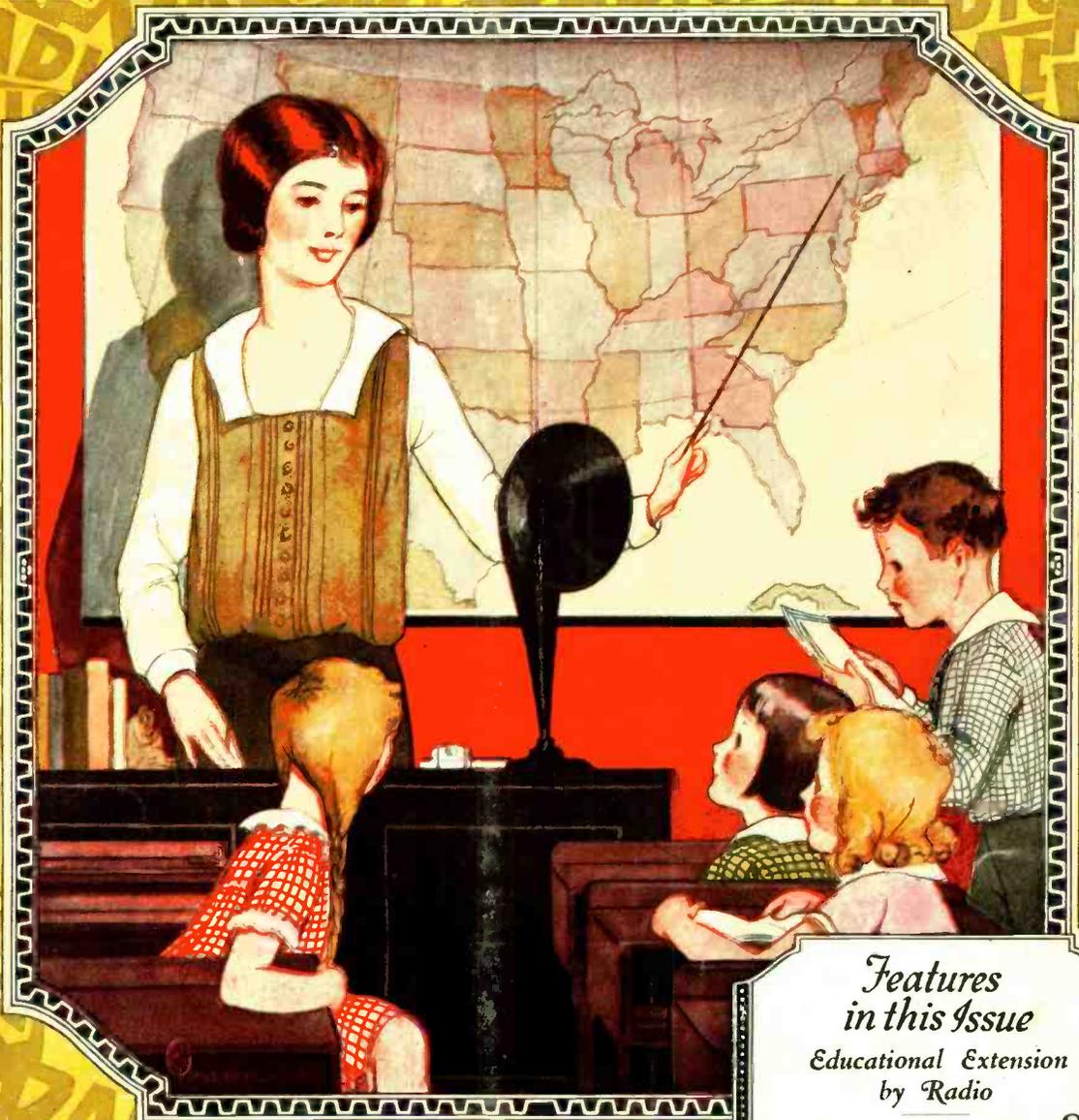


Wireless Age

The Radio Magazine



*"America's Foremost
Radio Magazine"*

*Features
in this Issue*

*Educational Extension
by Radio*

*The Second Shot?
By Garret Smith*

*"Build the Double
Regenerative Receiver"*

*From Herdsboy to
Scientific Heights*

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The Wireless Age

America's Foremost
Radiophone Review

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Your Authors

GARRET SMITH (The Second Shot?) though still a young man has had considerable success in writing for the higher class magazines. Perhaps his best story is "Honest Hutch", a Saturday Evening Post story afterwards pictured by Will Rogers, and considered to be the best screen production ever turned out by that famous comedian. Mr. Smith has been associated with the New York Tribune for a long period. His best known long story is doubtless "On the Eve of 2000" published by The Frank A. Munsey Company.

ALFRED J. "HOLLYWOOD" McCOSKER (Selling the Movies by Radio) has been in the newspaper field for seventeen years. He began as office boy under Arthur Brisbane, ran copy for Alan Dale of the N. Y. American and later did reporting on the Hearst newspapers throughout the country. While on the Boston American he inaugurated the annual movement: "Paint Up and Clean Up". He has been active on Western newspapers especially in Chicago, Denver and Salt Lake City. His work in the moving picture industry includes such positions as Editor of the Exhibitors Trade Review and Business Manager of the Motion Picture Department of the Morning Telegraph which was the pioneer newspaper motion picture department. His work in radio broadcasting movie information, particularly the features of the well known successes has earned him an enviable reputation.

STEFFEN F. NIELSSEN (The Yacht Ara's Complete Radio Outfit) is a world war veteran. His first schooling in radio was under the able direction of Poulsen—inventor of the Poulsen Arc Transmitter. Later he attended one of the prominent universities in Germany. Before the war he conducted the research work in the laboratories of the University of Texas. His knowledge of several languages and his extensive experience in both the theory and practice of wire and radio telegraphy and telephony, eminently fit him to speak authoritatively on matters of technical interest.

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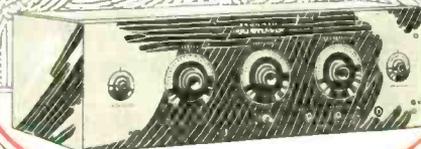
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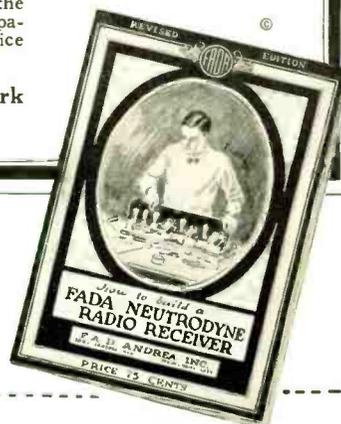
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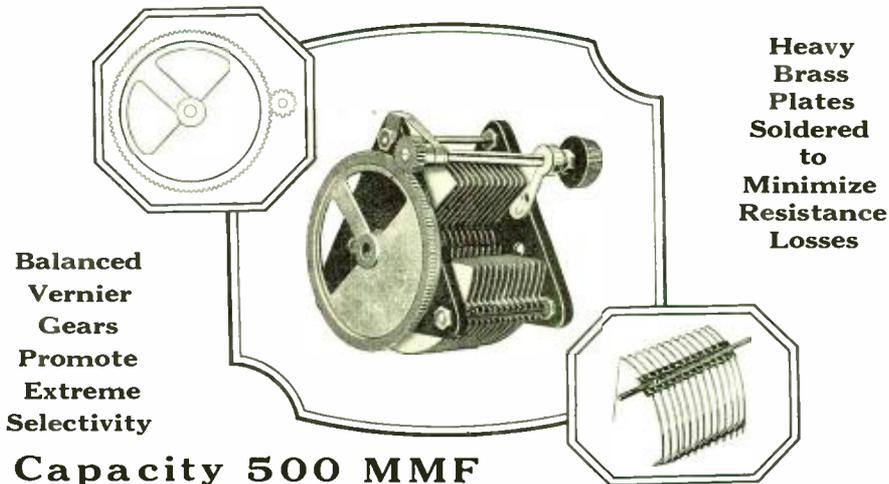
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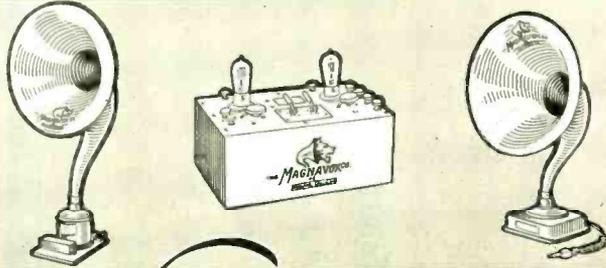
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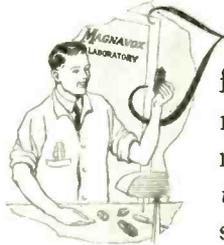
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Editorial Chat

THIS is the month of school-days and the return to pursuits of study and learning. Quite appropriately, therefore, THE WIRELESS AGE presents a comprehensive story of the past, present and future systems of education. Never before in the world's history could it be said, "a twirl of the dial brings to us the wisdom of the ages," but radio in our day has made it literally true, and in addition, the system of education now in vogue—radio broadcasting—returns us to the natural channels of acquiring knowledge—truly can it be said: "In the school of learning it is once again playtime—we play while we learn."

PROF. M. I. PUPIN

Truth is stranger than fiction 'tis said. Read the story of Professor M. I. Pupin in this issue and draw your own conclusions. No tale of fiction could be more fascinating or inspiring than the true life story of the Serbian herdsboy who roamed westward across the sea to the land of opportunity, and with unrelenting zeal embarked on a course of learning that brought him to the scientific heights. Read the story of his achievements. It will inspire and instruct.

THE SECOND SHOT?

Garret Smith has done a radio fiction story that should prove entertaining. Everybody enjoys a mystery, and while some think there is considerable mystery about radio, when another mystery is added to it, an appeal is made to our inquisitiveness that demands appeasing. Such is the plot and character of "The Second Shot?" You will like it. There are other stories coming.

CHILD EDUCATION

Mothers particularly will derive help and enjoyment by reading Mrs. Christine Frederick's article on "Radio and Family Education."

The practical application of radio broadcasting in the home for the purpose of instruction and culture of the child mind and also the grown-ups, as well as a means of relieving mother of some of her numerous responsibilities is told in the language of experience. Mrs. Frederick relates what she has actually accomplished in this direction.

TECHNICAL

The Double Regenerative Receiver, another construction article that will arouse interest, is presented to our "fans." It is up-to-the-minute. Tried and tested in our own laboratory, we acclaim it unusual for volume with UV-199's, and selectivity is all that can be desired.

Then there is the article about the yacht *Ara's* radio installation. This will appeal to the experienced.

TRAVEL

"The Adventures of a Radio Operator" will take you abroad—so to speak—on travels through the Orient where you will find many strange things in out-of-the-way corners.

VARIETY

This issue of your magazine is another you will enjoy. Then open your mind to the pleasure of still another to come. Information with a punch—entertainment that is informative—in short, what you want, as you like it, where it ought to be. WIRELESS AGE—THE Radio Magazine.

—THE EDITORS.

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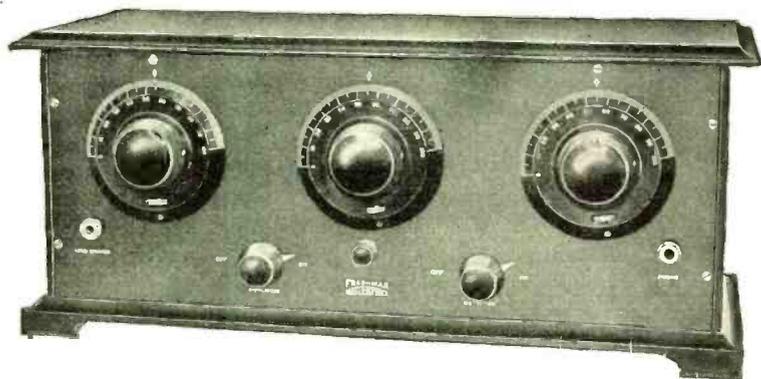
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Radio
on theRiver
Styx

HE dreary, muggy waters of the River Styx flowed noiselessly past the Present on its way to Hope Eternal. Fate leaned on the helm apparently unconcerned as to the course.

Below, in the music room, several figures lounged around a radio set listening to the strains of Raggedy Ann. Closer inspection revealed their identity. Aristotle, Sophocles, Homer, Dante, Voltaire, Newton, Nietzsche and Rousseau. A queer party.

Jean Jacques Rousseau arose and addressed the gathering: "We did foregather here at the good counsel of Cleopatra, she being the master of this craft; save it having been, forsooth, the one she did own during the mortal days of her glorious reign; the purpose of this meeting being for naught else than to listen in on educational programs broadcast by our earthly brothers. And I am of the mind that each of us, having made history in our respective eras, shall learn of what avail to the world our lives have been. In this year of grace, 1924, the peoples of the world—the other world—should have come to know the lesson beyond price taught by ignorance."

At this point Cleopatra entered without troubling to open the door. Newton jumped to his feet and shouted: "I do wish you would not defy the laws of physical science by walking through a door without opening it!"

Aristotle glared at Newton. "Don't forget," he admonished. "you did upset a few of my theories in your time, for which I derive small solace."

Cleopatra smiled. "Well!" she exclaimed. "Emperors would fain quarrel over me for less than that; nor am I disturbed by such gross demonstrations."

Then, becoming serious, she proceeded with the business of the meeting. The educational development of the early Egyptian Dynasties was reviewed; the influence of priestcraft on the problems of abstract thought; and the multiplication of scribes and the accumulation of writings as a result of custom demanding records of affairs of state.

"Whereupon," she concluded, "more people today, know about my Obelisk—Cleopatra's Needle—than do those who would know aught of the library I built at Alexandria, or the records of great importance to civilization stored there."

Homer leaned forward. "True," he said. "Mortals, the adventures of Ulysses peruse; nor are they mindful of the philosophical teachings in the *Odyssey*."

Dante laid his hand on Homer's arm: "Ah, woe is me: nor am I read with comprehension lest such mortal turn from kind and custom, his weary way to seek amidst the un-frequented labyrinths of my blank verse."

Bacon laughed uproariously. "By my troth, Dante, Shakespeare has them sore puzzled to this day. Mayhap he had a few lions in the Sherwood forest and a clock in the period of the Merchant of Venice, but it did require the great wisdom of Goethe to understand Hamlet."

"There are many matters of which I am grossly ignorant," interrupted Cleopatra. "Tell me in good truth—did you write Shakespeare's works?"

"That, you will never know," Bacon replied. "The question, alone, has adroitly attracted students who might otherwise have never studied Shakespeare. I shall always leave that question open for the benefit of the mortal world."



OPHOCLES, observing that Cleopatra was on the verge of practicing her artful wiles on Bacon in order to extract the desired information, anticipated another historical situation by taking possession of the floor.

With characteristic directness he plunged into the subject of educational development following the decline of the Egyptian Empire. He dealt with the philosophical teachings of Greece, the commercialized schools of the Phoenicians, the militaristic tendency of the Roman educational system, and the moral trend of Christianity.

Jean Jacques Rousseau then dealt with the growth of formalism in the Middle Ages, and the economic conditions that led up to the French Revolution. Voltaire and Nietzsche elaborated the individualistic principles of Rousseau's teachings, treating with the transition period, and its effect on modern education. The sudden announcement in the loud speaker that the evening's educational program would commence, forestalled what promised to be a bitter controversy. The company hurriedly gathered around the radio to listen.

After the popular bed-time stories had been broadcast by Nick Carter, a talk on "Child Psychology," by Horatio Alger, Jr., was put on the air. This was followed with "Household Hints," by Laura Jean Libby. The "Musical Appreciation Course" was broadcast by direct wire from Coney Island. The next speaker before the microphone was the president of the Bucket Shop Exchange who delivered his weekly talk on "Safe Investments." A ten-minute lecture on "Political Economy" by the Soap-Boxer was followed by the "University Extension Course in Agriculture," broadcast through the courtesy of the Commission Brokers' Association. The big event of the evening was then put on the air. The second of a series of lectures on "Education" was delivered by the Society of Affiliated Flappers and Sheiks.

Sophocles rose, strode to the buffet, and grasping a cup, took a long draught of its contents.

"What are you drinking?" Voltaire asked.

"Bitter aloes," Sophocles answered. "On one occasion, in Athens, I did drink it for my nerves after I had sought vainly to prove that truth and understanding would be the reward to those who would but open their minds to knowledge. What we just heard on the radio is, forsooth, a confusion of what was actually broadcast. The confusion in the minds of those who listen in, but hear naught of what is truly broadcast save that which they might encompass without effort."

As one voice, the company spoke: "Pass the cup around, Sophocles. We'll all partake of this soothing brew!"

The Garden of Knowledge

A Twirl of the Dial Brings to Us the Wisdom of the Ages

Dr. Herman H. Horne, Professor of Philosophy, at New York University, sends this message to our readers: "Our American people are quite as ready for something solid as for entertainment. Some see in radio their one opportunity for university instruction. It is idealism, after all, that really grips the heart of humanity."

By WILLIAM A. HURD

RADIO has come to the individual as the one great medium for the dissemination of information and the consequent acquisition of knowledge. Should he fail to acquire knowledge it is mainly his own fault. Should society fail to exploit radio for spreading enlightenment then the fault lies somewhere between the individual and his social structure.

Archæological records have so far failed to disclose the origin of mammals. The first trace of these little fur-coated animals has been found near the close of the Reptile Age. Unlike the reptiles, which deserted their comparatively tender progeny at birth, the mammals cared for their young until such time that they had acquired the parental wisdom, born of experience, and handed down to the younger generation. Fully equipped, both mentally and physically, for the great struggle of existence, the young mammals stepped forth into the world prepared to compete with the massive creatures of that era.

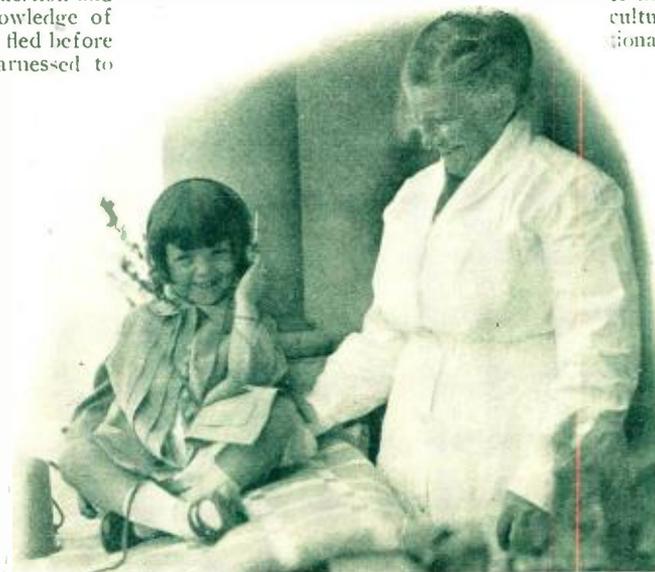
In the later, but still dim shadows of antiquity, mankind trembled before the awful manifestation of natural forces. His was an existence of fear. But his, too, was the gift of reason. He had but to question and to him would come a knowledge of these phenomena. Mystery fled before reason. Elements were harnessed to do his bidding. And so it is that we approach a conscious evolution.

EDUCATION is conscious evolution. The voluntary acquisition of knowledge. But the acquisition of knowledge that we may put to some practical use. This, alone, has been effected largely by the natural economic circumstances, or conditions, of the land upon which any given peoples depend.

The early Egyptian civilization is an example. The silt left behind the flood waters of the Nile made Egypt an agricultural nation. Occasional

droughts, however, forced the Egyptians to invent an irrigation system, which they did under the difficulty of scant engineering knowledge. This led to greater projects requiring a better engineering knowledge. They studied the stars, and subsequently founded a system of astronomy, all for the sole purpose of keeping a record of the seasonal changes that meant life or famine. And all this necessitated the keeping of records.

Skill in engineering and ease of transportation make for progress. The Nile stimulated the one, and made possible the other. Equality of sex was closely approached. Cultural development was natural. Art, the sciences, painting, and finally literature, were all steps toward a higher education. In the Sallier papyrus, the wise Dauf counseled his son: "Give thy heart to learning . . . for there is nothing so precious as learning." But the purpose of learning was practical. The search for truth for its own sake was considered a waste of good time. And because of this the religion of the early Egyptians lacked any degree of morality. The subsequent decline of the Egyptian Empire was in a large sense due to this lack of moral fiber in their cultural development and educational growth.



"The Man in the Moon" and other bedtime stories evidently delight the young and this picture ought to delight the story-tellers

THE Oriental peoples had begun to control nature, but were opposed to the development of the individual. Class distinctions further hampered their natural progress.

Education was developed to the point of present day elementary and higher school training, but the latter was mainly reserved for the priesthood. The method in educational training was not initiative, but neither was it genuinely rational. The individual had little freedom. He was in bondage to the past.

Individual freedom be-



The modern educational system. Radio now plays an important part in extending the facilities of the foremost universities

gan among the Jews, Greeks and Romans. These peoples had ideals and considered the future. Individualism became a fact. But not universal. It remained for Christianity to make individualism universal. This was accomplished through the Christian tenets which recognized the brotherhood of man, gave to women and children their rights, and demanded a high standard of morality.

Following the corrupt and immoral vices of the Romans, who knew no other virtue than civic, the Christians' religion made a universal appeal because of its equitable tenets to all men. The religion itself served as an education. In fact, the early Christian catechumenal schools, which prepared the would-be converts for entrance to the church, were the forerunners of the parish schools of today.

THE keynote of education in the Middle Ages was authority and repression. The Renaissance, the period of awakening, degenerated to a level approximating Ciceronianism. Then followed the Reformation period in which religious and theological awakening played an important rôle. The reaction to this was formalism, and the back swing of the pendulum resulted in the search for real things. Realism was the beginning of our modern scientific movement.

Religious and political growth soon developed into Puritanism and Rationalism. But this, too, became formal, hard, and eventually underwent a change. It was the perfect setting for the complete reaction that came with the teachings of the Swiss-French philosopher, Jean Jacques Rousseau. Thus was the way prepared for the French Revolution.

Out of the ruins grew modern civilization, the balanced educational growth that stresses the interdependence of the individual and society.

Shakespeare summarized the situation at that time with this: "There is no darkness but ignorance."

WE must know the educational aim of any period to estimate the development of that period. We must know its content, the method, the organization designed for its execution, and finally the results.

The attitude of the eighteenth century was certainly destructive. But the social development, the psychological effects, and the scientific progress of modern times has been built on the ruins of that experience.

The present tendencies in education should test the relation of the individual to society. The value of his activities is measured largely by his ability to harmonize with society. The interests of both are mutual.

The study of the child's development was indirectly started by Rousseau. He, and to a large extent, Pestalozzi, tried to reach the child through a sympathetic insight into the activities of the child. This educational process later found its justification with Herbart and Froebel in the underlying basis of psychology. Rousseau was concerned with the rearing of individuals separated from other individuals. This was essentially an unsocial, narrow perspective. Herbart, in direct contrast to this selfish attitude, was concerned with application of popular instruction and upon the development of moral character.

