-Eisemann Radio Corporation said, "So long as the serial number remains on the panel of a receiver the manufacturer's guarantee is binding."

Condensers

(Continued from page 51)

charge present upon the condenser we find that half of it is gone through this high resistance path. We then say that this condenser has a high resistance because the result is the same as if we had a high resistance in series with the condenser as per the illustration figure 3 which, though there are four units of energy available only permits two of them to pass to the condenser from which they will later be available for use. When we say that a condenser has low resistance we mean, in so far as relates to leakage of energy is that the condenser has such an excellent insulating medium that the leakage of energy is so slight that the loss is the same as we would have with only a low resistance in series with this condenser. Figure 4 shows the many leakage paths between the rotary and the stationary plates where the condenser uses only end plates made of insulating material as compared to the condenser in Fig. 5, which has metal end plates with only a small leakage path or rather four of them which though shorter than in the case of Fig. 4 have infinitely less surface area in width and as a result less paths over which the energy may flow.



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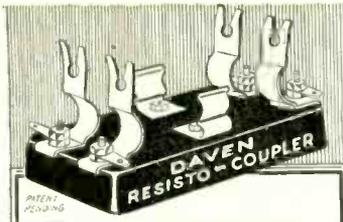
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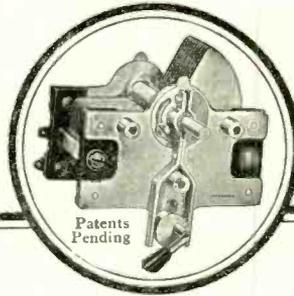
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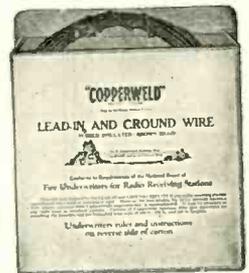


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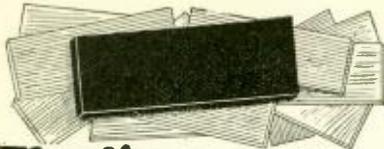
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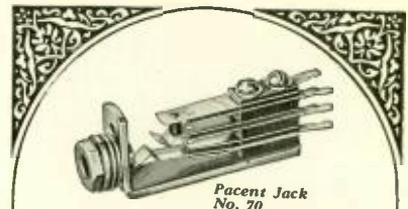
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- 8 AHP Franklin A. Selberling, Stan Hywet Hall, Akron, Ohio
- 8 AHM Robt. F. Wirsching, 1104 Oxford St., Dayton, Ohio
- 8 AHN Samuel Calate, 13 Reed Park, Rochester, N. Y.
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- 8 AIN L. D. Evans, 41 Merritt Ave., Battle Creek, Mich.
- 8 AIZ Charles Wain, 1106 Genesee St., Buffalo, N. Y.
- 8 ALZ John S. Hare, 1285 Lincoln Hl., Columbus, Ohio
- 8 ALB Albert H. Moses, Chestnut St., Jefferson, Ohio
- 8 AMI Roland Breisch, 216 Margonia St., Pittsburgh, Pa.
- 8 AMO Joe M. Maury, 522 N. Main St., Sidney, Ohio
- 8 AMT Julius Jeffries, 11 Main St., Salem, Ohio
- 8 AMU Arthur N. Storgard, 3235 W. 30th St., Cleveland, Ohio
- 8 ANA Forrest P. Wallace, 919 W. Washtenaw St., Lansing, Mich.
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- 8 APM Geo. Wells, 613 Lake Blvd., Joseph, Mich.
- 8 APP Warner W. Hartman, 5015 Leonard St., Cincinnati, Ohio
- 8 AQJ Lyman E. Williams, 720 West Kalamazoo, Mich.
- 8 AQV Elmer W. Wolf, 4394 E. 12th St., Cleveland, Ohio
- 8 AQL Lawrence Carter, 505 So. Jefferson St., Sturgis, Mich.
- 8 AWC R. Nelson Warfield, 32 Copeland Pl., Buffalo, N. Y.
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- 9 BIX John A. Keltan, Seventh St., Woodward, Minn.
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- 9 CDA John H. Cooper, 1547 Monroe St., Denver, Colo.
- 9 CIE John H. Hanert, 369 Lake Drive, Milwaukee, Wis.
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- 9 CZK Oscar Green, 1223 Marquette Ave., Clearlake, Wis.
- 9 CZU Dale W. Oliver, 1223 Marquette Ave., Clearlake, Wis.
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- 9 DIN Harry L. Crawford, 2512 Francis St., New Hampton, Iowa
- 9 DLH E. M. Cherrington, Jr., 2512 Francis St., St. Joseph, Mo.
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- 9 CNU Arthur E. Miles, 4751 S. Dupont Ave., Minneapolis, Minn.
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- 9 CWU George Klenert, Jr., 1868 Milwaukee Ave., Chicago, Ill.
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- 9 TB Harold A. Witt, 1528 N. Austin Blvd., Oak Park, Ill.
- 9 TX Marshall D. Waymouth, 320 N. Elmwood, Park, Ill.
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- 9 VI Evert E. Thiele, Rockford, Iowa
- 9 VV Elmer Enke, 2440 N. Sawyer Ave., Chicago, Ill.
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- 9 WY Edwin L. Barton, 215 Star St., El Dorado, Kans.
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- 9 BCM Roland L. Taylor, Tilden, Ill.
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- 9 BGD Archie J. Verille, Jr., 204 Montezuma St., Hancock, Mich.
- 9 BFM George R. Carlson, 408 1/2 2nd St., Michigan City, Ind.
- 9 BFE Earl L. Meves, 17 McClellan St., Tama, Iowa
- 9 BFR Calvin Brown, 17 McClellan St., Tama, Iowa
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