In this you have the fundamental underlying the best stories broadcast to children. It will be well worth your while to secure the "History of Education," by Frank

Pierrepoint Graves, from the library. Read that pulsating volume and then tune in again on the bed-time stories. Watch your child as he listens.

ABRAHAM LINCOLN said that education is the most important work in which we as a people can be engaged. The broadcast stations of the country are engaged in this work. The various educational programs radioed to you, at your fireside, are packed with popular interest. They must be to hold the listener in.

Once you have caught the really human interest thread that cunningly weaves through broadcast educational programs you will have acquired a new means of diversion quite suited to your taste.

Bacon held that some men, like the spider, spin all their knowledge out of themselves; some collect it indiscriminately like the ant; while others gather facts wherever they can find them, and from these facts bring forth new products by means of their own thoughtful elaboration. This classification may be applied to those who use radio for what they can obtain in an educational sense.

BROADCAST stations across the country put on the air many varied programs of an educational character. Educational in content but entertaining in mode.

New York University broadcasts a series of talks, or chats, if you like, on subjects to do with philosophy of life, modern public problems and systematic psychology. Their program for this Fall will include biology, economics, anthropology and ethnology, and many other studies of general interest. Each, however, will be framed and presented with the view to attracting those who would have



Even daddy is amused at the wonderful influence radio entertainment has upon the child mind

them in an understandable, popular vein. The courses are based on the work offered in the University. It has been demonstrated that students get but little from a course composed solely of lectures. Some outside work, or collateral reading, must be done if the listener wishes to get the most value out of his study. New York University will supplement their programs with reading matter designed for the radio listener.

Likewise Columbia University furnishes their radio audience with supplementary reading which aids, materially, the educational courses broadcast by the University Extension Department.

The University of Pittsburgh, Antioch College, Cornell, The Queen's University at Kingston, Ontario, the State College of Wash-

ington, Kansas State Agricultural College, Georgia School of Technology, North Dakota Agricultural College, and a host of other universities, colleges and high schools, broadcast educational programs. The versatility displayed in their programs is remarkable. Their grasp of the radio mind is nothing short of ingenious.

Turn to the Broadcast Station Directory in this issue and count the number of educational institutions operating radio broadcast stations. The number totals to about seventy. That directory can be of service to those who will use it.

HERBERT SPENCER in his book "Education," first decides what constitutes real knowledge, and then deals with the subject of education as intellectual, moral and physical development. In one section of the book, he says: "The men to whom, in boyhood, information came in

"The time is not far distant when, in every city, at least one high school will be radio equipped and utilization made to broadcast instruction in high school subjects. Registration in regular classes will be undertaken by mail and credit given following tests and examinations suitably passed. This will give thousands who work in daylight hours a chance at more and better education. Mathematics, English, Economics, Science, History and Languages can be taught successfully by this method. An inexpensive receiving set will be the only expense. The city will loan free of charge the required text books.

"Today the use of radio is confined almost solely to entertainment. Tomorrow people will come to see and use its possibilities for education."

—F. G. KENNEDY,
Principal, North Central High School,
Spokane, Wash.

Sigmund Spaeth, Ph.D., is internationally known as an authority on music. An experienced writer, he has written many common sense articles on music; to the readers of this magazine he says: "I want people to realize that if they respond to any kind of music in any way, even if it is no more than 'keeping time when the band goes by,' that response can be developed into something really worth while. I want them to realize that their love of a good tune is nothing to be ashamed of, and that any lasting appreciation of music must be founded upon that sincerity which responds to fairly simple and obvious rhythms and melodies—so I am glad to give full credit to the radio for its help in popularizing good music."

—SIGMUND SPAETH, Ph.D.

"There is a great deal of evidence to indicate that the motion picture industry consciously appeals to the unthinking. In so far as this is true, motion pictures cannot be truly educational. So far it has appeared that radio broadcasting has made a somewhat similar appeal in many instances, although it has not gone as far, perhaps, as motion pictures have in this direction.

"In my opinion, the educational effects of radio will depend primarily upon the type of mind to which radio programs are designed to appeal. I feel that the same fundamental principle applies here as applies to newspapers, magazines, and motion pictures."

—F. D. FARRELL,
Dean and Director,
Kansas State Agricultural College.

"The newspaper, the telegraph, and the telephone have added their bits toward increasing the scope of education and international good-will. Every means of communicating intelligence is bound to further the intellectual standing of the masses. Radio appears to be more prolific in its possibilities along these lines than any one of the others. It not only adds a method of point to point communication, but it also has a broadcasting power rivaling that of the press."

—C. S. PERKINS,
Instructor, Massachusetts Radio and
Telegraph School.

"Not since the invention of the printing press wrought its wonderful change in the common education of the Middle Ages, has there been any agency so fraught with possibility in the cause of public enlightenment as radio. It is one of my pet thoughts that a century hence when some historian writes radio into the story of the world's progress, its overshadowing feature in the review of Time will be that it contributed a new standard of mass education to our great turmoil of humanity."

—GUY E. ENTWISTLE,
President, Massachusetts Radio Institute.

"To my mind radio forms the most fascinating field in the realms of science. It is considered of such educational value that schools and colleges throughout the entire country are equipped with radio transmitting and receiving sets. It should, and will be a part of every man's education for it teaches some of the most valuable fundamental principles of electricity and it must be realized that electricity is the greatest force in the world today."

—J. A. DOWIE,
Chief Instructor, National Radio Institute,
Washington, D. C.

dreary tasks along with threats of punishment, and who were never led into habits of independent inquiry, are unlikely to be students in after years; while those to whom it came in the natural form, at the proper times, and who remember its facts as not only interesting in themselves, but as occasions of a long series of gratifying successes, are likely to continue through life that self-instruction commenced in youth."

In that passage Herbert Spencer has touched the keynote of many complexes nursed in the hidden recesses of our sub-conscious minds: the complex resulting from forced issues in the matter of good reading, or perhaps the attempt to cultivate in the child a taste for good music. How many of us have come to view with apprehension the mere thought of reading the Scriptures because there are those of us who were forced at a tender age to read its contents, not for the action and the images there presented, but rather for the abstract morality contained therein which is so difficult for the immature mind to grasp. Thus was a complex registered in the subconscious mind that later becomes distorted as adult reason attempts to side-step the early impression.

COLUMBIA UNIVERSITY broadcasts a brief course in the Old Testament calculated to arouse interest and stimulate reference to certain passages in the Bible. The method is unique. The listener is asked to sit around the camp fires of Syria while the Fathers tell again the thrilling accounts of human sacrifice, and of Abraham's leadership; of the turning from the freedom of the deserts to the cramped existence in Egyptian cities, and the later glories of King Solomon's Reign. Such is an example of what radio brings to us.

How many of us have suffered the torments of dress regalia to sit through a music recital unable to grasp the true significance of what we genuinely wished to understand. Perhaps there are those of us who in childhood days were backed into a corner and the lesson of good music—classical music—was drilled into our rebellious minds under the terrifying proximity of a dictatorial finger. Such vain-glorious efforts to reach the sub-strata of plebeian tastes unaccountably present in youth somehow fails to penetrate the stubborn resistance of a young mind. A later-day complex is inevitable.

Music appreciation courses are broadcast for just such reasons: the education of the musically-inclined by gradual initiation into the erstwhile mysteries of orchestration. The knowledge gained by radio, supplemented with a small amount of reading, will open new fields of interest to us, particularly when we listen in on symphony programs broadcast by the Philharmonic Societies and the leading theaters. Broadcast music can bring to us the creative genius of great masters, but it remains for us to interpret the pictures devised by these great composers.

THE garden of knowledge, in a broadcast sense, is a garden of wonders. A twirl of the dial brings to us the wisdom of the ages. The history and knowledge of subjects ordinarily beyond our grasp come to us by radio. Science has none of the academic or prosaic that somehow lingers with the memory of blackboards, and the tired, care-worn figure of a teacher. Literature comes to us fresh, invigorating. This by radio.

As we roam the airways that lead to the garden of knowledge it is once again playtime—we play and learn.



Radio helps you in doing your "daily dozen"



And last, but not least, radio sings 'em to sweet sleep

Broadcast Artists



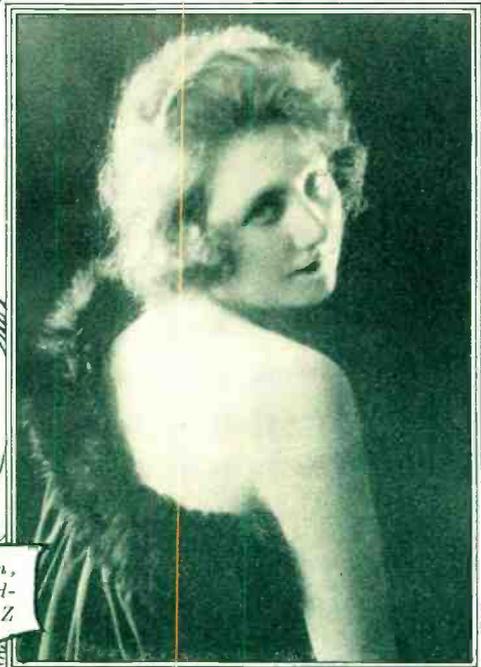
Margurite Quimby, of Cleveland, as she appeared before the microphone



Hon. Wendell Philyss Dodge, author and playwright, appeared at WOR



Clyde Agnew Criswell, author of the popular radio play "The Secret Wave"



Miss Ruth Arden, soloist with the Kudisch Ensemble—WJZ

Voices You Hear Nightly



("HM") Howard I. Milholland, chief announcer at KGO, the Pacific Coast broadcasting station of the General Electric Company

Dr. Ralph L. Power, also known to the microphone tappers as the "Sky Crier of the Los Angeles Examiner"

Meet Miss Helen M. White, secretary to the manager and only lady announcer at station WGR

Edward Borroff, chief announcer at the Westinghouse station KYW, Chicago. His voice has probably reached all sections of the country

Wm. Holliday, program manager of WWJ—The Detroit News. Broadcast listeners are probably more familiar with his novel programs than with his dignified appearance

A Herdsboy ASCENDS SCIENTIFIC HEIGHTS

From Idvor to Castle Garden and through the institutes of learning in Hungary, Berlin, Vienna, Cambridge and Columbia the herdsboy emerges as university professor, research engineer, inventor and the far famed scientist—Prof. M. I. Pupin

By STUART HYDE HAWKINS

If you should by chance thumb over the pages of the 1924 volume of "Who's Who in America," and should glance at a point about halfway down one of the right-hand columns in the "P" division, you would find the following terse paragraph:

PUPIN, Michael Idvorsky, University Professor. b. Idvor, Banat, Hungary, October 4, 1858; s. Constantine and Olympiada P.; A.B. Columbia, 1883; Ph.D. Univ. of Berlin, 1889; (Sc.D. Columbia, 1904; LL.D. Johns Hopkins Univ.). Married at London, England, Sarah Katherine Jackson of N. Y. (now deceased); Asst. Teacher Elec. Eng. 1889-90, Inst. Math. Physics 1890-92, Adj. Prof. Mechanics 1892-1901, Prof. Electro-Mechanics since 1901, Columbia. Fellow A. A. A. S., N. Y. Acad. Sciences; mem. Nat. Acad. Sciences, Am. Philos. Soc., Am. Physical Soc., Am. Math. Soc., Am. Inst., Elec. Engineers. Address, The Dakota, 1 West 72nd St., N. Y. City.

Since there is little hint of unusual interest or romance in the skeleton biography, you would in all probability continue to thumb over the following pages until you reached the appendix and closed the fat red volume. Which would be a grave mistake—you should have closed the volume immediately after reading the Pupin sketch, and turned to the biggest and most complete atlas obtainable, for surely "Idvor, Banat, Hungary," has an intriguing sound.

But, unless you had a pre-war atlas, and a very large one at that, "Idvor" would be among the missing places. So, to save you exasperation and trouble, I shall tell you what I found when I decided to see what actually lies behind the array of collegiate titles won by this "university professor." And in advance let me say that the story which I unearthed is worth far more trouble than I had to go to in getting it, for it is such a story as our greatest authors could not render more fascinating, more inspiring, with all their pretty phrases and word-pictures.

First, to find Idvor. On most maps it is non-existent, and on the large-scale detailed ones it is but the veriest shadow of a dot, for it is almost infinitesimal in size. And yet in splendor of history and glory of tradition it is gigantic, and in its history lies the key to the career of Michael Idvorsky Pupin. There is romance in the story

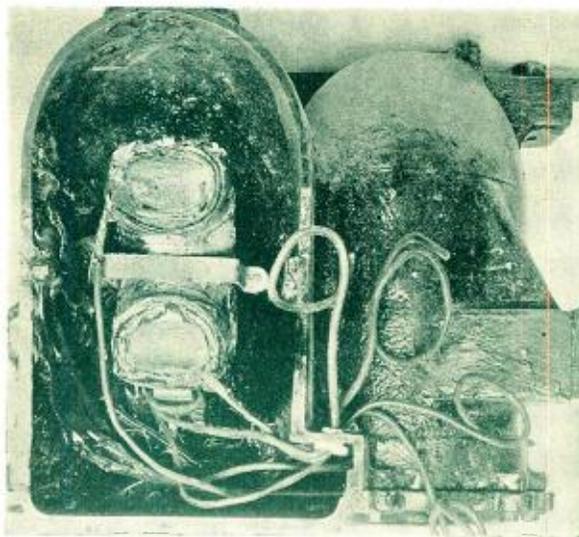
of his life, and there is romance in the story of Idvor; there is a splendid independence in the history of Idvor, and a splendid independence is one of the outstanding characteristics of this man of Idvor.

Centuries ago, when the fear of Turkish invasions sat upon all southern Europe like a pall, the emperor of Hungary invited a community of Serbs, noted for their courage and their strength, to leave their native valley and live upon the southeastern border of his empire, promising them complete and perpetual independence in return for the preservation of the Hungarian domain against Turkish inroads. To those Serbs, independence was the most cherished of all mortal possessions, and they moved—whole villages of them—to the flat borderland, where they settled down to their business of agriculture and war. For generation after generation they formed the wall against which the ever-recurring waves of Turkish armies dashed and spent themselves in vain; and the little village of Idvor was the center of many and many a barbarous struggle. It is even today a point of pride among the people of Idvor that not once did the Turks succeed in breaking through, and the little Idvorians still listen wide-eyed and breathless as the old men relate the sagas of those unconquerable ancestors who fought so fiercely and so successfully that they might have perpetual independence.

Rich in glorious tradition is the history of the men of Idvor, and when Michael Pupin was a tiny youngster that history was not to be found in books, but was told

and retold by the elders of the village as they sat in solemn social congress before the blazing logs on cold winter nights. By the time he was six he knew the tales by heart, and thrilled with pride that he was an Idvorian—a descendant of the fighting heroes of old. Tradition is the best of preceptors, and the love of independence flourished within the lad as it had within his forbears.

Neither of Michael's parents could read or write, and at first the attendance at the village school irked the athletic lad beyond measure, until his mother gave him an insight into the wonders of the world to which the written word is the key. From then on he absorbed the teachings of the village schoolmaster eagerly.



The Pupin coil made possible transcontinental wire telephony. It is termed a toroidal telephone repeater coil and is wound around a soft iron core, the whole unit being inclosed in an iron weather shed for protection against moisture and the elements

As a youngster he learned, unwittingly, a principle which has but recently—since the invention of radio—become generally known. During the summer months the boys of Idvor were sent out as herdsmen, watching over the oxen of the village; because of the heat of the day, the animals did most of their grazing by night, and marauding cattle-thieves were constantly waiting to drive any wanderers from the herd, so that some method of keeping guard other than by vision was imperative during the Stygian nights. The boys used to stick their long-bladed knives into the ground, lying with one ear pressed against the handle; for they found that the sound of the grazing oxen came far more clearly through the medium of the ground than it did through the air, and with the knife-blade as detector the boy, lying quietly on the edge of the pasture, could locate a straying ox through his hoof-beats at a considerable distance.

During the long summer nights and the warm days questions arose in Michael's mind which he was unable to answer; questions as to the nature of light, heat, and sound, which the humble Serbs defined as divine creations that could not be explained. And while he was striving to answer the "What is it?" of his mind, news reached Idvor of an experiment made by an American, one Benjamin Franklin, with a kite and key during a thunder storm; the schoolmaster explained Franklin's theory to the eager youth, and the boy's father chided him for heresy when he related the story at home. Again his mother stepped in on behalf of education, and her son was allowed to continue his studies. Shortly thereafter young Michael outgrew the school at Idvor, and attended the more advanced school in the village of Panchevo, fifteen miles down the river from Idvor. There he found an answer to his question as to the nature of sound, for Kos, the schoolmaster, could and did explain the transmission of sound by vibration. In the playing of the bagpipes by the village piper young Pupin found verification of the explanation, and the tunes of the bagpipes became indelibly associated in his mind with the nature of sound. To his queries about light, however, Kos was unable to answer.

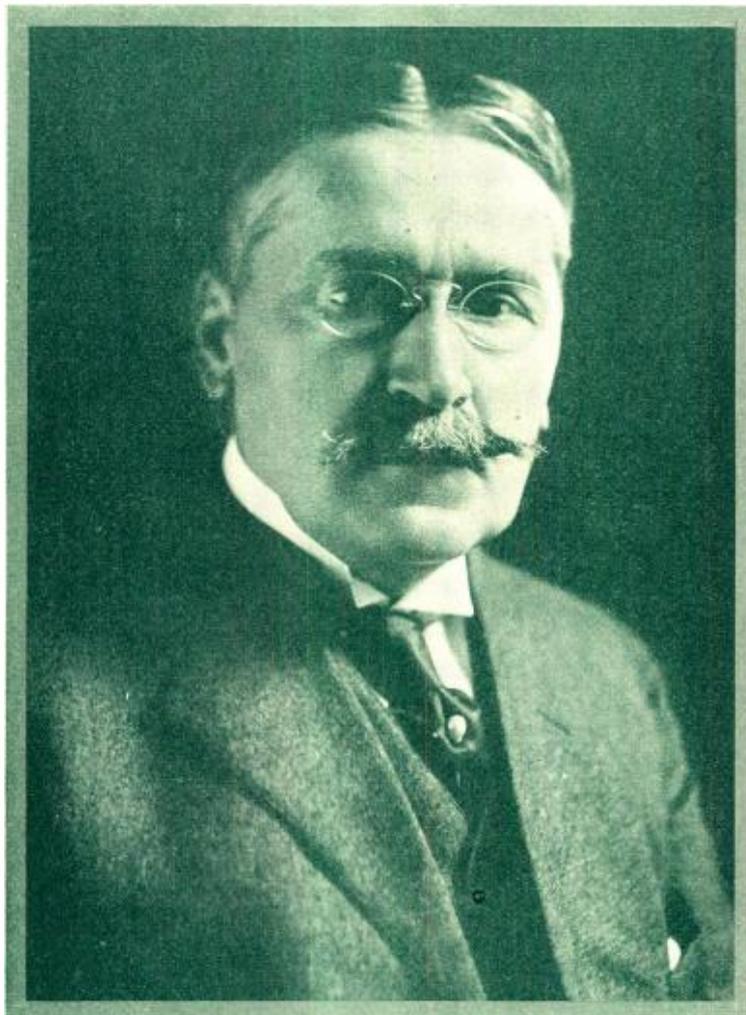
At that time word reached the villages of the greatness of Abraham Lincoln, the American Liberator, and Michael heard his father call Lincoln the "American Kara George"—and was not Kara George almost a god to the tradition-loving Serbs? America became a very nice place indeed to the growing boy, for did not Benjamin Franklin and Abraham Lincoln both live there, and were they not both great heroes?

Shortly afterward—in 1872—Michael became embroiled in a demonstration which took him away from the quiet little village; the emperor of Austria-Hungary, since there was no longer any danger from invasion, abrogated the pledge of independence to the frontier-Serbs, declaring them subjects of the empire, and the spirit of revolt smoldered hotly in Idvor and Panchevo. A school-boy parade found Michael carrying a banner which was decidedly not complimentary to the emperor, and he uttered many cries of a decidedly independent nature as he marched. In consequence Kos, the schoolmaster, persuaded the parental Pupins to allow the lad to leave the vicinity, and go to school at Prague. Since the boy was already as far advanced as was his teacher and since it was almost imperative that he should not attract the attention of the authorities until their suspicions as to his loyalty to the emperor be quieted, young Michael, then fourteen years of age, said goodbye to his

parents for the first time and sailed down the river bound for the "great school" at Prague.

On the boat he met several older students, who treated him most considerately and stole his food; an incident which so firmly impressed the necessity of constant watchfulness upon the lad that he never afterward forgot it. Having stayed awake from excitement all night that he might not be carried beyond the proper landing, he went to sleep just before arriving there and was carried to Vienna. Alone in the vast city—the first he had ever seen—with no idea of how to get to Prague, he was approached by an American couple, who took him under their protection and transported him to his destination. Again the greatness of America was impressed upon the boy.

At Prague he found an even hotter bed of revolutionists



Prof. M. I. Pupin, dean of radio engineers, and professor of electro-mechanics at Columbia University since 1901

than at Panchevo, and was soon one of them; his studies suffered somewhat because of his radical tendencies, and when his father died the next year he knew that he could not remain there and allow his mother to pay his tuition when he took no interest in the work he was expected to do. Consequently he sold all his belongings, scraping together enough money to buy a steerage passage to America, and on March 12th, 1874, the sixteen-year-old boy sailed from Hamburg on the *Westphalia*, having written his mother a glowing account of the brilliant future which awaited him in the new country.

Professor Pupin describes himself upon his arrival at Castle Garden as "the Serbian greenhorn," for he could not speak a word of English, and had no idea of what he was to do. His first two experiences in New York were blessings in disguise, for they did much to fit him for life in the new land. As he walked across the Battery, with his bright red fez on his head, a group of newsboys spied him and marked him as their prey. One of them, when the newcomer showed no appreciation of the shouted insults—he had not the faintest idea of what they were saying—walked over and knocked the fez to the ground. Michael understood that language, and jumped upon the boy with all the fire and strength which the long summers of rough-and-tumble with the other herdsboys had given him. To his amazement, the rest of the newsboys did not aid their comrade, but formed a circle and watched the fight with interest. When the newsy was defeated and the insult avenged Michael arose and continued on his way, with the cheers of the others following him. Certainly fair play was a prime virtue in America, he decided, and felt a strong liking for the country to which he had just come. A little farther on he passed an old woman selling pies, and, being somewhat hungry after the excitement and exertion, spent almost his last coins on a luscious-looking prune pie. Strange to relate, the pie was full of prune-pits instead of prunes, and the little Serb realized all too keenly that he was still very much of a greenhorn.

By the simple expedient of sitting quietly in the Immigrant Employment Office at Castle Garden, he found a job—for a Delaware farmer, who spoke Serbian, took him to Delaware as a mule-driver. There Michael learned to speak English, and the rapidity with which he picked it up, and the meticulous care he took to lose the foreign accent, gained him the praise of "a smart boy" from his kindest tutor, the farmer's daughter. That winter he returned to New York, and managed to pick up enough money to keep himself alive by painting signs—a profession which only the law of supply and demand qualified him to fill. Having been brought up in an agricultural country, he naturally gravitated to the farm again the next summer, this time being employed on a farm in Saint Mary's, Maryland. As soon as the season was finished, he headed for New York, walking through Philadelphia en route. After one day in the quiet town he decided that he could not emulate the career of Benjamin Franklin no matter how long he stayed there, and started walking north to Manhattan again. He passed through Princeton, and became imbued with the desire to attend the college—the dignity and beauty of Nassau Hall impressing him with a deep and abiding sense of reverence.

Back in New York, he secured a position in a cracker factory—and met Jim. Jim was the engineer of the factory; a man of little education, but boundless in com-

mon-sense, who did much in stimulating the "Serbian greenhorn's" interest in science and study. There in the engine-and-boiler room of the cracker factory Pupin made his first studies of the nature of heat, augmenting his observations by reading the *Scientific American* and the scientific section of the *New York Sun*. Jim helped him tremendously, expressing in his own words the truths which the lad found couched in scientific terminology, and as the "What is it?" of his childhood was answered Michael found a multitude of more detailed questions to puzzle over. To Jim belongs the credit of removing the last trace of greenness in the boy's consciousness, for the old engineer explained the history of the United States in such a way that the boy grasped the similarity between the young American traditions and the ancient Idvorian ones—and the new country felt warm and homelike at last.

Through his interest in the history of the country came his decision to attend Columbia University instead of Princeton, for it seemed to him that many of the heroes of the United States were Columbia graduates, and surely the university must be a splendid one to have produced such men as Alexander Hamilton. And forthwith he settled down in earnest to pass the entrance examinations.

The college career of Michael Idvorsky Pupin sounds more like a fairy tale than a fact, for it is almost inconceivable that a raw youth who had arrived in this country, unable to speak a word of the language, only four years before, could accomplish what he accomplished. The cold conciseness of the "Who's Who" biography gives no inkling of all that that period meant to the young man, and

it is more than probable that he himself had no realization of the magnitude of his achievement. In 1879 he passed the entrance examinations to Columbia with such high marks that he was not required to pay tuition for the first year, and the "Serbian greenhorn" had become a university student. He worked his

way through by winning scholarships, by tutoring the more affluent but less brilliant classmates, and by sawing wood during vacations. And in his junior year he was elected class president—this man who eight years before had been set upon by a gang of newsboys!

He received his citizenship papers and his diploma within twenty-four hours of each other, in 1883—and with his diploma came a three years' scholarship enabling him to go to Cambridge, England, in further pursuit of the answers to his insatiable "What is it?" England was the home of Faraday and Maxwell—and those two names were the outstanding ones in the world of electrical engineering at that time—so Michael Pupin hied himself to England. At Kings College in Cambridge he found the satisfactory answer to his question "What is heat?" and "What is light?": during vacation he visited France, and visited his mother in Idvor. Back again—driven by the ever present urge to find out for himself—the truths of the scientific world—to Cambridge, where he met the famous Tyndall and cleared away his last questionings as to the nature of light; then to the University of Berlin, to study under Helmholtz, the foremost electrical experimenter and authority of that day. While there he learned the explanation of the Hertzian oscillator—the granddaddy of radio—and with Helmholtz's aid satisfied himself as to Faraday's theories.

While on vacation he met his future wife, and at once headed for New York to find some sort of a position. A month later he returned to London, though he had ac-

OUR best authors with all their art could not render a story more fascinating or inspiring than this true life story of Prof. M. I. Pupin.

cepted the offer to be "teacher of mathematical physics in the department of electrical engineering" at Columbia, and married Sarah Katherine Jackson, the sister of a classmate of his. After one more year at the university of Berlin he received his Ph.D. and returned to New York and the position at Columbia.

There occurred the second great metamorphosis in the life of this one-time herdsboy; the "university student" became the "university professor," who was shortly to gain international fame for his research work and his inventions.

As an educator and instructor, Professor Pupin holds high rank in collegiate circles today; but it is upon his activities in electrical research that I am going to touch, for it is there that we find the ever present "What is it?" of Michael Pupin, and can see the independent Idvorian youth finding out for himself.

A young college professor who is teaching classes in three different subjects does not have much time for research work, and until 1890 or so Instructor Pupin had little opportunity to experiment with the meager equipment which at that time was accorded the electrical engineering department. As soon as he could, however, he commenced evening research work, experimenting with the passage of electricity through various gasses at low pressures—the first approach to vacuum tubes. He published two papers on this work, but found that Professor J. J. Thompson of Cambridge had anticipated and bettered that very work, so he—being, as I have said before, most independent by nature—turned to something else. The something else was a very worthwhile something.

While at the University of Berlin, Pupin had been much interested in Helmholtz's acoustical resonators with which the professor proved his "harmonics" principle of sound transmission; and the young instructor built electrical resonators, employing the same dynamic principles as the ones employed by Helmholtz, for investigating the Rowland distortions in electric current. These resulted in the discovery of the electrical "harmonics"—and Pupin, remembering the bagpipes of his boyhood, called the manipulation of his apparatus "tuning." You use the principle which Pupin first employed and named, every time you listen in on your radio receiving set. He patented his invention, and in 1908 sold it to a representative of the Marconi Company. Thus was made possible the first receiving set.

In 1895 the discovery of the X-ray by Roentgen was announced, and through Pupin's familiarity with vacuum tube research he was able to make the first X-ray photograph in this country. He employed a fluorescent screen, thus shortening the time required to make the photograph by almost sixty per cent. By this time the name of Pupin had become one of note throughout the scientific world.

It is for his greatest invention—the invention which bears his name, the Pupin coil—that the whole world knows Professor Pupin, however; for without that in-

vention you could not telephone from New York to Boston for five times the rate you now pay. The Pupin coil—the coil which makes long-distance transmission of sound over wire possible—is the direct result of that persistent "What is sound?" which so worried him as a boy. Through his grasp of the nature of sound, he was able to apply to the electrical current the same physical characteristics which cover vibration of a string—and the Pupin coil is the result. The American Telephone and Telegraph

Company bought his invention, and has found nothing to supersede it for efficient transmission of long-distance conversations.

Prof. Pupin was at one time director of the research laboratory at Columbia University and is an ex-president of the Institute of Radio Engineers. Under him at Columbia University such men as Dr. Alfred N. Goldsmith, Major E. H. Armstrong, inventor of the regenerative, super-regenerative and super-heterodyne circuits in radio, Prof. J. H. Morecroft and



Prof. Pupin receiving the Medal of Honor from the Institute of Radio Engineers for his research work in radio. Major E. H. Armstrong and Prof. J. H. Morecroft, president of I.R.E. presented the medal

others have studied and furnishes the reason for the title "Dean of Radio Engineers."

His duties as university professor did not prevent him from developing his inventions, for he has worked extensively in the practical adaptation of his inventions in connection with the telegraph and telephone. Many of his improvements are known by his name throughout the world.

In view of the wonderful achievements of Prof. Pupin there is hardly a gathering or meeting of scientific men for purposes of discussing new developments especially in the field of radio, but what his presence is desired and his opinions are sought. He is a pleasant, versatile and authoritative speaker having as a background an experience unusual to most men upon which he can draw to make clear his thoughts and at times afford the entertaining touch so necessary to attract his audience.

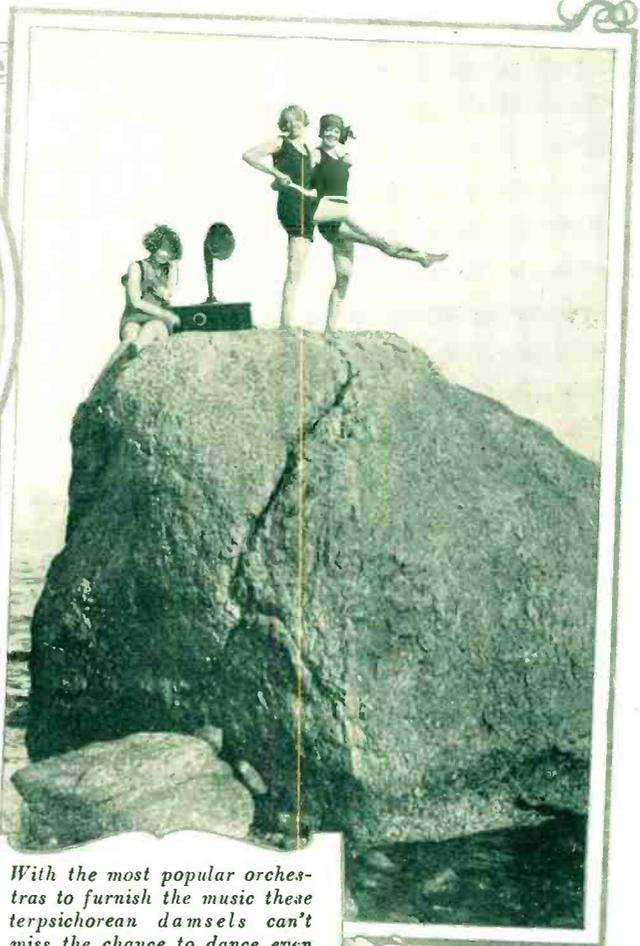
The modesty of Professor Pupin with reference to his achievements was strikingly illustrated on the occasion of one of his lectures on the toroidal coil and its mysteries which we were fortunate enough to attend. The Pupin coil and many of his other inventions had already been developed and used extensively in the business of the world and were adding to his widespread fame, so we knew it as the famous "Pupin Coil." Irrespective of this, not once in the course of the lecture was it referred to in that manner—not once did he hint that he was the man who had given it to the world.

So we shall leave him—this independent son of Idvor, whose work has resulted in the convenience of the telephone and of the radio—whose name today looms large in the world of electrical science. We shall leave him answering the "What is it?" of the Columbia students, and asking himself the same question concerning phenomena which most of us have seldom if ever heard about, Michael Idvorsky Pupin, the "Serbian greenhorn," student, professor and inventor!

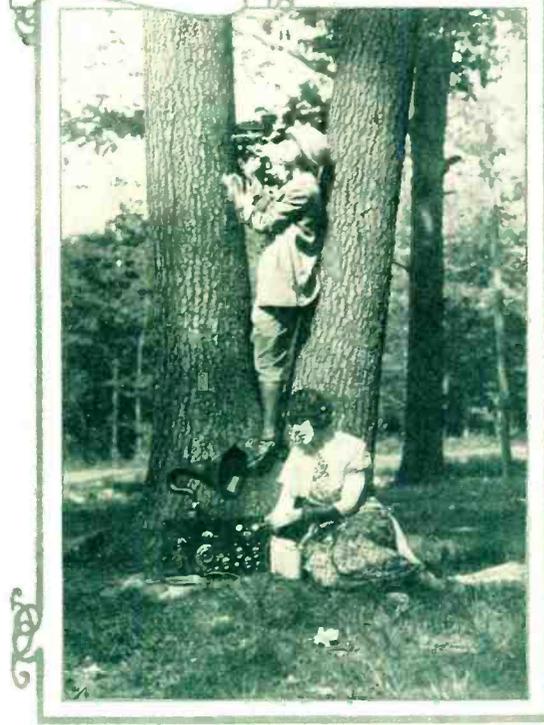
Women in Radio



Miss Mimi Palmeri, the beautiful star in "Ragged Edge" takes a dip and listens in



With the most popular orchestras to furnish the music these terpsichorean damsels can't miss the chance to dance even though the floor is "terrible"



Vacationists this year took their radio sets along and were suprised at the pleasure it afforded them—and some of the ladies did their own installing

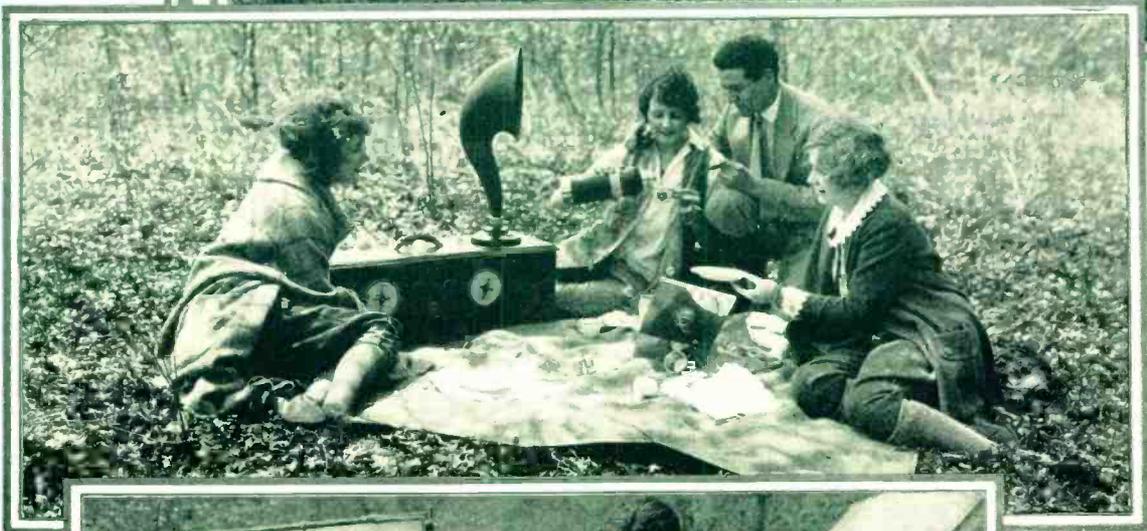


New York society finds pleasure in "listening in" to radio broadcasting while enjoying afternoon tea

Radio in the Great Out-Doors



Radio helps to bring civilization back to nature in the great wild woods where the young find freedom and pleasure



The roadside picnic for auto parties is enhanced considerably by the presence of a portable set and loud speaker

Carefree and young again, Bob Mulford—the famous automobile race driver—listens in to broadcast programs during one of his camping tours

The Second Shot ?

There was a loud crack in the horn, like a pistol shot! —just one—and then the mysterious Dunellin case was tried a hundred times over, in the newspapers, on street corners, in homes, clubs and offices

By GARRET SMITH

THE mysterious killing of Andrew Dunellin, leading citizen of Flowerville, was a tragic anti-climax to the celebration of the hundredth anniversary of that city.

Dunellin, as master of ceremonies, had been his most triumphantly flamboyant self on that final evening of the carnival week and of his own life. The great mass meeting which closed the event had turned into a personal tribute to him. Prof. Mayhew, of the History Department of the State University, who had come to give an historical sketch of this pioneer community of the commonwealth, struck the keynote in his complimentary references to the city's most progressive citizen. Senator Nefus reiterated it. When Andrew Dunellin himself threw the meeting open to general discussion of building a permanent memorial, the adulation reached its height.

The 3,000 citizens who thronged the Grand Theater gave him thunderous applause. This approval was echoed, in thought at least, by the majority of the 100,000 more who listened to the proceedings before the bellowing mouths of radio horns in all parts of the city. It seemed as if Dunellin had successfully oiled the waves of opposition that had at one time threatened to disturb his career.

At the close of the meeting he gave an impromptu reception in his box to prominent citizens, friends and newspaper men, who crowded in to shake his hand. In his hearty friendliness to all comers there was no hint of secret fear. When he and his immediate party started out of the theater the last of the crowd had departed. Old Mike Hartigan, assistant janitor, a little the worse for liquor as usual, lingered suggestively near the entrance, waiting to lock up. The only other person in sight was Martin Lewis who stopped them in the lobby.

"Pardon me, Mr. Dunellin," he said, with nervous abruptness. "May I see you upstairs a moment? We ought to phone a little final statement to the

papers, giving the total pledges on the memorial."

Lewis was a rising young lawyer of the city, and one-time leader of the waning opposition to Dunellin's overlordship of Flowerville. Dunellin had considered it a good move to make him vice-chairman of the Memorial Committee, and in that capacity he had acted as radio announcer at all the events of the week, the master of ceremonies before the great absentee audiences.

Dunellin's eyebrows elevated slightly now at the young man's unceremonious manner, but he yielded politely to his demand.

"Excuse me a moment, gentlemen," he apologized. "I'll run you home in my car, Tom," he added to old Thomas Carroll, the labor leader, who was one of the party.

"No, thank you, Mr. Dunellin," Carroll declined. "I'll get home just as quick by hopping the last trolley that's due out here about now. You've a car full, and these gentlemen won't care to ride all over town at this time of night."

"Just as you wish, Tom. I'll say good-night, then," Dunellin agreed.

"We'll walk over to the trolley with Mr. Carroll, and you can pick us up there," suggested Senator Nefus.

The Senator and Professor Mayhew were staying over-night at the Dunellin home.

"Seems funny to see Mr. Dunellin and Martin Lewis workin' together after the way they fought a while back," remarked Carroll as they started across the square.

"What was their trouble?" asked the Professor.

"Lewis claimed that Mr. Dunellin bribed the Board of Aldermen to get the contract for the water reservoir, and then stole a fortune from the city in skimped materials. He made charges enough to send Mr. Dunellin to State Prison for thirty years if he could prove it, but he couldn't. Mr. Dunellin, instead of suing him for libel, said the young man meant well,

but was misguided. He's been throwing little things in Lewis's way ever since, and I guess the young fellow's changed his mind."

"Dunellin certainly has a gift for handling men," commented Senator Nefus.

"He has that," Carroll agreed. "Why, there's even that drunken old Mike Hartigan, the assistant janitor at the theater, we saw in the lobby just now waiting to lock up. Couple of years ago he was threatening to shoot Dunellin on sight for getting his boy sent up for stealing in Dunellin's bank. Well, Dunellin gets the boy pardoned after a year and meantime gets Mike this soft job at the theater. Mike swears by him now."

The Grand Theater stood at one corner of the city's square facing into it. Diagonally across it at the other corner was the trolley stop, about fifteen hundred feet away. The three men sauntered slowly across the grassy lawns, looking back occasionally to see if Dunellin's car had started yet. It was a pleasant Fall midnight, the air clear, cool and still. Nothing broke the silence but the occasional drone of a distant trolley-car.

They reached the car line and found they had a minute or two to wait for Carroll's car. A few feet away the patrolman on the beat was gossiping with a proprietor of the little general store on the corner. There was still no sign of Dunellin. Diagonally across the square they could see the light still burning in the manager's office of the theatre, where Dunellin had gone to confer with Martin Lewis.

"Must have had a lot to say after all," yawned the Senator.

At that instant, sharply distinct through the silence came the sound of two crackling explosions from the direction of the theater.

The policeman whirled about.

"Something doing over there!" he exclaimed and started for it on the run, blowing his whistle for help as he ran. The four civilians lumbered after him.

Two other patrolmen, summoned by the whistle, joined them as they reached the theater, but there was no other sign of life about the front of the building, whose main doors were still wide open as when they had left it. But when they poured into the lobby they came upon Martin Lewis standing at the foot of the stairs looking up.

He whirled toward them in nervous alarm. He was deathly pale and greatly agitated.

"Where's the shooting?" demanded one of the officers.

"I—I don't know. I left about five minutes ago and got half a block away when I heard it. It sounded as if it came from the theatre. I thought of Mr. Dunellin, first thing. I left him alone up in the manager's office. I heard you coming so thought I'd better not go up there alone."

The policeman bounded up the stairs, the rest following. On the first landing they met Mike Hartigan, the

full glare of the overhanging light lay Andrew Dunellin, his head in a pool of blood, his arms thrown wide and clutched in his right hand a heavy revolver.

For a full moment no one spoke. "Good God! He's killed himself!" exclaimed Senator Nefus.

But the policeman who had been with them when the shots were heard and who, by tacit consent of the others, had taken charge, was on his knees closely examining the body and the weapon.

"How many shots was it you heard, sir?" the officer asked at length, looking at the Senator.

"Two," the Senator affirmed.

"I also," the Professor corroborated.

"Same here," agreed Carroll.

"Me too," from the storekeeper.

"I couldn't be sure," Lewis said. "I was around the corner when I heard it."

Where's that janitor? Don't let him get away."

But Mike Hartigan had vanished. "It's murder all right and Hartigan's the fellow did it," was the unofficial verdict of Inspector Leebuck of the Detective Bureau, after he had looked the case over.

So the drag-net was drawn for old Mike. He did not return to his home that night, and it was late the next afternoon before he was picked up in the back room of a friendly saloon, now very drunk. His story told at the coroner's inquest after he sobered up was hazy and conflicting. He repeated his statement that he had sat down at the bottom of the balcony stairs to wait for Dunellin and Lewis to come out and had fallen asleep. He thought he heard somebody go by him up the stairs while he dozed. Pressed on this point, he said maybe they were coming down stairs, and finally admitted it might have been footsteps overhead.

He persisted, however, in the statement that the shooting awakened him, though he contradicted himself several



"Something doing over there!"

times as to the number of shots he heard. He said he looked in the main auditorium first, then had started up the stairs, but he was afraid he might be shot himself so came back

and met the officers. Again he contradicted himself as to how far up the stairs he had gone.

"But why did you run away?" asked the Coroner.

"I was scared fear they'd blame me fer goin' to sleep on duty an' lettin' the fellow come in that murdered Mr. Dunellin. Soon's I heard the officer say Mr. Dunellin'd been murdered, I says to muself, 'This ain't any place fer me, an' I beat it.'"

He admitted he had been drinking from a hip-flask that evening, but denied that he had been irritated at Dunellin for keeping him so late.

There were several witnesses, however, who said they had been among the last of the general audience to leave and that old Mike had been in a

assistant janitor, staggering down.

"Where was it?" again demanded an officer.

"I dunno," Mike declared. "Sound-ed upstairs. I was takin' a bit of a nap waitin' for 'em to get through up there, and it woke me up. I got most up there when I think I don't know what I may be gettin' into; I better call a cop."

The officer pushed the partially sobered Mike one side, and they continued on. The door of the manager's office stood wide open. The little group pushed in, then stopped aghast.

In the middle of the floor under the

"I heard two myself," the officer added, rising to his feet, "but only one shot has been fired from that gun. The bullet that killed him went into his mouth and out the back of his head. Looks to me like murder. Somebody else fired that second shot."

"Jan," he added to one of the officers, "better scout around the building and see if you find any prowlers or signs of 'em. And, Joe, don't let any of these people out of here while I call the captain. I'll have to ask all of you to stay right here till the Cap decides what to do. Don't touch anything. There may be finger-prints.

profane fury because people were so slow in getting out.

Others testified that at the time his son was sent to prison on Dunellin's charges, Mike had threatened to shoot him, and he had been known to carry a gun.

"Did you have a gun that night?"

"I did not, sir. Haven't had a gun in two years."

Martin Lewis' story was simple and direct.

"I went up to the manager's office with Mr. Dunellin, and we finished totaling the pledges made toward the memorial by adding those made after the meeting adjourned. He wanted to compose carefully a few pleasant words to go with his announcement of the total; said he would phone the papers and told me not to wait for him. He insisted he could work faster if he was alone, so I left, passing Mike sound asleep on the stairs when I went out; at least he seemed to be asleep. I had just turned the corner from the theatre when I heard shots and went back."

That two separate shots had been fired was established by the five reliable witnesses who heard them from the trolley station, the only persons who claimed to have heard the shooting clearly.

It seemed to be a clear case. The Coroner's jury found that Andrew Dunellin came to his death by a pistol shot fired by Michael Hartigan. Popular indignation ran high. There was serious talk of lynching old Mike, but this was suppressed by the prompt action of the police. There was universal demand for swift punishment. Mike Hartigan was indicted for murder in the first degree, and rushed to trial.

At this point there was considerable public surprise at the action of Martin Lewis. Neither old Milke nor any of his family or friends had any money to pay a lawyer to defend him. It looked as though his fate would have to rest with the perfunctory services of some minor attorney appointed by the court.

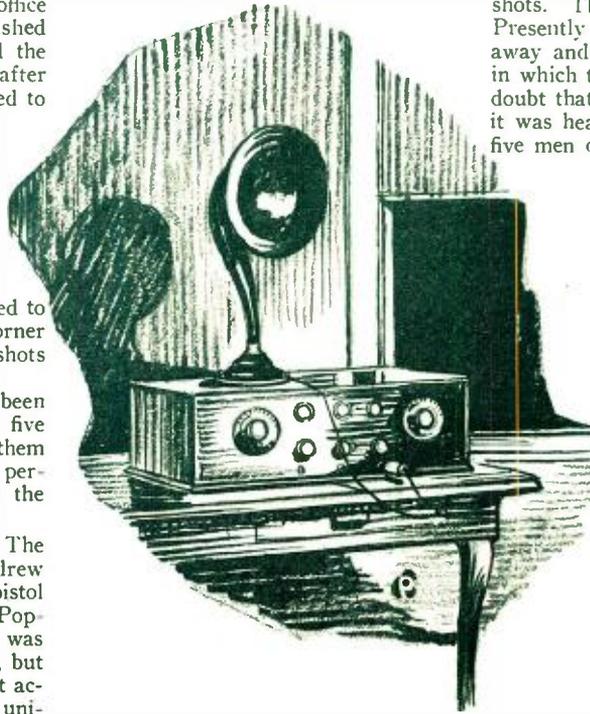
Then Lewis came forward and donated the entire resources of his law firm to the defense of the old janitor. His partner, Harvey Powell, one of the best trial lawyers in the state, volunteered to appear in court.

To the further surprise of everyone the defense rested its case mainly on the contention that no second shot had been fired, that it was a clear case of suicide, that those who thought they had heard a second shot had probably been deceived by an echo.

"We shall show further," said Attorney Powell in opening for the defense, "that the defendant Hartigan

had been a staunch friend of the deceased for over a year; that there is no evidence that he had a weapon with him on the night in question, that if he had and used it, he was too befuddled with liquor to have so cleverly disposed of it on the spur of the moment that it has never been found."

But, though the defense had the advantage of the alleged weapon being missing, and produced numerous wit-



nesses to Hartigan's present lack of motive, they were weak in their main point of contention, that there had been no second shot. Hartigan, himself, and Lewis both now swore glibly that they had heard only one shot and stuck to it.

Hartigan's testimony, of course, was passed over as controlled by self-interest, but the apparent change of front by Lewis caused some surprise.

"You stated to the officer at the time of the shooting, Mr. Lewis, that you were not sure how many shots had been fired," said the district attorney.

"I was not under oath then, and did not know that my statement might involve another's safety. I did not wish in the excitement of the moment to contradict positively several other reliable gentlemen."

The prosecution proceeded smoothly to carry out its program as outlined in the prosecutor's opening.

"The picture is so clear," said he, "that we can safely fill in the missing bits. The defendant, Hartigan, is seen about the theatre drunk and quarrelsome. He had been known to carry a

weapon at times. Doubtless he had it that night. He is finally left alone at midnight, kept out by the man he still secretly hates. He broods over his present discomfort and past wrongs. Finally, he goes upstairs and berates his victim. When the latter rebukes him, Hartigan draws his weapon. Dunellin draws his, but Hartigan is the lucky one. He leaves his victim and as he goes down the stairs is met by five men, all of whom heard the two shots. The gun is safe in his pocket. Presently in the excitement he slips away and has nearly thirty-six hours in which to hide the weapon. Can we doubt that second shot was fired when it was heard and will be sworn to by five men of more than ordinary intel-

ligence and probity, a United States Senator, a well-known scholar, a prominent labor leader, a reputable merchant, and a man of good standing on our police force?"

Inch by inch the defense fought this conclusion in vain. Their one chance of breaking down the testimony as to the second shot on the ground that the witnesses had been deluded by an echo failed on a field test. Court and jury adjourned to the trolley stop in the square opposite the theatre where the witnesses had heard the shooting. Shot after shot was fired in the manager's room of the theatre, but it failed to awaken any echo perceptible to the listeners. The acoustics of the theatre were too good to cause any reverberation. The buildings about the square and back of the theatre had neither the height nor position to throw an echo in that direction.

So when the defense was apparently at the end of its resources, it was evident that the prosecution would have the verdict. There was a hurried consultation between Martin Lewis and his partner, Powell, counsel for the defense.

"Your Honor, I wish to call Mr. Lewis to the stand again," said Powell, in evident agitation.

"Mr. Lewis," asked Powell, "Will you please state again exactly what happened on the night of the killing of Andrew Dunellin?"

Then Lewis threw a bombshell into the court-room.

"I wish to retract my previous statement and make a new one," he said. "In so doing I must convict myself of perjury, committed in an effort to spare the reputation of a man whom this entire community reveres and

from whom I myself have accepted many friendly favors. I did it further to spare as much as possible the feelings of that man's bereaved family. Further, I must admit frankly, I realized that to tell the truth would compel me to appear to the public as the cause of that man's self destruction. But now I find it necessary to tell the truth in order to save the life of an innocent man."

The witness paused and wiped the heavy beads of perspiration from his brow. Then, after a moment with a visible effort, proceeded.

"I was in the room with Andrew Dunellin when he shot himself. Only one shot was fired and that his own. Michael Hartigan is innocent. He was down in the lobby when it happened, as he swore he was."

He paused again and fought for self-control. Court, jury and spectators sat motionless, with tense white faces. There was not a sound in the court room.

"Some years ago," Lewis went on at last, "I made very serious charges against Andrew Dunellin in the heat of a political campaign. I thought I could prove them then, but I found I couldn't, and was forced to retract them. In time I came to believe I was wrong.

"On the evening that Andrew Dunellin died, just before I started for the mass meeting, a man called at my home and handed me three affidavits which I will present in evidence if the court permits. These documents supply the evidence I had failed to get and had come to believe did not exist. They prove that Andrew Dunellin obtained the water supply contract by bribery and made a fortune by using cheaper material than the contract specified.

"The man bringing me these affidavits was on the way to the newspapers with them. I made him promise to wait twenty-four hours, while I tried to get Mr. Dunellin to make voluntary restitution, I agreeing to have private detective agents watch him meantime, and see that he did not escape.

"I had no chance to see him till after the meeting that night, when I

gave the pretext that we must make up a statement for the papers, in order to get him alone in the manager's office at the theatre. Then I put the whole matter before him. I told him he could not escape, but that he could lessen his punishment by making a confession to the papers that night, at the same time offering full restitution. I volunteered the services of my firm at his trial.

"He simply stared at me till I had finished. Then he shook his head.

"I had feared this might happen some time," he said. "The restitution is arranged for in my will," and before I could make a move, he drew his revolver from his pocket, placed the muzzle in his mouth and fired.

"My first impulse was to run for help. But as I ran I was thinking



"I'd been sitting listening to the meeting all evening."

rapidly. I thought of the double blow of the suicide and the exposure to his family, friends and business. I thought that I would appear to have forced the suicide by threat of exposing him after accepting his friendship. Why not keep out of it and let it remain a mystery? I could get the affidavit withdrawn now that he was dead.

"On the last landing I saw Mike Hartigan staggering to his feet and looking wildly around. Then he went into the auditorium as he testified. That left the coast clear. I slipped outside the door and waited until he went upstairs, then I slipped back into the lobby till the police and others arrived. You know the rest. I throw myself on the mercy of the court."

Martin Lewis walked to his seat beside his counsel like a man in a dream. Powell arose and murmured perfunctorily, "Your Honor, defense rests."

The district attorney followed suit, and a few moments later the jury, without leaving the box, voted Mike Hartigan not guilty.

Following the verdict there was a moment of hushed expectancy, then the district attorney arose—

"Your Honor," he said, "I demand the arrest of Martin Lewis on the charge of murder in the first degree for the killing of Andrew Dunellin."

The entire City of Flowerville boiled afresh at this new and greatest sensational development in the mysterious Dunellin case. The case was tried a hundred times over in the newspapers, on street corners, in homes, restaurants, clubs and offices. There was much difference of opinion over details. Some declared Dunellin ought to have been shot and pronounced Lewis a hero. Others said the young lawyer was a desperate blackmailer, and had shot his victim when he was defied. Still others believed the shooting was in self defense, while yet another group maintained it was a quarrel between crooks, who had been working together, but had a falling out.

But all agreed on one thing—Martin Lewis had shot and killed Andrew Dunellin. There was not a chance in the world of drawing a jury that would vote otherwise.

The district attorney was jubilant. He didn't like Lewis. He was a strong partisan of Dunellin. There had been a lot of fumbling in this case. His office didn't stand any too well in the matter. Here was where he would redeem himself beyond question. The only fly in the ointment was that the case was too easy.

"Lewis has hung himself," he exulted to his assistant. "He and his partner tried every dodge in the Hartigan trial to prove only one shot was fired and failed. He's admitted he was in the room when it happened. He admitted and proved the best ground in the world for a deadly quarrel. Of course he had a gun with him. Would any sane man go into a room alone with Dunellin to prove he was going to expose his crookedness without having a gun with him to defend himself, and be darned good and ready to use it?"

In his interview with Lewis, Powell, the prisoner's partner and attorney, voiced much the same opinion.

"Martin," he said, "I'll do my best, but we're up against it. We can't get around that second shot. If you'd told the truth at the outset, admitted shooting and claimed self-

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Radio and Family Education



Radio is almost an ideal educating influence because it induces manual training and is filled with a constantly increasing lure into wider and deeper technique—it establishes direct personal connection with the world of ideas and events

By MRS. CHRISTINE FREDERICKS

I HAVE four children—one just out of baby clothes and another just out of knickerbockers. What every mother knows is that education is a great deal more than sending youngsters to school. "Education" starts with the never-ending baby-questions of Carol, the youngest, up to the actions of David, the oldest, when at the wheel of the family automobile. If anyone should ask me what word is most synonymous with "mother," I would instantly reply "university," for I have found it necessary to make my home into an institution of education, with myself as dean of the university, and father—like most university presidents—a more or less absentee and ornamental head!

This home university is no mere figure of speech. My home must offer—and does, to a large extent—a liberal arts curriculum and selective, vocational courses; a summer school outdoors, and evening classes to boot. Also a kindergarten, and once in a while a special corrective course for a temporarily wayward or abnormal child. And, like a modern institution of learning, there must be plenty of amusement, social life and, above all, a good "mess hall" with plenty of nourishing food. A library and a museum and a campus and athletic facilities are matters of course, according to the status of your pocketbook.

As dean of this family educational institution, with a very small faculty of teachers, I or any mother needs every bit of assistance that can possibly be afforded; especially so since the modern psychologists tell us that a

child's character is formed largely before it ever gets to the schoolroom. There is no substitute for this home university; even the charity experts now realize that children in orphan homes and other institutions are usually better off if they have a family atmosphere, even if it isn't of the very best.

What is so hard on mother, the dean of the home university, is that she so often has to do practically all the teaching—conduct all the classes. Fathers, from the stone age onward, never were much at professoring in this home university. Mother has had to be kindergarten teacher, librarian, tutor in Latin, chemist, cook, chambermaid and matron.

You can imagine, then, how the intelligent mother has welcomed radio. It has put at her disposal a whole line of teachers, and added thousands of people to the home university faculty. It has been just as though the combined teaching staff of Harvard and Yale were suddenly placed at the service of some little college down in Arizona. Yes, quite!

Of course, I know that the great bulk of mothers haven't yet realized what a help they have in radio, even if there are sets in their homes. The sad fact is that the men of the family—husband, brother, son or grandfather—have so monopolized the radio set that mother in many cases knows nothing more about it than that she can't get hubby to bed at any decent hour any more, and that the "A" battery boasts a very nasty acid which has several times nearly ruined her rugs be-

cause of improper or careless handling.

When the radio fans give her a chance to regard the receiving set as a piece of household equipment of more value to her than anyone else we will begin a new era for the home university.

First there will be the little children. It is true that they must patiently be initiated into radio, if they are really to like it. A little child has quick likes and dislikes, and if you try to make it listen to things without interest you merely form a distaste. But if you induct children into radio rightly they will love it. Probably no man in the world ever has swayed so many children at one time as the famous "Man in the Moon" in the early days of radio. A lot of purely adult fun has been poked at the bed-time stories, and they are not now so much in vogue largely because of the selfish impatience of adults who did not want to listen in to baby prattle.

But mother and the children are going to demand their share. They will insist on other things than prize fights, political conventions and other man-interest programs. They will want good stories for the children, and more of the function of the "Man in the Moon," because many a mother can testify to the strong influence this able broadcaster had over her children. A private tip to the "Man in the Moon" about a little boy's naughtiness—the incredible magic and awesomeness of hearing his name and his misdeeds spoken about from out of the air, in a grievous voice has had a correcting influence beyond comparison. And to

the well-behaved—the word that a star had been made for him or her has been a satisfying reward.

My own youngest children are story-crazy. Father is besieged the moment he arrives home for his daily quota of two stories which necessitates the reading of endless fairy story books. The story is, of course, an age-old educational device. Example, even in fiction, is the best teacher. The story over the radio affords endless opportunities as an educational aid for the younger children. I am sure if my husband's stories were broadcast they would induce the same rapt attention from other children as they do from our own little ones. Even for these little children a broad range of material coming over the radio is educative.

As for the boy in the family, radio is as full of education as the sea is full of salt. He gets it first, merely in the sharpening up of his interest. Every mother knows the heart-rending cry of the boy, "There's nothing for me to do, mother!" But once caught in the net of radio interest, it's a poor lad who isn't in for a year or two at least

of experimenting and brain-teasing!

Radio is almost an ideal educating influence, because it not only is manual training, but is filled with a constantly increasing lure into wider and deeper technique; while to cap the ideal climax, it establishes direct personal connection with the outside world of ideas and events. I used to believe a printing outfit did this, combining, as it does, manual work with words and ideas; but radio infinitely surpasses it. Small wonder that radio set-building is now a standard manual training equipment in schools.

In my opinion it is a serious mistake, an injustice to any boy—and I believe also to a modern girl—to let them grow up without a practical knowledge of mechanics and electricity. A man finds it necessary so very often in life to use practical mechanical knowledge; and in this day of electric washers, ironers and vacuum cleaners, a woman does, too. Radio, considered simply as manual training, is a splendid practical as well as a theoretical education. Few, if any, subjects lead out into more sciences, or tap the

sources of all scientific knowledge more fully than radio. A youngster who knows radio is almost certain to know a lot about science, physics, chemistry, and allied subjects.

It is even true that grown-up women are acquiring a needed education in electricity via radio. There is often the most ridiculous ignorance on women's part about electricity. They send for electricians to do a little job that anybody could do in three minutes; often they send for him when they don't even need him at all—they have simply been stupid. Electricity is the modern woman's servant to a very large degree. So radio is in a sense bringing up mother, if she takes an interest in it.

Considered as musical education, radio is a vastly important thing. You might say the phonograph has done all you can expect from radio in musical education. The blunt truth is that the phonograph is canned music, while radio is live music. My young people don't want to listen to an orchestra phonograph record. They get no thrill because they know it is canned. But they will listen to a Philharmonic concert, or some other high class music, on the radio. As



"Home Sweet Home," with all of its constructive power to support and advance civilization, has been enhanced by the introduction of radio broadcasting

a rule, they prefer to dance by phonograph music, it is true, because it takes sheer volume and clear time-marking to make dance music enjoyable. But the musical thrill in radio for young people is the sense of attending an actual event; listening to an actual performance. The telephone has habituated us to regarding what we hear over the wires as real, so that the intervening distance and the ear-piece does not destroy the sense of reality.

Educationally, the musical value of radio lies in forcing upon the attention of young people some of the beautiful compositions. Left to themselves they will not play records of "The Unfinished Symphony," or "Scheherezade" on the phonograph; but if a good orchestra plays it they'll enjoy it. There should, of course, be more of the better type of music, especially music presented educationally, as some of the New York *Globe* concerts were presented. More broadcasting of the music of the big orchestras is also bound to come, and will be a very great educational boon.

It is not generally appreciated that young people at boarding schools find radio a joy. My son, now at prep school, who had surfeited himself with radio at home, found himself calling loudly for a set once he got to school. School rules requiring lights out at 10 P. M., he and his chum discovered that it did not refer to radio tube lights, so they went to bed and listened in until sleeping time. Thus radio became an excellent preventer of old-time mischief, no doubt!

I find my youngsters are more interested in the broad world of affairs since we have had radio in the house. They take note of major political, business and other events. They ask questions and make dinner table conversation with the newly broadcast information. It is true, they often exercise their lordly prerogative as listeners in to tune out, just as those in a meeting may boo a poor speaker. But on the whole they collect, in their own way, their quota of fact and impression, all of which is educative because it presents data to the mind for a judgment.

The other evening some singer over the radio sang a sentimental ballad about "the salt, salt sea." My gradu-

ate class, the older two children, laughed him out of earshot—but they went to our home university library and got out a reference book to settle a dispute that arose as to how the sea ever got salty, anyway! Thus does the difficult business of home education proceed along the narrow road of interest—something which radio never fails to stimulate in one direction or another, even if only to tune out that old bore, quick!

For a long time I was not able to keep my youngsters interested in calisthenic exercises. Then when a broadcasting station put out Walter Camp's daily dozen, I got them interested. We put a loud speaker out on the lawn, and the whole family, including the

ous stations, and acquiring, at the same time, a stimulating medley of impressions from the broadcast music and lectures.

One of my children was unlucky enough to be laid up with illness for a period in the school season, and it was a great trial for her to discontinue lessons. Radio stepped into the breach and kept her contented and alert.

My radio faculty is very important in my home university. It has lifted a considerable load from my shoulders, and will lift more when, as I contend should happen soon, there will be more attention paid by broadcasters to the needs of the family.

And now I'll come to the education by radio of the adults themselves. There's more than a jest behind the modern quip about educating father and bringing up mother. I

have been a Chautauqua lecturer throughout the entire United States, and I can testify from intimate knowledge as to how important the educational aspect of radio is to the adults of the great stretch of territory of this country. The annual Chautauqua lectures have been almost the only education which millions of people have had—their one contact with outside educative forces. Great as are the circulations of our magazines and newspapers, they are plainly but a drop in the bucket. There are 25,000,000 homes in the United States, and the most optimistic publication men have never claimed that more than about 7,

000,000 of these families read magazines or metropolitan newspapers. The rest may read the local gossip and the outstanding telegraph news in local papers, but a surprisingly large number never even do that. Education through the printed page is not the easiest or simplest method whereby to educate people. The mighty vogue of the movie has shown us that, for about 15,000,000 families see the movies. The eye and the ear are the masses' greatest tools for education.

Radio can easily put education into every home, since radio sets are now so cheap. When I recall the pathetic sight I saw in Florida, of two small children traveling each day, through swamp and woods and by row boat,

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Children's hour is now filled with new and old fairy stories that improve the child mind more effectively than could be accomplished without radio broadcasting

help, took part to the rhythm of radio!

Another time, we stimulated flagging interest in rhythmic dancing in the same way—out on the lawn to the time of good dance music via radio.

This summer I discovered my very active nine-year-old girl crying because school was over and she didn't have things to do any more! I realized that a summer school must be organized on the spot; and I turned to radio for help. She is such an active child that it was difficult to get her started, but now she knows how to tune in all by herself and has caught the long distance fever. Her DX work has been associated with her geography lessons. I supplied her with a map, and now she is getting a whole new set of educational thrills working out the vari-

“Selling” the Movies by Radio

Movie chats over the air prove
a boon to meritorious pictures and
are popular with the “movie fans”

By ALFRED J. “HOLLYWOOD” McCOSKER



PERHAPS the best way for me to take the harshness out of the word, “selling” which occurs in the title of this article is to tell a story.

Also, it will make us both feel at home because it is largely through the medium of story-telling that I have become known to the vast radio audience and through which genuine friendships that I hold invaluable have had their beginnings.

When in my radio talks, which deal with the cinema, I wedded the “whisper world” with the “shadow world,” no thought of “selling” was in my mind. But, as the talks continued, that is exactly what happened and here comes the story. I was placed very much in the position of the maiden lady whose nightly prayer was, “Please, God, I don’t ask anything for myself, but do send mother a son-in-law.”

More than a year ago, while I was in charge of the motion picture department of America’s oldest theatrical daily newspaper, a glorified old sheet published in New York, the thought occurred to me that everyone was apparently interested in the slightest whisper of inside information concerning motion pictures; an indication that I gleaned in my social life away from the industry. Added to this was the fact that nearly everyone was interested, if not enthusiastic, about radio. The radio audience, which comprises the dual personnel, might, I speculated, approve a weekly feature talk in the realm of the silent screen. I believe now, and have for a long time, that I was right in my assumption.

But do you know, when some of the

leaders in the ranks of the theatre owners learned of my intention to send movie chats over the air they were up in arms. These earnest gentlemen saw the advent of the radio only as dangerous competition that must be stifled if their enterprises were to survive or if ever the “SRO” sign was to flash under the electric lights. Some of the

most important executives in the exhibition branch of the industry urged me to abandon my projected radio talks if I had any regard for long friendship—and their pocketbooks.

“How,” they argued, “can you expect people to be at home listening to your radio talks about pictures and at the same time be at the right side of the box office of our theaters?” The answer was simple. I could not expect them to be in two places at once. But

what I could expect without recourse to phenomena, was that people might be in one place listening via radio to news of meritorious movies and at the same time, desire to be in another place witnessing them. It is only true to report that this is precisely what happened. Thousands of letters I have received from newly made radio-movie fans attested the truth of my original contention.

I will add here that my radio talks may not have been good for all pictures, but they have proven a value to theater owners who featured the better ones. By nature I am a booster. I preferred not to mention by radio any picture which did not merit a good “send-off.” The radio audience was speedily alert to this and the plan saved me from joining the obnoxious ranks of “panners” as chronic fault finders are known to film profession. Correspondents have written me, saying, “I went to see such and such a picture and now I know why you did not mention it in your radio reviews.”

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“Baby Peggy,” the tiny movie star of “Captain January,” tunes in to McCosker’s talks

Speech and Music in the World of Sound

Characteristics of harmonic vibrations—pitch, quality and loudness of notes and overtones analyzed—a scientific treatise on sound as related to speech and music

By JOHN P. MINTON, B. S., Ph.D.

IN the paper in the August issue of this magazine on "The World of Sound" we described the parts played by the vibrating objects, the air and the ear in the sensation of sound. It was necessary to have objects with little quivering motions and it was necessary to have the surrounding ocean of air to conduct or direct these motions throughout all the surrounding space. Some of this sound energy fell on the ear and produced the sensation of sound as related in our paper on the human ear which appeared in the July issue of *THE WIRELESS AGE*. In the present paper on speech and music we shall deal only with the vibrations of the objects themselves as related to speech and music.

The vibrations of material objects

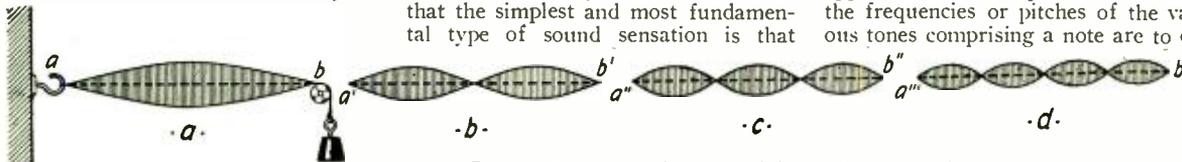


Figure 1—The form a string takes as it is vibrating, in the various modes to form a note

such as used in speech and music are very special kinds of vibrations. We can all recognize our own spoken language, many can understand several foreign spoken languages. We can detect the differences between a piano and a violin; we can recognize the sound from two musical instruments of the same kind as being markedly different; we can perceive with the ear the marked differences that exist between the same note when played by the piano and organ, or when sung by two voices. Why is all this possible? I shall endeavor in a simple way to explain why this is possible.

Any one of us can see immediately that there must be something regular and unchanging, continuous and sustaining, about such sounds as are produced by the mechanisms, so to speak, we have named. Surely, we could not hope to have the ear and the brain perform in so remarkable a fashion as they do, if such sounds as mentioned here were irregular and changing, dis-

continuous and not sustained. Sounds of the latter type are for the most part mere noises and are unpleasing and irritating to most of us. It is difficult to identify them. If we are able to identify them to any extent whatever it is because some sounds of the former type are present to a small extent. What then are the characteristics of the sounds of which speech and music are composed?

Let us consider music first. We have stated that objects must vibrate in order to produce sound. There is one type of vibration which physicists call simple harmonic vibration. Ohm, who was a professor of physics in Munich about 1850, and who gave to the electrical world the law known by his name, definitely introduced the idea that the simplest and most fundamental type of sound sensation is that

which is caused by a simple harmonic vibration. The most familiar illustration of this simple type of vibration is the swinging pendulum. It swings back and forth about its mid-position at a constant rate, never varying. If we take a string, suspend a weight from one end, hold the other still and give the weight a tap with a hammer, we shall observe that the time of complete to and fro swing remains absolutely constant as the motion dies away and the weight comes to rest. The time of vibration determines the pitch or frequency, which is the number of complete to and fro motions which occur in one second. If we have any body vibrating in these simple harmonic motions, it causes the air molecules to swing back and forth with it in the same kind of motion. If the motion is rapid enough, say above twenty or so per second, the ear will hear them. If they are too rapid, say above 20,000 per second, the ear will not hear them. This has been ex-

plained in our first paper. The actual range used in speech and music is much more narrow than this; perhaps it includes all frequencies from about 30 to 8,000 or 10,000 cycles. Cycle is a term which applies to a single complete to and fro motion of the vibrating body.

In music the sensation of hearing produced by a simple harmonic motion is easily recognized and is called a simple tone, or a pure tone, or merely a tone. In music, produced by either voice or musical instruments, the sounds are more complex and are referred to as musical notes. These latter are composed of several pure tones and, when we investigate these notes and analyze them by physical apparatus at our disposal, we find that the frequencies or pitches of the various tones comprising a note are to one

another in a very special relation, namely, they are proportional to the simple whole numbers 1, 2, 3, 4, 5, etc. These overtones, so to speak, are called harmonics, and are known by their respective numbers such as first, second, third, etc.

There are three terms which are used to describe a note, namely, pitch, quality and loudness. Pitch of a note is ordinarily determined by the tone of lowest frequency in the note. By quality is meant the unmistakable character which enables us to distinguish the notes of one instrument from those of another. Quality is determined by the harmonic tones present in both number (such as first, third, etc.) and in magnitude. These alone enable the ear to detect the differences between the voice, the piano, the organ, the 'cello, the flute, the violin, etc.

As to loudness, this is of a psychological character, but it is associated with the magnitude of vibration of the air molecules or the sound pressure

acting on the drum membrane of the ear. The ear can judge loudness accurately between two pure tones of the same pitch, but it cannot judge with any degree of satisfaction the relative loudness of two tones of much different pitch or of two notes from different instruments.

Since the present issue of this magazine is an educational one, the above rather didactic discussion is in harmony with this purpose. It is of considerable value and of much personal satisfaction to be familiar with the above terms and to know to what they apply.

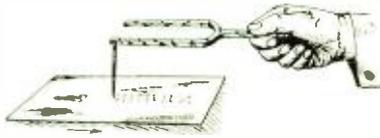


Figure 2—The simple harmonic vibrations of a tuning fork

We are all familiar with the fact that musical instruments fall into two general classes, the string and the wind instruments. The former type includes the piano, the guitar, harp and mandolin, the violin, viola d'Amore, viola Da Gamba, etc. These are all string in-



Figure 4—Metal reed and reed pipe

struments, some are plucked, one struck and some bowed, yet they are all recognized when played as being different. The reason is that the notes and quality of the music from each instrument is different than that produced by all the others. As already pointed out, the quality difference is caused by the presence of the harmonic tones. A change in the mechanical construction of the instruments brings out or changes the relative magnitude of the harmonics and introduces too, when new lengths of strings are used in the modified construction, a new set of fundamental tones and overtones, and we have therefore, a new set of string instruments. It is not the difference in the strings of the instruments of the same kind which cause one instrument to be superior to another. We know that the strings of an instrument play little part in determining the quality of music given off from the instrument. In fact, practically none of the sounds come from the strings of any of the string instruments. They really come from the body of the instrument or the sounding board as in a piano, all of which are set in motion by the vibrating strings themselves. Since the

body of any one kind of instrument made by many different manufacturers is certain to be different in many important details of construction, it is at once apparent that these instruments will produce different musical quality. This is what determines the value of an instrument. With the violin, for example, much care is taken in the finer instruments in their construction, and the quality of their notes will change with age because the body is apt to alter. We really hear the body and for this reason certain of the older violins are a really great treasure. The most famous of all, of course, are the violins made by the great Italian violin maker, Antonio Stradivari, whose

ple harmonic type of motion already referred to. If, however, the string is vibrating in all the forms shown in the figure, or if we have four different strings, one vibrating as (a), one as (b), etc., then we have a note given off instead of a pure tone. In music, of course, the vibrations are of the more complicated type and for this reason we hear notes entirely and the resulting sound is much more pleasing and satisfying because of the many fine variations a musician can produce. I venture to say that music would be far from pleasing if we had only pure tones at our disposal. It is of utmost importance to know that a given string vibrating simultaneously in all the four

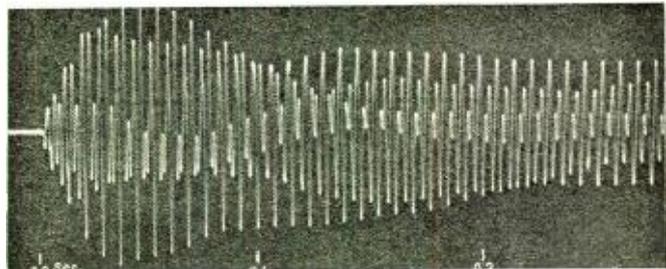


Figure 3—Complex vibrations and overtones of a note on the piano

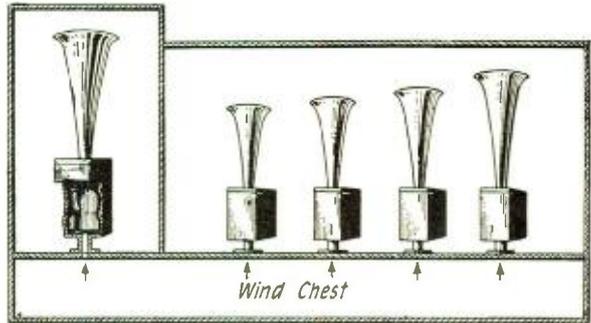


Figure 5—Series of reed pipes attached to wind chest

wonderful work was done from about 1666 to 1737. None since have equaled him. Let us now consider the vibration of the strings themselves.

In figure 1 is shown a picture of the form a string takes as it is vibrating in the various modes to produce a note. The first mode (a) is the fundamental one and produces the lowest tone of the string; (b) is the second mode and gives the next highest tone which is octave of the first tone and is twice the pitch or frequency of the first tone; (c) the third mode, is three times the frequency of (a); (d) is the fourth mode, and is four times the frequency of (a). The tones given off by (b), (c) and (a) are the second, third and fourth harmonics of the tone produced by (a). Each of the modes (a), (b), (c) and (d) produce a pure tone and is a sim-

ple harmonic type of motion already referred to. If, however, the string is vibrating in all the forms shown in the figure, or if we have four different strings, one vibrating as (a), one as (b), etc., then we have a note given off instead of a pure tone. In music, of course, the vibrations are of the more complicated type and for this reason we hear notes entirely and the resulting sound is much more pleasing and satisfying because of the many fine variations a musician can produce. I venture to say that music would be far from pleasing if we had only pure tones at our disposal. It is of utmost importance to know that a given string vibrating simultaneously in all the four

modes as shown in figure 1 will give. say a violin note on a violin body, a mandolin note on a mandolin body, a piano note on a piano body, etc. That is, the body controls the magnitudes or intensity of the harmonics and thus the quality or nature of the music. It is of considerable advantage to study music and speech by means of pictures of the vibrations. In this way we discover many important things about them and are able, as a result, to develop new and greatly improved reproductions of speech and music. This is our constant aim. In figure 2 is shown an easy way in which a picture can be made of the simple harmonic vibrations which produce the simplest kind of a sound sensation as first announced by Ohm many years ago. The tuning fork, here shown, gives this

type of a sound wave. The smoked paper *m n* is moved along at a constant speed and the vibrations of the prongs are recorded on the paper by the light pencil at *p*.

In figure 3 is shown a more complicated type of vibration. It is secured only by careful scientific manipulation which need not be described here. The curve represents one of the low notes on a piano. These low notes of a piano are rich in harmonics or overtones. An analysis of such a curve as this shows there are more than ten harmonics present all of which go to make up the quality of the note heard. Such curves as these can be analyzed by physical methods and we then find out not only what tones are present, but to the exact degree or amount they are present. In this way it is possible to find in precise physical data what the real difference is that makes one instrument or voice different from another instrument or voice.

There is another large group of instruments, known as the wind instruments, whose action depends upon vibrating columns of air instead of moving strings. In this class we find a large variety of instruments. For example, we find here the organ, oboe, English horn, bassoon, double bassoon, flute, piccolo, clarinet, French horn, trumpet, trombone, tuba, cornet and many others. The vibrations are for the most part confined to the air columns or enclosed air. Some sound, but not much, come from the material of which the particular instrument is made. For example, all of us are familiar with the "brassy" sound from the band instruments, particularly when the sounds are very intense.

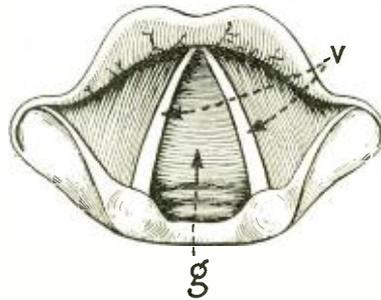
If the reader will refer back to figure 1 and imagine the string is an air column of one of the wind instruments, he can readily comprehend the type of motion the confined air undergoes for the different modes of vibrations. Here, however, the air particles move back and forth along the column and are called longitudinal waves, as all air waves are. The string vibrations, on the other hand, are all transverse to the direction of the strings.

We shall have opportunity in another paper to write more about these musical sounds, and for this reason let us consider the voice sounds in the remaining space allotted to us. We shall not be able to cover the whole subject, but we shall be able to include some of the essential facts. The discussion will be carried further in another paper.

The human voice is the most wonderful instrument of all. It can produce all the beautiful, finely shaded notes whose tones include practically every pitch in the whole frequency range from less than 100 cycles to

10,000 cycles. Its performance is matched only by the ear itself and neither the hand nor mind of man can make or conceive instruments more wonderful than these two.

To show the action of the human organs producing vocal sounds, it will be best first to describe the vibrating metal reed to which different pipes have been added as in the reed pipes of an organ. In figure 4 is shown a sketch of a metal reed, *RR*. The reed is a strong spring and sets its own rate of vibration. The wind is blown from the wind chest (see figure 5) as indicated by the arrow and maintains steady vibrations of the reed which causes a note to be produced. In figure 5 is seen a series of resonating pipes, with enclosed reeds, attached to a wind chest. These different pipes



Vocal cords, or muscular ledges, attached to the larynx as indicated by *v*. The cavity *g* controls the harmonic tones set up by the vibrating larynx

give various qualities to the notes because each pipe is of a different size and, therefore, brings out or emphasizes certain overtones. The overtones emphasized by each pipe are different because of the difference in size.

The human voice is the same type or nature in its performance as the metal reeds, the wind chest and the pipes. The lungs correspond to the wind chest and produce the wind or driving power. The larynx compares with the reed we have just described. The mouth cavity with its various configurations corresponds to the various pipes. This cavity can readily be formed into various shapes to control the harmonic tones and their magnitudes set up by the vibrating larynx. Attached to the larynx, as shown in the accompanying picture, on either side are the vocal cords which are a pair of muscular ledges, so to speak. These muscular cords can be stretched at will and the varying tension in them gives us the soprano, contralto, tenor, bass, etc. It also gives us the variations in any one voice and makes it possible to produce with the help of the changing mouth cavities all the fundamental tones with running accompaniment of overtones which are the means of speech and musical sounds of the voice with every shade of beauty and inflection. The infinite delicacy and

variety of the tones thus produced by the voice are equaled only by the wonderful delicacy of the ear which distinguishes them and the brain which interprets them.

It would be unfortunate to leave this interesting subject of speech and music at this point and for this reason our next article will carry the discussion into the field of scientific data of tremendous import.

Standard Frequency Stations

AS a result of measurements by the Bureau of Standards upon the transmitted waves of a limited number of radio transmitting stations, data are given in each month's Radio Service Bulletin on such of these stations as have been found to maintain a sufficiently constant frequency to be useful as frequency standards. A new station, WBZ, is included in this month's list. There may be many other stations maintaining their frequency just as constant as these, but these are the only ones which reached the degree of constancy shown among the stations upon whose frequencies measurements were made in the bureau's laboratory. There is, of course, no guarantee that the stations named will maintain the constancy shown. As a means of maintaining constant frequency the high-power low-frequency alternator stations listed below have speed regulators. Most of the broadcasting stations listed use frequency indicators—one-point wavemeters—and maintain a maximum deflection of the instrument on the frequency indicator throughout the transmission. These broadcasting stations with rare exceptions, vary not more than 2 kilocycles from the assigned frequency. The transmitted frequencies from these stations can be utilized for standardizing wavemeters and other apparatus.

Station	Owner and Location	Kilo-cycles	Times measured	Deviation Per Cent.
NSS	U. S. Navy, Annapolis, Md.	17.50	81	0.2
WGG	Radio Corp. of America, Tuckerton No. 1, N. J.	18.85	100	.2
WII	Radio Corp. of America, New Brunswick, N. J.	22.04	82	.3
WSO	Radio Corp. of America, Marion, Mass.	25.80	90	.3
WWJ	Detroit News, Detroit, Mich.	580	41	.1
WCAP	Chesapeake & Potomac Tel. Co., Washington, D. C.	640	56	.1
WRC	Radio Corp. of America, Washington, D. C.	640	40	.1
WSB	Atlanta Journal, Atlanta, Ga.	700	52	.1
WGY	General Elec. Co., Schenectady, N. Y.	790	89	.2
WBZ	Westinghouse Elec. & Mfg. Co. Springfield, Mass.	890	9	.0
KDKA	Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.	920	114	.1



Pompeii



Karikal, India



Geneva

Adventures of a Radio Operator

A series of true incidents of adventure, humor, pathos, history and travel, as told to the writer by a radio operator whose experiences they relate

By W. S. Fitzpatrick

Assistant Superintendent, Marine Department, Radio Corporation of America

HORACE H. WOODCOCK has had many interesting happenings; they may not be more than the average radio operator, but his were seen through observing eyes that delight in the unusual. He is well read and fond of travel and naturally appreciates the real value in sights of foreign lands. He is an ardent sportsman—displayed by his love of hunting, fishing, golf, motoring and his possession of a motor-boat—he enjoys the thrill of adventure.

Perhaps the excitement of being caught taking pictures in a forbidden section of the Mikado's palace and subsequent escape from the police by diving through an unknown culvert, may not appeal to you as an experience you would desire to pass through, but Mr. Woodcock, it must be remembered, is a full-blooded young American of a type who would find more sport in being chased by a band of savages on one of the southmost islands of the Philippines than to be entertained by the Governor-General in Manila.

This—I repeat—is Horace Woodcock.

He is fearless, as many of his experiences show, and he is very resourceful. His acting as chief steward of a ship on a voyage of several months after the regular steward had been left behind, is one instance. At another time, he took the part of ship's surgeon in treating an injured member of the crew, undoubtedly saving a life. Still another of the numerous examples is best described in an accompanying picture showing him in the act of untangling an aerial that had been blown down in a far-Eastern monsoon. In this case there was no spare wire aboard and it was necessary to rebuild the new aerial from the remnants of the old.



Horace H. Woodcock
To right—Mr. Woodcock untangling a much tangled aerial



Notwithstanding his intense, serious quest for new conquests, Horace Woodcock has a keen sense of humor. Note a sample in this letter addressed to a clerk in the maintenance department of the radio company:

"Aboard S.S. Java Arrow,
Bombay, India, March 22, 1923.

"Dear Sir:

"A terrible error has occurred which I must correct. It is this way:

"You gave me inventory sheets to fill out and told me to give one back before I sailed. I sailed right away and couldn't do it. So I mailed it to

you before we left Port Arthur. I gave length of aerial spreaders as sixteen feet. Yesterday we had the aerial down on deck for rehauling and I measured the spars and found them to be twenty feet long.

"So in order to make them jibe with inventory I sawed off two feet from each end.

"I figured that some other operator might make a similar mistake some day, so I painted '16 feet' in large letters underneath each spreader, so it can be seen from deck.

"Now there will be no excuse for any operator following me, from sawing off any more.

"Respectfully yours,
"HORACE WOODCOCK."

Imagine the consternation at the radio office when this letter arrived! Such "Spreader" cost over twenty dollars each and he had sawed four feet off each of them!

But the office force knew Woodcock and his pranks—they knew his letter was not to be taken seriously, so merely cor-

rected the inventory copy that he had mailed in.

By this time you must have formed the opinion that Mr. Woodcock has an unusually impressive personality. You're right!

You would be glad to meet him and were you to ask his impressions of the various voyages he has made, he would tell you:

"Contrary to the general impression, sea-going radio operators do not have all their excitement on shipboard; life aboard is mostly routine and the man who participates in an SOS marks the day in red.

"The real thrill comes in stepping

ashore in a foreign country with the fixed determination to drink deep of the romance and legends of peoples whose history is lost in the haze of antiquity—wander through the streets of dead Pompeii; visit Karafeh outside Cairo; stand bathed in the mystic stillness of the Parthenon by moonlight or gaze upon China's great wall with an attempt to realize its vastness."

If you're a smoker, he will offer you his favorite brand of little cigars and try to convince you of their superiority over cigarettes; then with a "By golly"—his most common expression and the strongest ejaculation in his vocabulary—he will explain how indis-

enter upon the platform. He could see from the gesticulations of the natives that curses were being heaped upon him, but the fate that was in store for him was his only concern for the moment.

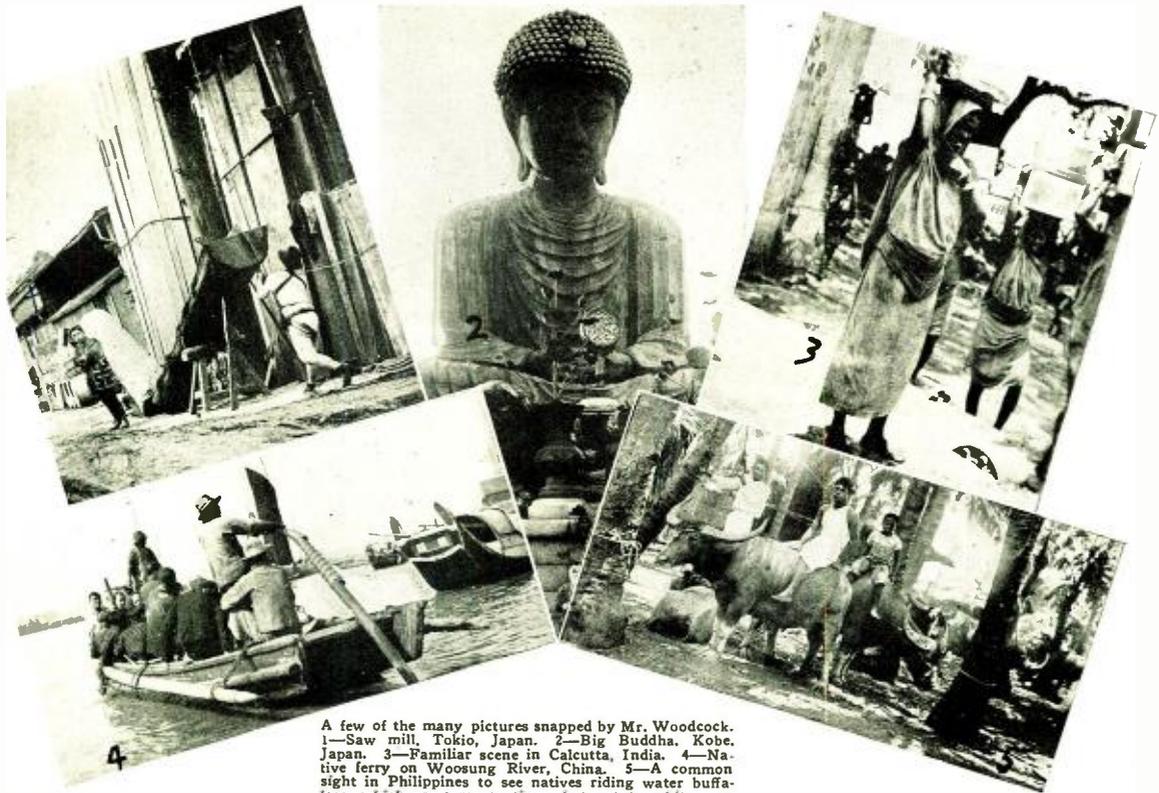
He had succeeded in making three exposures—possibly the only ones ever made there—and he wondered if the native code called for death for this rash deed or merely being tied behind a fast horse as a penalty.

The sharp cry of an Englishman to "come this way quickly" brought him to his senses and he lost no time in following the instructions. The Englishman issued orders to two natives,

He might better have tried to take away Woodcock's money or even his life, but the highly prized camera—never!

With one grand shove, Woodcock's adversary was sent sprawling in a corner and the intruder with his camera safe under his arm, darted around a corner and started down a long, narrow passage.

Two guards at the other end, spying him with a mysterious looking box, prepared to meet him. The fact that he was trapped flashed through his mind and with a thought of standing a better chance with the lone attendant than the two armed guards, he turned



A few of the many pictures snapped by Mr. Woodcock. 1—Saw mill, Tokio, Japan. 2—Big Buddha, Kobe, Japan. 3—Familiar scene in Calcutta, India. 4—Native ferry on Woosung River, China. 5—A common sight in Philippines to see natives riding water buffaloes, which are tame to them, but not to white men

pensable is a camera on visits to foreign lands.

He has sent out his quota of SOS's—three of them thus far—but his most impressionable moments have been those of taking hard-to-get pictures.

Once, when visiting the Towers of Silence on Malabar Hill, Bombay, he slipped away from the guards and entered the gray stone circular platform where Parsee dead are left to the offices of vultures for burial. No living being is supposed to enter upon this platform other than the white-clad Nasasalars, to whom are entrusted the funeral rites.

Much excitement followed his detection, but no one seemed impelled to

presumably his servants, who escorted Woodcock outside to a conveyance, in which he was whisked away amid the glowing excitement of the spectators.

A somewhat similar, but more thrilling, experience occurred to Mr. Woodcock in Tokio, Japan, prior to the great earthquake.

He was taken in a rickshaw to an entrance of the grounds of the Imperial Palace which he innocently entered without the necessary permit.

He walked unmolested about the grounds. Reaching a side door to the palace, Woodcock set up his camera and was just snapping a picture when an attendant rushed up and grappled with him to wrest the camera away.

on his heel and increased his speed in the opposite direction.

Passing the door of the alcove where he had left the attendant lying, he saw him excitedly gesticulating and yelling to several uniformed guards who had been attracted by his cries for help.

They saw Woodcock too, and started in hot pursuit.

"By golly! I felt that the whole Japanese army was after me as I ran across the open grounds," Woodcock said, in relating the story, "and imagine how my heart thumped as I felt them gaining on me—then it must have stopped, for I felt my blood run cold as I came to an embankment about fifteen feet above a drained moat."

Although it was truly exciting, Woodcock talked in his usual calm voice. Proffering one of his favorite smokes and lighting one for himself, he proceeded:

"I expected to hear a bullet whiz by or else feel one passing through me. Why they did not shoot, I do not understand. Perhaps they did, but I was too excited to hear; at any rate, I wasn't lit.

"There was no time to lose so you can bet I lost none. My only recourse was to jump, which I did, then dodged through a dark culvert

"The soldiers evidently thought I would not be game enough to attempt passage through.

"By golly, it was no easy job plowing through that mud in the dark, but I finally made the other end. I glanced cautiously about and seeing no one, I climbed out into a small alley which led to a crowded street, through which I lost no time in getting to the ship."

Once in a North African port Woodcock and a radio man from another ship were approached by a native who, for a stated sum, agreed to guide them to and through one of the famous tombs of ancient kings.

With several officers of the ship the two operators returned and each of the party was provided with a donkey; then with two companions of the guide they started for the desert.

Let Woodcock tell the story:

"The donkeys were lazy and clearly showed they were in no hurry to get where they were going—in fact would just as soon stay home.

"As a means of impressing the beasts with the value of time and show that they were not violating any traffic rules in respect to speed, each guide carried a stick, which was freely used to the discomfort of the rider of the particular donkey receiving the unannounced whack.

"We were out in the open road when my steed received its first—and last—crack.

"Without warning either to the donkey or me the stick came down, the donkey's hind legs went up and I landed in the center of one of the largest cactus plants in all Africa.

"By golly, it took hours to extract those prickles, and don't think they didn't hurt through my thin clothes. Every man in the party assisted in the operation of removing them."

It was some time before they got on their way and eventually arrived at the promised tomb, which proved to be highly interesting, the pleasure of

Pushing open a side door he found a young Chinese girl chained to the wall of a small dark room and beside her a small baby.

From the girl's appearance and actions it was plain to see that she was in great distress and was in need of immediate help.

He rushed down the stairs and upon reaching the door found his exit blocked by a big, rough-looking Chinaman.

Woodcock was a little too quick for him and a well-aimed blow sent the man to the floor. Without loss of time Woodcock reported his find to the authorities but never learned of the outcome. The following day he discovered that he was being followed but as he did not go off the main highway and was then returning to the ship, which was about to sail, no harm came to him.

The following interesting description of Pompeii was written by Mr. Woodcock upon his return from a recent voyage to Italy:

The fortunate seafarer whose ship stays for a time in Naples seldom misses a visit to Pompeii situated on the shore of the Bay of Naples, almost immediately at the foot of Mount Vesuvius. To its proximity to this volcano it owes its celebrity; the peculiar circumstances of its destruction by the

great volcanic outburst of Vesuvius in 79 A. D., and its rediscovery in modern times, converted that, which would otherwise have been known as a faded world-wide for the most interesting relics preserved to us from antiquity.

A train ride of about forty-five minutes brings one to the entrance of the dead city where guides can be procured.

Mr. Woodcock's many other interesting experiences must be reserved for a later time. The pictures presented were taken from among his collection of thousands.



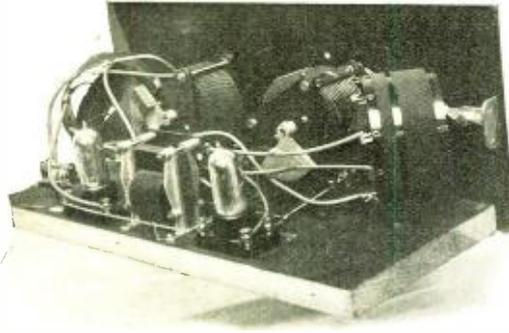
Some of Mr. Woodcock's art collection accumulated during his trips: 1—Statue of smiling Buddha, Dum-e-tey made of rosewood, from China. 2 and 3—Japanese prayers. These are placed in such a way that the wind makes them flutter, the idea being that every time they move it is the same as if the owner had offered the prayer. 4—Bamboo seat from one of the Sampans, China. 5—Japanese split bamboo pillow. 6—Japanese split bamboo basket. 7—Japanese palm leaf hat; the top is made from a single leaf and is reinforced on the underside with strips of bamboo. 8—Japanese bamboo rake used by farmers, street cleaners, etc. 9—Granite mortar and pestle from Japan. 10—Japanese comb made of wood. 11—Japanese tooth-brush. These brushes are supplied with towels to each hotel guest. 12—Japanese wooden shoes. 13—Japanese basket. 14—Purse from India. This has two compartments, one for copper coins and the other for silver. 15—Leather sandals from Bombay, India. 16—Brass lamp from Calcutta, India. 17, 18 and 19—Brass dishes from Calcutta, India. 20—Silver toe rings from Calcutta, India. 21—Silver arm ornament from India. 22 and 23—Silver ornaments from India. 24—Brass spray for scented water from India. 25—Brass container used for carrying betel leaves. 26—Marble ointment box from Genoa, Italy. 27—Manila sandals from the Philippines, (Chinelas). 28—Palm wood shoes with leather tops, Philippines (Bakia). 29—Wooden shoes with coarse woven tops. 30—Palm leaf fan from India.

the visit being marred only by a demand of the guides for additional remuneration.

While in China during one of his voyages to the Far East, Woodcock noted a tower which appealed to him as being an excellent one from which to obtain good pictures of the town.

He found the tower to be a part of a public building, which he entered, and seeing no one, passed through a side door that brought him to a circular staircase in semi-darkness.

Reaching the top of the tower he secured some good pictures and was about to descend when he heard the cry of a baby.



How to Build the

Double Regenerative Reflex Receiver

An economical and easily made receiver that has done real work—loud speaker reception on two dry cell tubes of stations over a thousand miles distant

By R. A. Bradley

REGENERATIVE receivers with all sorts of variations have been used for years by American amateurs and broadcast listeners. There are probably more regenerative sets in use in this country today than any other type. This is undoubtedly due to the ease with which, the wholly inexperienced may construct one and the simplicity of operation. Every one knows the advantages of regeneration in a receiver—the tremendous increase in sensitivity and in signal strength. But nevertheless we reach a point in the sensitivity of a given tube past which it will not rectify—that is when the signal sets up such weak currents in the antenna that the detector tube fails to respond to the infinitely small voltage applied to its grid.

In order to extend the limit of sensitivity, amplification at radio frequencies is used to step up the signal voltage before it reaches the rectifier or detector tube. Most forms of radio-frequency amplifiers now in use are critical in operation. Because of the design of the transformers and the capacitive feed-back between the grids and plates of the tubes, the amplifiers show a tendency to oscillate. To prevent this several methods are used at the present time including resistance, inductance

and capacity "oscillation preventers." Of these the most efficient is the "inductance preventer." If the transformer inductance or windings are properly designed the tube will not "spill over" and the amount of regeneration taking place can be nicely controlled.

The result of our experimentation in this line has been the Double Regenerative Reflex Receiver. It incorporates a regenerative detector with feedback coupling to a stage of tuned radio-frequency. The output of the detector is then fed into an audio-frequency transformer and reflexed back through the radio-frequency tube, making this tube operate at both radio- and audio-frequencies.

The action is as follows: Suppose we omit coil L3 in the circuit diagram for an instant. The transmitted carrier wave sets up currents in the antenna when L1 is tuned to resonance. The signal voltage is then impressed upon the grid of the amplifying tube. Greatly amplified it passes to the detector tube and is rectified and again amplified. Tickler coil L6 is adjusted so that the signal is fed back into the grid circuit of the detector tube where the action and advantages of regeneration are noticed. Suppose now we put in

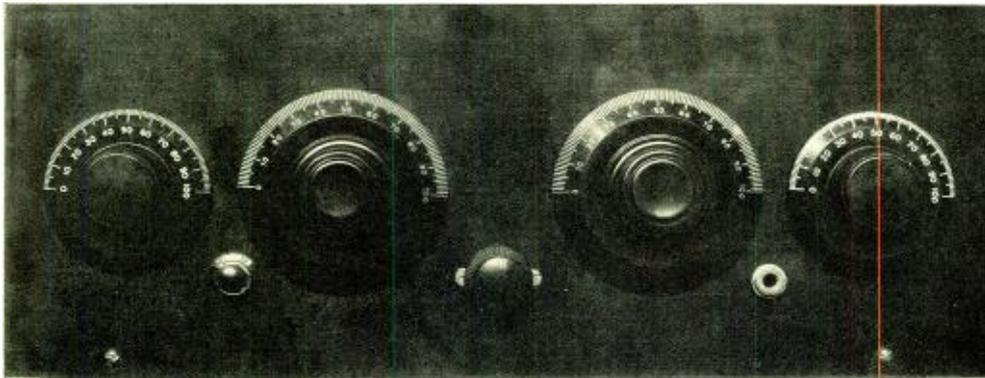
coil L3 and couple it to L2. We now feed radio-frequency current (amplified) back into the R.F. tube where it goes through the amplification over again. The operation of the reflexed current is, of course, known to all, therefore, we will not elaborate on it. But it is easily discernible what great possibilities there are in this double feedback.

We have given much time and experimentation to this receiver and it certainly has proved worthy of our expectations.

The volume obtained from this little two-tube receiver is about equal to a detector and two-stage audio set using six-volt tubes. And its reaching qualities in the way it steps out for distance will be a joy to the builder.

CONSTRUCTION OF THE TUNING UNIT

The two tuners were made up especially for this set after the correct windings were determined. But they can easily be made up by anyone having two ordinary 180° vario-couplers. There should be 35 turns of No. 24 D. S. C. on the rotor coil of each tuner. Now remove the present primary winding on the outside coil and wind on 45 turns of No. 20 D. S. C. This forms the secondary wind-



Front panel view of the Double Regenerative Receiver

ing which is tuned by the variable condensers. After putting on the 45 turns there should be a space left of about 3/4-inch on the tube. In this space and three-sixteenths inch from the secondary winding wind 10 turns of No. 18 D. S. C. This forms the primary winding which on the first tuner is the antenna coil and on the second the plate coil of the first tube. Two double honeycomb coil mountings using two 50-turn coils and two 35-turn coils may be substituted for these two tuning units. When these are used coils L1 and L4 are made by removing the plug attachment of the honeycomb coil and wrapping ten turns of wire around the outside and then replacing the plug. The honeycombs will not be so efficient nor as easy to handle, but will nevertheless be fairly good.

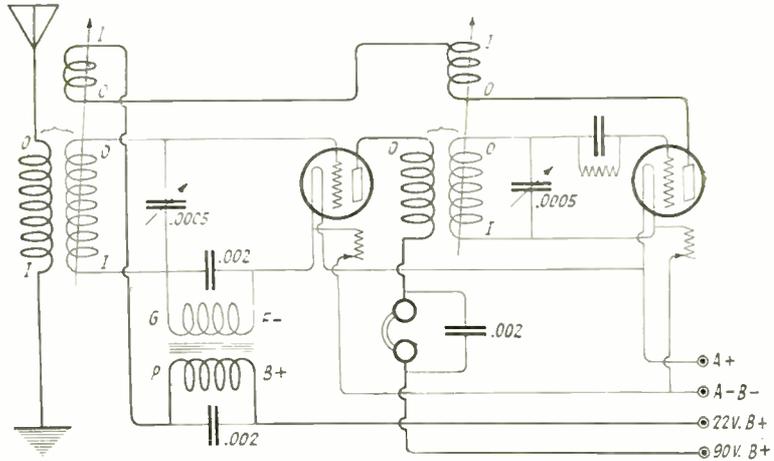


Figure 1—The two tube double regenerative circuit from which the set described here was built. Begin winding at 1 on the coils and end at 0

In the actual construction of the receiver the panel drilling comes first. The templates for the variable condensers should be carefully laid out on the panel and center lines marked for the drilling of the holes for the mounting screws. A pencil line drawn from one end of the panel to the other, three and one-half inches from the top, will provide a center line for mounting the two tuning units and the two variable condensers. After the panel has been drilled the two special couplers and the two condensers together with the jack and Fil-Ko-Stat and filament switch should be mounted on the panel before the panel is fastened to the baseboard. In fastening the baseboard be sure to use good strong brass screws at least seven-eighths of an inch long, because the weight of the condensers and other instruments mounted on the panel is considerable and a strong support is necessary. After the panel is fastened securely mount the two tube sockets and audio-frequency transformer securely

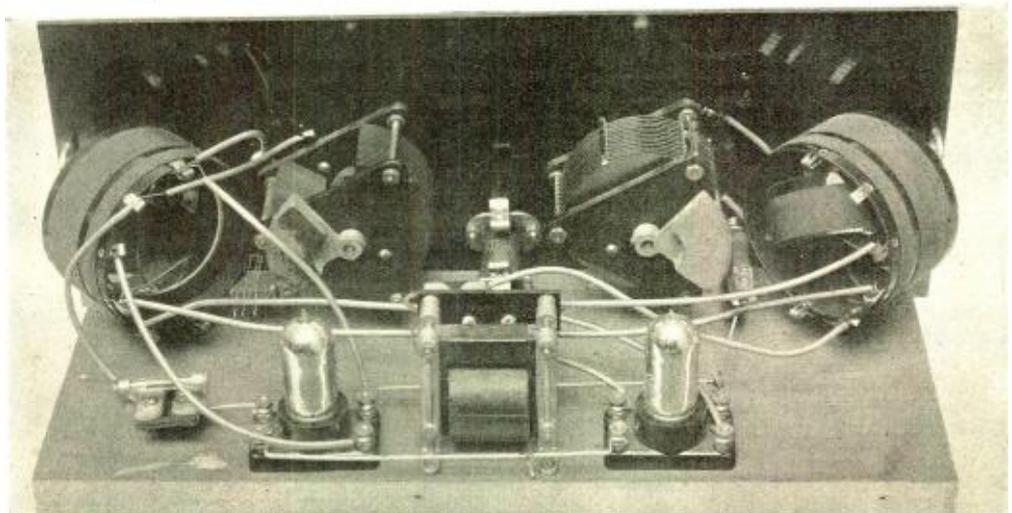
on the baseboard with the transformer placed between the two sockets. If desired, room can be left for the addition of one stage of straight audio-frequency amplification, but this

should not be required if the set is properly constructed. Do not attempt to hook up the set with bus wire as it will be a terrible task. Use No. 18 bare copper wire with a good grade of cambric spaghetti tubing. Make all connections as short and direct as possible. As usual it is necessary to connect the rotary plates of each variable condenser to the filament side of the circuit and the stationary plates to the grid side. If the circuit seems unstable or shows a tendency to spill over try reversing the primary terminals of the audio-frequency transformer. The UV-201A tube may be used very successfully with this receiver. Of course suitable sockets must be used depending upon the tube. Do not omit any of the fixed condensers shown in the diagram, as the receiver will not operate properly without them. We recommend that in hooking up the set you first use 45 volts on the plate of the radio-frequency tube and then 67 and then raise it to 90 if any appreciable gain is noted.

THE LIST OF MATERIALS NECESSARY

- 2—.0005 mfd. variable condensers (General Radio)
- 2—Na-ald UV-199 sockets
- 1—.00025 Micadon grid condenser
- 1—1 1/2 megohm gridleak (Daven)
- 1—Fil-Ko-Stat
- 1—7"x18" Condensite Celeron Panel
- 1—7"x17"x7/8" baseboard
- 1—2"x7" terminal strip
- 1—Acme audio-frequency transformer
- 3—.002 Micadon fixed condensers
- 4—3-inch Na-ald Dials
- 6—Eby binding posts
- 1—Phone jack (Pacnet)
- 2—Tuning units which may consist of the two special wound coils as described in the text or:
- 2—Triple mounted spider web coils or:
- 2—Double honey-comb coil mountings with honey-comb coils

Rear of receiver with binding post sub-panel removed from rear of baseboard. All the connections are clearly shown. Note especially the two tuning units and how they are placed with respect to each other



Before we go on we had better give a short treatise on how to properly set the dials on a tuning instrument.

The dial on any tuning instrument should be an indication to the operator of the set as to the position of the instrument behind the panel, and although directly the dial readings mean nothing as far as wavelength is concerned, a comparison is drawn between the wavelength and the number on the dial. The dial on a variable condenser should be set so that when the rotary plates are completely out of mesh with the stationary plates, the reading

is zero, when the rotor coil is parallel to the stator coil, there is a zero amount of coupling and likewise a minimum of induction. When it is set at 100 the rotor coil is parallel to the stator coil and maximum of inductive coupling takes place.

THE OPERATING DETAILS

After the wiring has been completed go over your diagram and check it several times to make sure that you have made no mistakes. This is not a complicated hook-up, but a slight error in the connections will render it inoperative. Turn the filaments to the proper

of the oscillating point. Now, retune condenser No. 1 and No. 2 for resonance with the incoming signal and slowly bring up the extreme left hand dial which controls the amount of feedback on the first tube. A slight readjustment of condenser No. 1, and a slight lessening of the tickler coil on the detector tube will perhaps be necessary. After short practice the approximate settings for L3 and L6 will be found without difficulty. The two condenser dials can now be calibrated for the exact wavelength of the station and the same station brought in

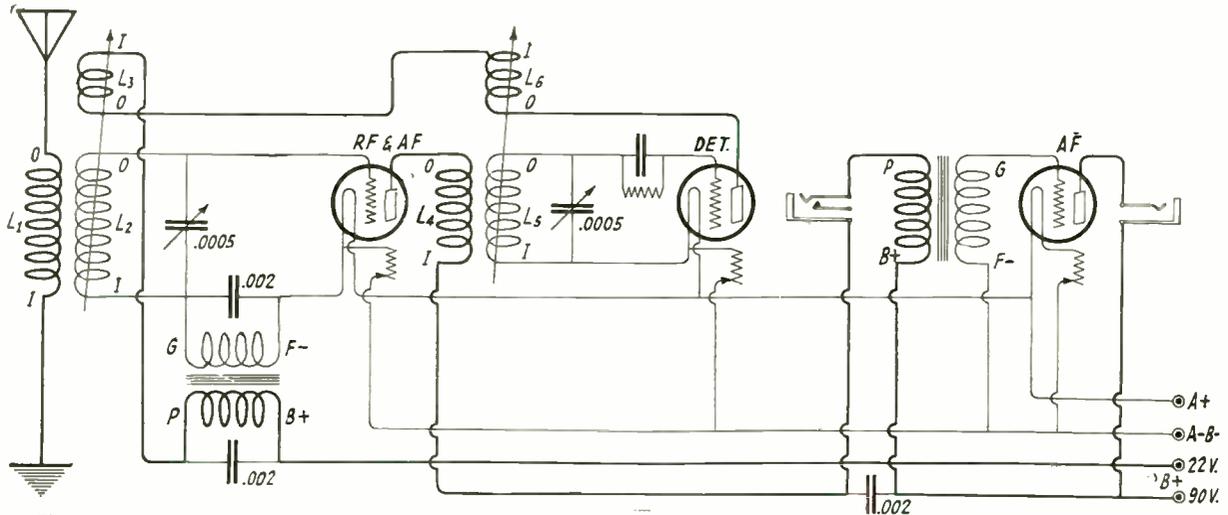


Figure 2—The circuit for the three-tube double regenerative set. This is the same as figure 1 except that a stage of straight audio frequency amplification is added

should be zero. This will then mean that when the rotary plates are all "in" the dial will read 100. On a single-circuit regenerative set, or in any set where a tickler coil is used as a rotary member with respect to a secondary coil, the tickler coil is set at right angles with respect to the secondary coil, to give a zero reading on the dial. This will then convey to the operator that there is zero feedback or no feedback. When the tickler coil is parallel to the secondary coil and the maximum amount of feedback is obtained the dial will read 100. In a vario-coupler, which incorporates the antenna tuning circuit and the secondary or grid cir-

brilliance by means of the Fil-Ko-Stat and slowly turn the two variable condenser knobs until a signal is heard. The readings on the two condenser dials should be approximately the same, that is, if you receive a station at 20 in the right hand condenser dial, the left hand condenser dial should read approximately the same. Now, with the left hand tickler coil set at 0 tune in your signal and slowly bring up the tickler coil in your detector tube which is controlled by the extreme right hand dial. The familiar hissing noise denoting regeneration will be reached shortly. The setting on this dial should be left just short

time after time at the same reading on the dials.

For general work this will be found a very satisfactory receiver, and a very sensitive one, but also it is incredibly sharp and great care in tuning must be used at the start. If the first tube, that is the radio-frequency tube, oscillates of its own accord with both tickler coils set at zero, then several turns should be removed from the primary winding of the second tuning unit. Although the diagram shows two rheostats, one on each tube, only one will be found necessary providing the tubes do not differ much in characteristics.

The D-Coil Receiver

So many letters have reached us dealing with the D-Coil Receiver described in the June issue of WIRELESS AGE that our technical staff in co-operation with Mr. McIlvain, the inventor of the D-Coil Receiver, have prepared another article on the set which will appear in October. Certain modifications have been made so that now we have a two-control D-Coil Set incorporating the astatic principle. Some of our readers' enthusiastic comments will also appear, and you will enjoy reading all about this wonderful receiver in the

OCTOBER WIRELESS AGE

*The Variety and
Significance of
Broadcast
Programs*

George Osborn's
Nicollet Hotel
Orchestra



Second Thoughts of a Listener-in

BROADCASTING education has been a matter of vital concern to educators throughout the country. The possibilities of education by radio have been recognized, but have not been measured. Decisive steps have been taken in several quarters to determine the method as well as the proper curriculum for effective teaching through this new medium.

Station WBZ was quick to grasp the trend in this direction. Several extension courses were tried and found to be entirely practicable. Their latest contribution in this has been the Musical Appreciation course in co-operation with the Massachusetts University Extension.

A feature of the course was the use of actual examples for the lectures. The radio students taking the course were not only told about the different forms of music with explanations of their characteristics, but actually heard the music by way of illustrating such points.

Professor Olmsted was chosen to present the course. He is Professor of Vocal Music at Smith College, Northampton, Mass., and conducts a studio of vocal teaching in New York City.

After graduation from Amherst in 1893, Professor Olmsted attended the Metropolitan College of Music where

he received a certificate in 1896. From 1894 until 1900, he studied harmony, counterpoint, theory and composition with Harry Rowe Shelly. During this same period, he studied voice with E. H. Anderson, F. W. Packard and H. W. Greene. In 1913 he went to Paris and studied with Madame de Latire and during the next year he was with George Hamlin and Coenrad Brothers. Later he continued his musical work with G. Wilym Miles.

It is only natural that with such a background of musical education that Professor Olmsted should be a successful teacher of music and voice. In fact, he has obtained much note throughout the East for his teachings.

One dollar was charged to those wishing to participate. Each student received printed information on the subject. This assisted the student in being able to differentiate between the various types of music heard over the radio. The money received was given to the instructor for his time and effort spent in preparing and presenting the course, and defrayed the expense of sending the suitable papers on the subject to the enrolled members of the radio student body.

The first course that Professor Olmsted gave, considered in general the self expression of music, the dance instinct, and the song instinct. In his

second lecture he considered the ancient and modern dance music. Following lectures treated with the subject of program music, the music of the theater, sacred music, patriotism and its expression, musical forms, and the greatest songs.

This is an example of just what can be done in broadcasting instruction and information. The New York City Board of Education broadcast programs from WJZ. Columbia University also broadcast extension courses through that station. Nightly courses in agriculture were broadcast by the Kansas State Agricultural College. Other agricultural colleges and universities broadcast extension courses in the same manner. In most cases, institutions broadcasting educational courses found them most effective when conducted in a similar fashion to the Musical Appreciation broadcast from WBZ.

One of the latest innovations in broadcast education has been instigated in Oakland, California. The mothers are "going to school" with their children by radio. While engaged in the home duties, the mothers have listened in on the KGO morning educational programs broadcast Tuesdays and Thursdays at 10:20 A. M.

The experiments were conducted by the Oakland Public Schools with the



Above: Carson Robinson, "Eveready Jay Bird" and two-tone whistler. Right: "Little Ahaspa," a Navajo maiden listening-in on the brink of the Grand Canyon, Ariz.



purpose in view of instructing hundreds of teachers and assembled classes scattered over a wide area. One speaker can thus inspire many thousands in city and country.

The program of each broadcast comes under the supervision of a special committee working under the personal direction of Dr. Virgil Dickson of the Oakland Public Schools.

This system has proved so successful, it has been contemplated for continuance this coming school year. One feature alone is a strong argument in favor of such teaching. The mothers, who in the past have found it difficult to follow closely their children's early development, can now tune in on the studies that mould young minds for future citizenship. Likewise, mothers may go to school with their children in other cities where public schools have entered the curriculum. New York City is another notable example.

In a later issue, the progress of broadcast educational programs will be considered at greater length. THE WIRELESS AGE considers this to be a most important phase of radio development.

THE farmers of this country have turned to radio for the many things enjoyed by city dwellers. Tempered by the restful, homestead atmosphere, these pleasures of the city lose the nerve-racking disadvantages encountered in congested districts. Nurtured in the barren quiet of rural

sections, the farmers' minds have become thoroughly receptive. But receptive only to information and entertainment. The farmers do not want the city man to presume upon their sphere. In short, they do not want an "outsider" to tell them what, and what not, to do.

Some stations now broadcast live stock, grain and general market reports. These combined with weather reports serve the farmer much as the stock ticker serves the broker.

A striking example of the service thus rendered was disclosed at KDKA. Among other reports broadcast, a government report of live hog shipments was given

in detail, including the estimated receipts for the following day's market sales. The government figures, however, were consistently wrong—either above or below the estimated receipts by 10,000 head. An investigation revealed a rather startling, but altogether encouraging condition that had developed. The farmers listened in on the governmental reports, made notes of the estimated receipts for the following day, and then arose at 3:00 A. M. to haul their hogs to market if a shortage was reported. On the other hand, if the market was overcrowded, and prices down, the farmers who had received the broadcast reports would not unload on the market until the prices were up. The result was a strong tendency toward market stabilization.

That is a typical example of just what radio means to the farmer today; the day of keen competition, and the greater need for a more equitable distribution.

In the West, the Farmers' Union functions as a strong co-operative marketing and buying organization. The American Farm Bureau Federation, in Chicago, operates as a political organization. And in the East, the National Grange Association, the oldest of the three, has a social and

fraternal objective. These three organizations, all powerful, are not friendly. There are many other farmers' organizations, all unfriendly, each to the other. It is, therefore, essential that extreme care be exercised when any one of them broadcasts a program, whether it be instruction, information, or entertainment. A National Granger, in the East, would very likely take exception to anything broadcast, for example, by the American Farm Bureau Federation in Chicago.

The farm journals encourage broadcasting market reports. A periodical publication cannot serve the farmer as radio does. Reports would be a thing of the past, one week late. But the farm publications can follow the broadcasting with a digest of all that has been broadcast. This is a real service. More because market and weather reports can be supplemented with further information of a pertinent character, following, as it does, the timely service of first importance.

To radio has fallen the distinction of being the one great vehicle by which the city dwellers, for long the beneficiaries of rural development, can repay the farmers with the things both like, but the one only, has been able to enjoy in the past. There is a great deal to be done for the farmers, and should be done as a matter of discharging obligations of long standing. It will be done through broadcast stations.

Broadcast Bits

IN looking over the broadcast news, a variety of unusual features may be discovered in nearly any section of the country. The versatility of radio becomes apparent at a glance.

Motion picture news reels are as keen for news as newspapers. Harry Birch, one of the oldest news reel cameramen in the business, carries a portable receiver with him, which he uses constantly for tips on camera-news. Tuning in station KYW is but a moment's work. Listening to the day's news requires but a few more moments. Then for the picture. Wherever he happens to be, his next job is a simple matter. Tuning in on broadcast news has provided him with information at any point, and at all times, affording him a greater range for seeking photographs—the time employed to some purpose that would otherwise be wasted by sitting around the home office waiting for a lead.

The Winnipeg Board of Trade, realizing the value of broadcast reports, delivers facts concerning the city and the province direct to their citizens through station CKY. Incidentally,

they broadcast information dealing with some thirty-five different topics of interest to tourists and prospective settlers. This is not original, but it does mark the increase of civic confidence in radio.

Radio waves, once started, recognize no barriers. They carry their message to mountain tops and to the depths of mines. When the giant United States navy dirigible, the *Shenandoah*, passed over Schenectady recently at a height of 3,000 feet, WGY exchanged telephonic messages with Lieut. Commander Lansdowne and weather forecasts were transmitted to the dirigible. R. Raven Hart, an engineer, reported reception of WGY's signals at Puento del Inca, one of the highest points on the Andes in Argentina, a distance of 5,200 miles from Schenectady.

C. H. Ingels, a construction engineer, reported reception of KGO, the Pacific Coast station, at Hermit Camp, in the Grand Canyon, 3,300 feet below the rim.

In a test recently conducted by officials of a Scranton, Pa., coal mine, signals from WGY were received at the lowest level of the mine, 480 feet beneath the surface, and a half-mile from the foot of the shaft. The experiment with radio in the mine was carried on chiefly to test the extent to which radio may be utilized for the preservation of miners' lives.

The Canadian National Railways has its parlor and club cars equipped with radio receiving sets of selectivity and patrons of this railroad are regular correspondents of Station WBZ. Almost daily acknowledgments are received from travelers en route who enjoy the nightly entertainments.

Dropping down to the bottom of the sea is a remarkable broadcast feat, but one that somehow seems to be merely another incident in the sequence of events.

C. O. Jackson, a deep sea diver, dropped over the side of a boat to the floor of the Atlantic Ocean. In his diving helmet, he had a special radio microphone, connected by lead cable to the boat and from there to the remote control station of WIP at Atlantic City.

From his point of vantage, Mr. Jackson described the strange fish and other sea creatures living at the bottom of the ocean. The appearance of the sub-sea foliage and mineral formations was broadcast in full detail.

Tom-tom Jazz

FROM out where tom-toms, war-club and wails of dancing natives is a part of the daily grind, word has come to KGO, the General Electric Pacific Coast Broadcasting Station, that radio jazz music heard by South

Sea native chiefs and their people is appreciated and awakens primitive rhythmic instincts.

"Concerts given by KGO are enjoyed here," writes W. R. Ragsdale, trader at Savaii, the last primitive island of Polnesia.

"The jazz dance music from the Hotel St. Francis is great and is very much appreciated by the natives who listen in regularly over the loud speaker."

That the tribal tom-tom has lost any of its appeal is not evident by the report, but modern jazz is influencing native music in South Seas. Through Ragsdale the chiefs of several different tribes send their applause to the jazz dance orchestra leader.

Listeners in New Zealand over a thousand miles further south report that they do not hear music there like the jazz heard over KGO. Members of the Australian Radio Relay League are reporting that this station is being heard in New South Wales, a distance of over seven thousand miles.

The Turf Radioed

SPORTS in radio has just had its greatest broadcast season. The following is a paragraph clipped from the sport page of the *New York Bulletin*.

"The radio is hurting the fight game too. There's a fellow sending out radio descriptions who is a corker. If you sit at home and tune in and hear him tell about the fight you get a bigger thrill than you do if you pay down your good coin. He makes the fights interesting, whether or not they are—and when the judge's decision is bad he broadcasts that fact, too. I understand the boxing commission took him to task one day for expressing his opinion to the million invisible fans and he laughed at them, as he should. He only was voicing the opinion of



Above: Janet Velie in the new revue "Round the Town," broadcast from WOR. Left: Baby Peggy, movie star, also did some broadcasting recently

most men who have been attending bouts the past year or two."

This reflects rather pointedly the viewpoint of newspaper sport writers.

From fights to racing is only a matter of twirling the dial. For the first time, since horse-racing became a favorite sport, track enthusiasts will be able to follow the progress of the horses during the forthcoming International Races at Belmont Park and Aqueduct on September 4th and 27th. Through the co-operation of Major August Belmont, and the Westchester Racing Association, Station WJZ of the Radio Corporation of America will broadcast running descriptions of both races.

These International Races, which are the result of the interest and enthusiasm aroused in racing circles both here and abroad by the Zev-Papyrus race last year, have aroused even more attention than did the former match, for Epinard is profiting greatly by the example of Papyrus. He arrived in time for a much longer training period here, allowing him to become completely familiar with our tracks, and is being handled by Jasper Leigh, a former American horseman who knows our methods of racing thoroughly. The three races which have been scheduled will allow the visitor to display his form at a variety of distances and over three different tracks.

—W. A. H.

The Yacht *Ara's* Complete Radio Outfit

Spark and tube transmitters, a direction finder, a four-element tube receiver, and loud speakers in the staterooms completes the radio installation on W. K. Vanderbilt's yacht which is about to cruise the Mediterranean

By Steffen F. Nielsen

"THE CRUISE OF THE *ARA*" in the June issue of *THE WIRELESS AGE* brought forth various inquiries as to the type of radio equipment used in accomplishing the unusual work done in handling traffic and supplying entertainment and news to those aboard the *Ara*, in addition to the work done with the direction finder as an aid to navigation. To satisfy the interest displayed by the readers of *THE WIRELESS AGE* a description of the station seems fitting.

The apparatus aboard the *Ara* was installed by the English Marconi Co., and is a duplicate of that aboard the *Majestic* of the White Star Line. In some respects it differs from the American type of apparatus and it is for that reason a complete description should prove interesting to American readers.

Three separate transmitters are installed on the *Ara*, one 1½ kw. tube transmitter, one 1½ kw. spark transmitter of the quenched type (500 cycles) and one smaller spark transmitter rated at ¼ to ½ kw. intended for emergency use, or for low power transmission.

The C.W. transmitter—shown on the left in figure 1—is rather small in size considering the output, but nevertheless it is capable of doing some good work, which is probably due to the efficient tubes that are used. The same set is used on nearly all the larger English passenger vessels, including the *Majestic*. It is noted for its pure C.W. note which is secured by means of perfect rectification.

The larger tube in the center is the oscillator and the two smaller tubes, the rectifiers. It will be noted on the top panel there are two rows of holes into which a plug is inserted. The top row taps are connected to the antenna inductance and by plugging in the different sockets any wavelength between 1500 to 3500 meters can be obtained on an average size aerial. The steps between the various taps are filled in by means of a variometer which is mounted on one end of the aerial inductance, placed directly be-

hind the top panel. The handle to the right of the top panel is connected to this variometer. The reaction coil is mounted at the left-hand end of the top panel and a small condenser is connected in parallel with the reaction coil. The lower row of tapings are connected to the A.T.I. through a condenser, called the feed condenser, by means of the plug attached and thence to the plate. Different power is obtained by inserting the plug in the various sockets, but usually there is one place where the set oscillates best and once found, that value should not be changed, except for obvious reasons such as increasing the power.

Below the three tubes are mounted three ammeters which show the current through the filament of the transmitting tube, the high tension supply to the oscillator and the aerial current respectively. The meter on the left-hand side is the ammeter showing the filament current of the oscillator. In the middle is the milliammeter showing the plate current and on the extreme right the aerial ammeter.

At the bottom of the panel will be seen two handles protruding, they are connected to two adjustable iron cores which regulate the values of the chokes in the filament circuits of the tubes. By the use of these chokes the filaments can be kept burning absolutely steady whether the key is closed or open, and that accounts for the steady note produced by these sets. At the extreme left on the bottom panel is the rheostat for the oscillator filament and on the right-hand end a push-button, which when pressed discharges the smoothing condenser, thereby rendering the set harmless in case any repairs have to be made. This smoothing condenser, being highly insulated, is capable of retaining its charge for several days and if not discharged will give a most unpleasant shock. All other apparatus such as grid leak condensers and radio-frequency choke, etc. are mounted back of the panel. A grid leak of 30,000 ohms is used. It is wound on mica sheets in several sections all connected in series making it

possible to replace one or more sections in case of a burn-out.

One peculiarity of the English tubes is that the filaments must never be burned below a certain brilliancy, but rather a little above the specified brilliancy or the tubes are certain to be damaged, quite contrary to the American tubes, where it is of importance to burn the filaments as low as possible. Burning these tubes below normal brilliancy will not only damage the vacuum, but also the life of the filaments.

TUBE TRANSMITTER

The transmitting key has two extra pairs of back contacts mounted. One pair is in series with the compensating choke and the primary of the transformer. They short-circuit this choke when the key is closed, thereby allowing for the drop in voltage. The second pair of contacts is arranged so that when the key is not pressed there is a break in the grid circuit, which is closed when the key is pressed. The object of this arrangement is to sharpen the telegraphing. If the grid circuit was left closed all the time the set would continue to oscillate after the key was released due to the electrical energy stored in the smoothing condensers, but by breaking the grid circuit the oscillations are stopped instantaneously.

Above the C. W. transmitter will be seen a wavemeter used to adjust the transmitter for the different wavelengths. A small tube lights up when the set is in tune with the wavemeter.

This set on full power puts 750 watts into the antenna, the plate being cool. Only 65 milliamperes are consumed by the plate owing to the extremely high plate voltage used.

SPARK TRANSMITTER

The main spark transmitter will be seen to the right of figure 1. It is of the quenched gap (500 cycle) type and is rated at 1½ kw. It differs chiefly from the American set by its use of a fixed coupling, that is the coupling can be changed by a system of taps and not by sliding of the inductance, as is usual

with the American sets. This coupling is quite critical and for best quenching a coupling of seventeen per cent. has been found best for these sets. They are very rugged, and there are no adjustments to be made after the set is once adjusted. To change the wavelength it is merely necessary to place the switch handle on the wavelength desired.

The quenched gap differs somewhat from the American gap as the discharge surfaces are exposed to the air and the discharge is in plain sight. When the gap is working properly an even stream of fire takes place all the way around and practically without any noise at all. The action of the gap depends largely upon the right per cent. of coupling. The gap is well made; heavy silver surfaces being used for the spark to discharge between. Chokes, condensers, etc. are mounted back of the panel. On the lower part of the panel will be found a small switch used for the 300-meter wave only. Normally this switch is kept closed, thereby short-circuiting the short-wave condenser. To the right is mounted the aerial ammeter above which is also mounted a small switch for the purpose of protecting the ammeter when not in use.

Above the main transmitter in figure 1 will be seen the emergency $\frac{1}{4}$ to $\frac{1}{2}$ kw. spark transmitter which is also of the quenched type. It is constructed for practical work like the larger set. A small motor generator driven by storage cells furnishes the power. It has a piercing note—800 cycles being the frequency used—and this high-

pitched note will often carry through interference where the lower frequency fails. On its rather small but efficient aerial, a double cage with twelve No. 18 bronze wires in each cage, the C.W. set radiates on $\frac{3}{4}$ power 10 amps., the spark set 15 amps. and the emergency 6 amps.

The same motor generator and power transformer is used for both the tube transmitter and the main spark transmitter, but when using the C.W. set, the primaries of the transformer are connected in parallel and the center point of the secondaries connected to earth. When using the spark set the primaries are connected in series and the secondaries are clear from the earth. A transfer switch performs these changes automatically.

The aerial change-over switch used for connecting either the tube or spark set to the aerial is so arranged that power cannot be supplied to the tubes unless the filaments are properly burning, thereby preventing damage to the tubes.

The send-receive switch is conveniently located on the right end of the operating table and a short side motion connects either aerial to transmitters or to receiving instruments. This switch breaks both sides of the A.C. mains and also short-circuits the receiving instruments while transmitting.

The switchboard located to the extreme right carries all the control switches for the main set and emergency power besides providing means for charging the storage batteries. Two large Edison storage batteries are used for lighting the filaments and

special English made "B" batteries, of the lead cell type, are used.

RECEIVING APPARATUS

Two receiving instruments are used. They are located next to the spark transmitter.

At the top of the instruments is a three-step power amplifier used in connection with broadcast music. Immediately below is a very efficient three-circuit tuner used mostly for copying press as it is more selective than the universal receiver mounted just below. With this receiver, although small in size, it is possible to receive over a range of from 300 meters to 24,000 meters. It is designed to receive through the transmitting inductances, under which condition the aerial side will already be tuned to the desired wavelengths, according to which side the transfer switch is placed. Inside the receiver there are a number of inductances, which can be connected into the circuit by means of a number of switch levers seen mounted on the front panel. Two variable air condensers are used for tuning the aerial and the secondary circuits. Switches are also provided by which the aerial condenser can be placed either in series or in parallel according to the wavelength, and for long waves a fixed condenser is connected across the secondary condenser. In the middle of the panel is located the coupling coil which controls the degree of coupling between the primary and secondary circuits.

Below the Marine receiver, two other instruments will be seen, the one

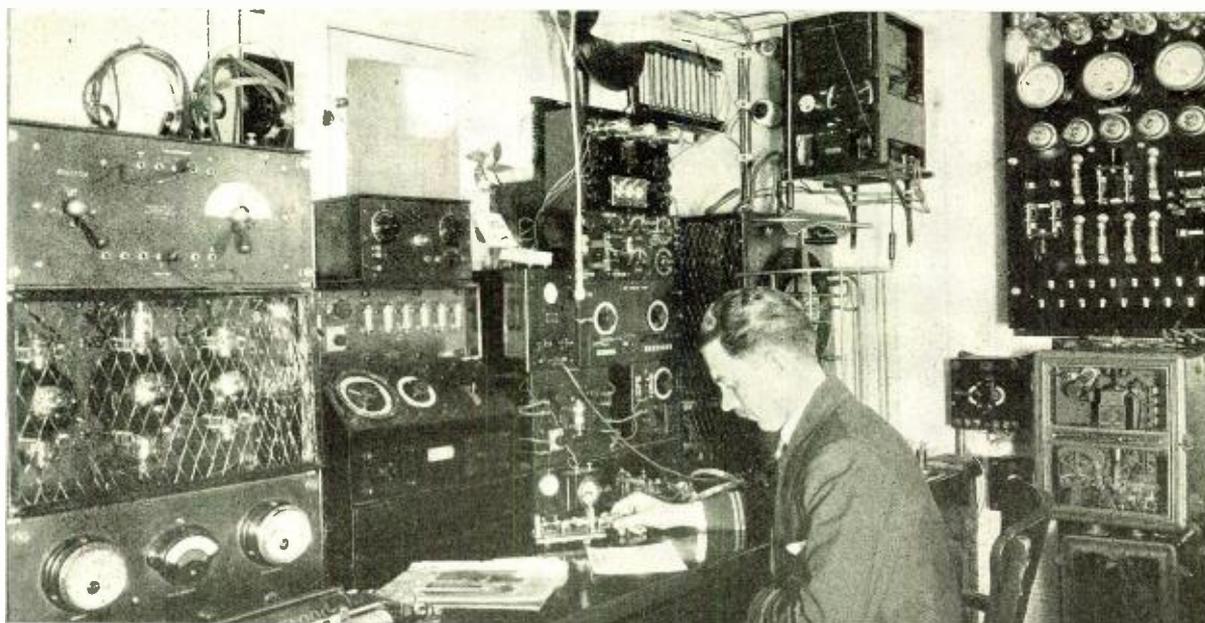


Figure 1—Left to right is the C. W. transmitter, the direction finder and gyroscopic compass, the two receiving sets and loud speaker (above) and the main spark transmitter (partly hidden by the operator's head). Above the main transmitter is the emergency spark transmitter and to the extreme right is the switchboard, and below, the motor-generator starter

to the right is the local oscillator which produces local oscillations for the purpose of receiving continuous waves by the beat method. It is arranged so that the strength of the oscillations produced in the receiving instruments can be varied at will, through an adjustable coupling. Eight different inductances are provided to cover all the wavelengths and they are connected into the circuit by means of a multi-point

High frequency amplification takes place between the filament, inner grid, and outer grid (the outer grid being connected to the "B" battery), in the same manner as the ordinary three electrode valve.

By referring to figure 3, it will be noticed that the radio frequency will flow through the condensers C2 and C3 in preference to the windings T2 and T3. Rectification takes place between

secondary windings have an equal number of turns. T2 is a closed core audio frequency transformer with an equal number of turns in both windings.

It will be noted that the potentiometer varies the potential of the anode with respect to the filament, and has nothing to do with the grids. Its sole duty is to give selective effects. The slider of the potentiometer ranges only

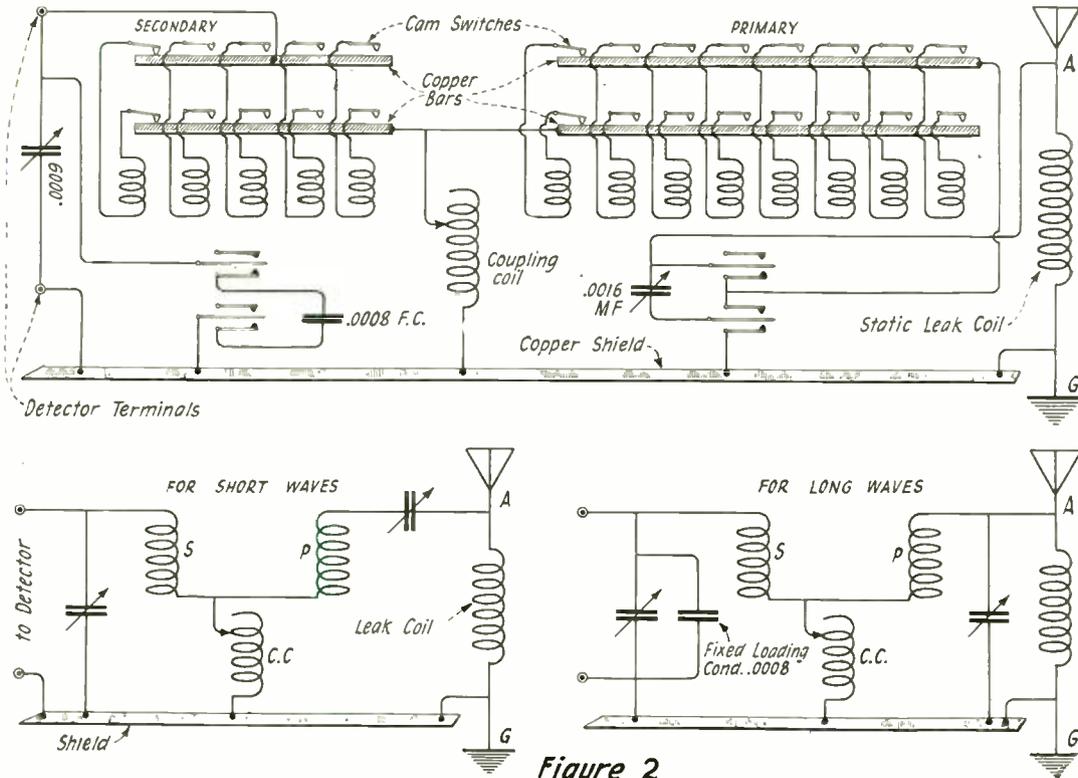


Figure 2
The universal receiver

switch of the anti-capacity type. Louder signals are the result, when using a local oscillator as the receiving instruments are thus tuned to exact resonance with the incoming signal and the selectivity is improved. It can also be used to advantage when receiving weak spark signals though the musical note is spoiled. The oscillating tube (V-24) is mounted on the front panel. Just below the tube is the graduated knob for varying the coupling. To the left end is the amplifier designed to be used with the Marine receiver, but it works very good on any other set. This amplifier differs from any American amplifier in that it employs a "four electrode" tube which results in economy in tubes and filament current. Three actions are carried out simultaneously by this four electrode tube, viz: high frequency amplification, rectification and low frequency amplification. This tube makes use of two grids, the usual plate and filament.

the filament and the anode. It will be observed that the transformer T1 performs the duties of the usual radio frequency transformer.

In this circuit the grids play no part in the action of rectification, and there is no high tension. The tension of the anode with respect to the filament is governed by the potentiometer and the maximum available is about three volts positive to the negative end of the filament.

The audio frequency pulsation of rectified current taking place in this circuit will act upon the filament inner grid circuit through the transformer T2 and these audible frequency pulsations will be again amplified between the filament and inner and outer grids and, now being of low frequency, will flow through the winding of T3 instead of through C3. Transformer T3 is an ordinary phone transformer used in connection with low resistance phones. Both the primary and the

over half of the total resistance, each winding being 110 ohms.

The various transformers (audio and high frequency), condensers, jacks, etc. are mounted inside the amplifier. The high frequency transformer has three windings all in series and the different windings are arranged through a switch to be included in the circuit or shorted out according to the wavelength which it is desired to receive. The audio frequency transformer is of the ordinary kind. The outer grid really performs the usual duties of the plate of a three-electrode tube and the outer sheath which looks like it might be the plate, is only used for rectification. This amplifier works very nicely and gives unusual amplification on all wavelengths, though the amplification falls off somewhat on the extreme long waves.

Above this amplifier there is placed an extra three-stage audio frequency amplifier, but it is seldom used except

when receiving very weak signals or music.

To the left of the receiving instruments is mounted the direction finder. This again differs from the usual loop type used in this country, in that it employs two stationary loops generally triangular in shape. One loop is mounted exactly fore-and-aft and the other athwartship; in other words each loop is at a right angle to the other. The receiving power of these two loops is made exactly alike by means of two adjustable chokes and they are connected through a magnetic switch to a goniometer. The purpose of this switch is to prevent damage through induction to the delicate amplifier, when the transmitter is in operation, so when the direction finder is not in use it is automatically grounded. The goniometer is connected to a four-stage radio frequency amplifier after which the signal is rectified. There is also provided one stage of audio frequency amplification which can be switched in or out at will. Next to the direction finder is placed a "repeater," which is part of the gyroscopic compass installed on the yacht. The purpose of having the repeater in the

certain switches whereby the direction finder is ready for use. Having picked out the station whose direction is required (which is done by turning of the tuning condenser), the switch to the left is placed in the middle position, thereby bringing the goniometer into action. It will then be noticed that signals rise and fall as the pointer of the goniometer is moved over the scale. The attention must now be fixed on two signals of equal strength on each side of the zero point and their readings noticed. At the same time the reading of the repeater must be read. The mean of the two readings on the goniometer scale will be the required direction, it is then merely necessary to add the number of degrees obtained from the repeater when the bearing was taken, to the goniometer reading, which gives the complete bearing. The loops are adjusted by means of calibrated chokes placed inside the cabinet and once they are properly adjusted there is little chance of error in the bearing obtained. Bearings as far as 200 miles have been obtained with not more than one degree error, but the instrument is only intended for ranges up to 50 miles or so, the range depend-

this installation is. It is not easy to answer that question, as it depends on so many things, such as favorable atmospheric conditions, the size and height of the aerial, etc., but its average daylight range on C.W. is well over 1600 miles, and on spark 300 miles during the day. The above mentioned distances are based on actual work accomplished during our last trip south and under unfavorable atmospheric conditions most of the time. The small emergency set is good for 125 miles daylight range any time. The good results obtained with this set, considering the rather small aerial, are largely due to the high efficiency of the aerial, porcelain insulation being used throughout. The motor-generator, being of the inductor type, there are no A.C. brushes and no moving windings. It is placed in a "silence" cabinet as is also the power transformer and transformer switch, the latter having a handle attached to it protruding through the cabinet within easy reach of the operator. The alternator is wound so as to be suitable for both spark and C.W. and as a result, the armature reaction is rather heavy. When using C.W. a small condenser is placed

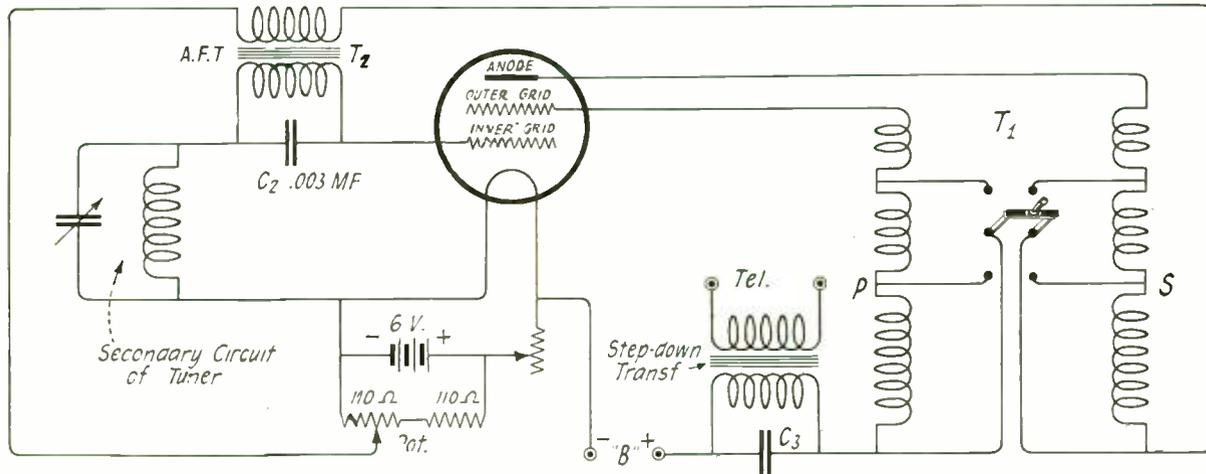


Figure 3

Four-electrode vacuum tube reflex circuit

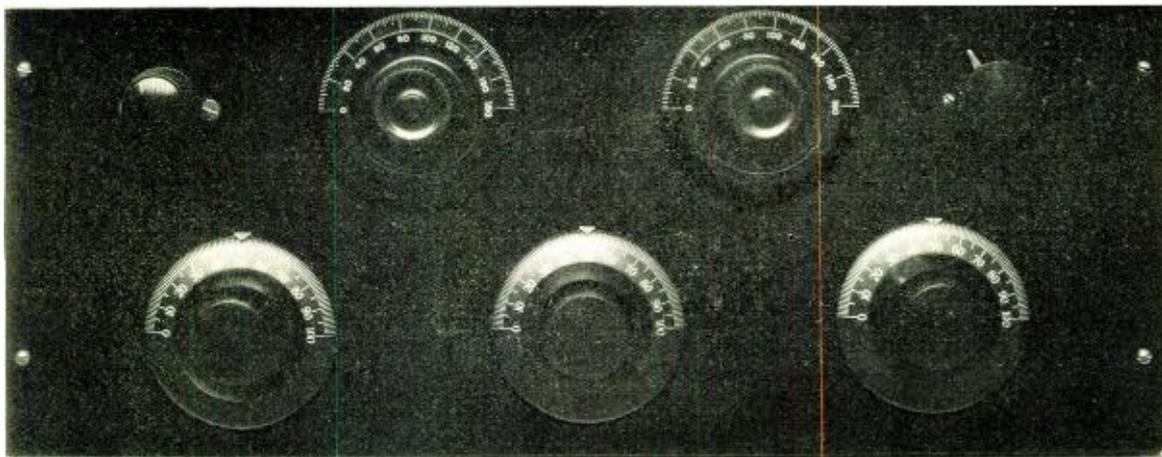
wireless room is that better bearings can be obtained and at the same time the finished bearing is delivered to the bridge. Were it not for the repeater, one of the mates would have to stand by at the compass while bearings are being taken and the bearing computed in the chartroom. As there is no magnetic error to the gyroscopic compass it is really very simple to take a bearing and the most essential thing for obtaining accurate bearings is speed, so as to obtain two or more bearings from the same station, if possible, while it is working. If it is desired to take a bearing it is only necessary to throw

ing somewhat on the strength and sharpness of the received signal. The direction finder is also very useful for receiving through heavy interference by taking advantage of its directional qualities.

GENERAL NOTES

All of the wiring is run in lead-covered cables which in turn are connected to the ground at frequent intervals. The ground connections, two being used, are obtained by screwing large copper studs into the hull of the vessel. A separate ground is employed for the direction finder. Perhaps many would like to know what the range of

across the high tension terminals to improve the power factor and so steady the volts. The power regulator, only used on C.W. is also placed in the silence cabinet with a regulating handle attached thereto and extending through the cabinet. The automatic starters and regulators are mounted on the bulkhead. When it is desired to listen to radio broadcast music, it is only necessary to throw a switch thereby connecting the yacht's music room with the receiving instruments, it being wired for that purpose, with sockets mounted out of sight, into which loudspeakers may be plugged.



Oscillation Controlled R. F. Receiver

Try your skill in tuning in stations. A set that gets long distance and is remarkable for its clear amplification

By ROBERT ALAN

DESPITE the fact that this receiver has five dials on its impressive-looking panel, it is not as formidable as it appears and is a sensitive, easily tuned receiver. It tunes quite like any tuned radio frequency set—there being three dials which should read approximately the same. The other two dials are merely balancing condensers in a trap circuit which control the tendency to oscillate. It's a corker for you DX-hunting people and it will make use of every bit of tuning ability which you possess in order to get the zenith of reception. But do not misunderstand—without any previous experience any one can tune it for ordinary reception of distant stations by following the calibrations of a previous tuning. The operation is as follows: The three lower dials are tuned to resonance with the incoming signal. The set will probably oscillate at this point. Now the secret of this efficient receiver is disclosed. The two upper dials control two small three-plate variable condensers. These two condensers are adjusted so that they overcome and render negligible the internal capacitive feedback of the tubes and as a consequence prevent the receiver from oscillating. By a further adjustment of these condensers a fine degree of regeneration may be had and just enough feedback take place to greatly amplify the signal over the ordinary transformer amplification. Thus, it will be seen that the peak of radio frequency amplification is attained in this type of set.

The dials once calibrated and set at

previously determined numbers will always bring in a given station at the same reading. We refer you to the "Information Desk" for July for full instructions on the calibration of a receiver.

CONSTRUCTION DETAILS

In assembling the parts for this oscillation-controlled radio frequency circuit first mount the aluminum frames on the panel at each end, allowing the top of the frames to come flush with the top of the panel. This will leave

approximately $\frac{5}{8}$ of an inch at the bottom of the panel which will nicely include the thickness of the baseboard. Before fastening the panel and aluminum frames to the baseboard mount all the instruments on the panel. The three National vernier variable condensers are not mounted in the usual fashion. The dial is taken apart and the thin metal framework behind the dial is fastened to the panel and then the condenser in turn fastened to this. Then the dial is centered properly and fastened to the shaft of the condenser. Draw a line on the panel five inches from the top and parallel to it. This forms a center line for the variable condensers. Along this line mark off points three and five-eighths inches, nine inches and fourteen and three-eighths inches from the left-hand edge of the panel. These will be the center holes for the shaft of each condenser. Then one and a half inches from the top of the panel draw a line parallel to the top of the panel and mark off points six and three-eighths inches from each end, also on this line mark off a point two and five-eighths inches from the right-hand end. This is the center hole for the Paragon stage switch. The use of this switch obviates the use and troubles of jack connections. It can be thrown from off position to first stage, second stage and detector with the phones plugged in the one jack.

Two and five-eighths inches from the left-hand end and along this same line drill a hole for the Fil-Ko-Stat which controls the filament current on the detector tube. This completes the drilling of the panel. The two radio

LIST OF MATERIALS

Three National Vernier .0005 mfd. variable condensers.

Five Na-ald standard sockets.

Two Paragon audio frequency transformers.

Two Duplex three-plate variable condensers.

One Fil-Ko-Stat.

Four Amperites for UV-201A's.

Nine Eby binding posts.

One Kellogg double circuit jack.

One Paragon stage control switch.

Spool of No. 20 D.S.C. wire.

Ten lengths of Essex Skwareflex.

One Set of Bremer-Tully radio frequency transformers No. 1, No. 2 and No. 3.

One Mica grid condenser and leak.

One .01 mfd. fixed condenser.

One 7" x 18" panel.

One Dubilier .001 fixed condenser.

One Baseboard 12 x 18 x $\frac{5}{8}$ inches.

One Hard rubber binding post strip 2 x 18 inches.

Two Quinby aluminum frames.

ACCESSORIES

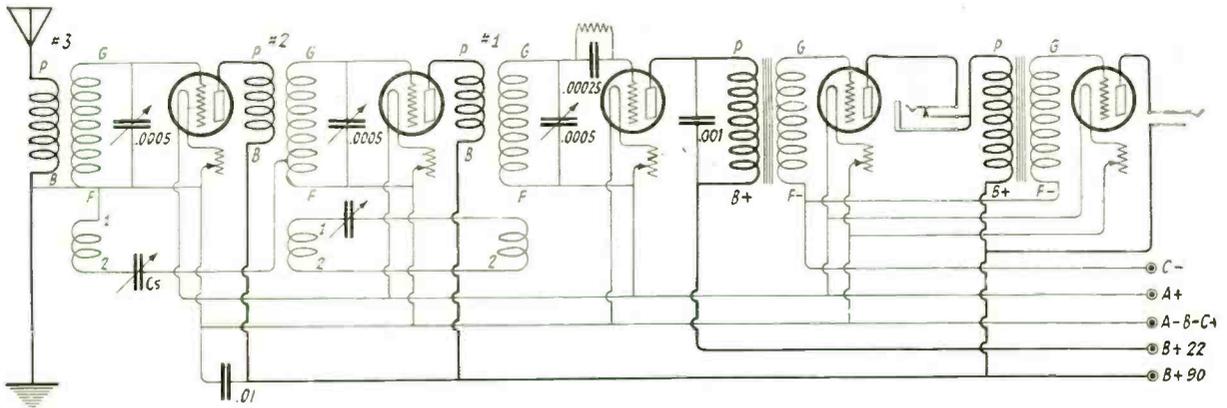
One 6-volt 100-ampere-hour storage battery.

Five UV-201A's or five C-301A's.

One set of head phones.

One loud speaker.

Ninety Volts of "B" battery.



Circuit diagram of the oscillation controlled receiver

frequency tube sockets are mounted directly behind the variable condensers on the baseboard and each socket placed between two condensers. The Bremer-Tully transformers Nos. 1, 2 and 3 are mounted between these sockets, so that the order from left to right is No. 3 transformer, a tube socket, No. 2 transformer, another tube socket and No. 1 transformer.

The detector and two stages of audio frequency amplification are placed in a straight line at the rear of the baseboard. They are placed in reverse order. That is the detector is on the right hand and nearest the output of the second stage of radio frequency, then follows an audio frequency transformer, a tube socket, another transformer and the last tube socket. Do not attempt to make all the connections with bus wire as this will present a very troublesome job and will be extremely awkward to

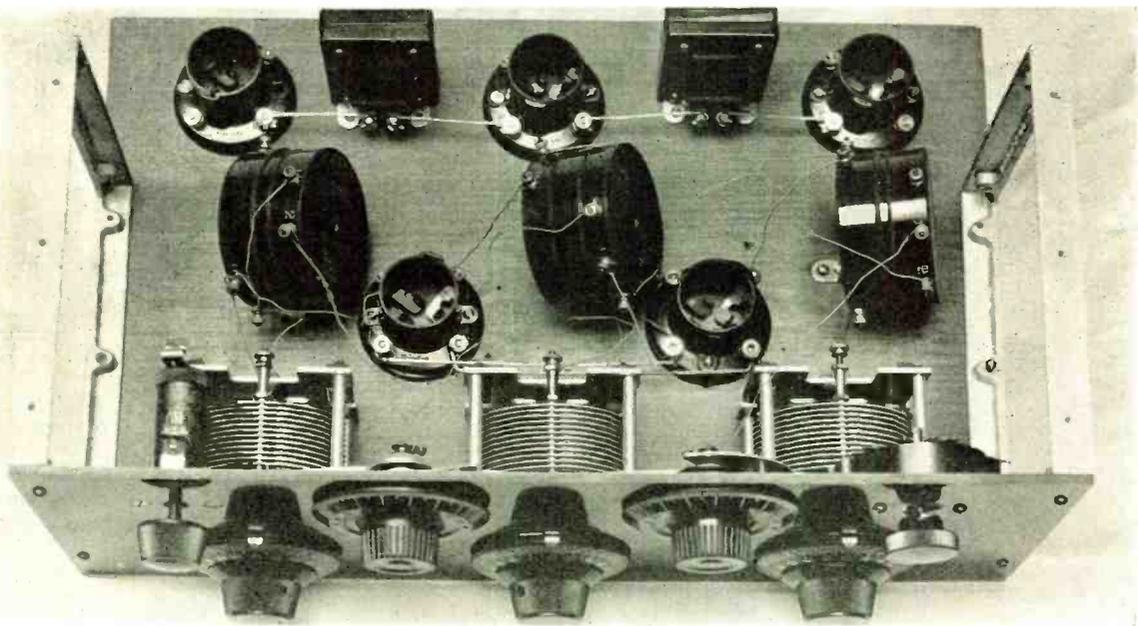
handle. The connections from the radio frequency transformers should all be made with No. 20 or No. 22 wire because it is necessary to adjust the position of the transformers when you come to actually operate the set. The connections on the A.F. amplifier, of course, can be of bus wire and likewise the filament connections on the R.F.

THE OPERATION

It is well to read these instructions thoroughly before starting work on this elaborate tuner. Remember that a radio set is a delicate piece of apparatus and that small things that may not impress you as worthy of notice may be of the most vital importance. This circuit has been developed with the object of combining into one circuit the greatest possible range, selectivity, and clearness of signals together with ease of control and simplicity. Like all other circuits of any merit it will repay

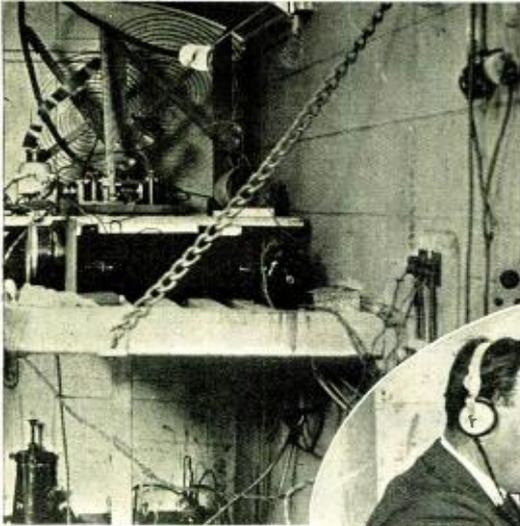
him who makes use of skill and experience and care in operation. The operator who desires to use his utmost skill in tuning will find that the balancing controls, that is the two 3-plate variable condensers afford great possibilities in the amplification of weak signals, because the radio frequency amplifier can be brought to the point of regeneration or maximum amplification of signals and past this by means of two small variable condensers. This permits a maximum amplification throughout the wavelength range. The dial settings will be consistent for all stations and a given station can be depended upon to come in on the same spot on the dial time after time. The two 3-plate condensers can be adjusted permanently for all ordinary reception, but may be used also in bringing up volume on distant stations to a remarkable extent. Be careful to follow the

(Turn to page 78)

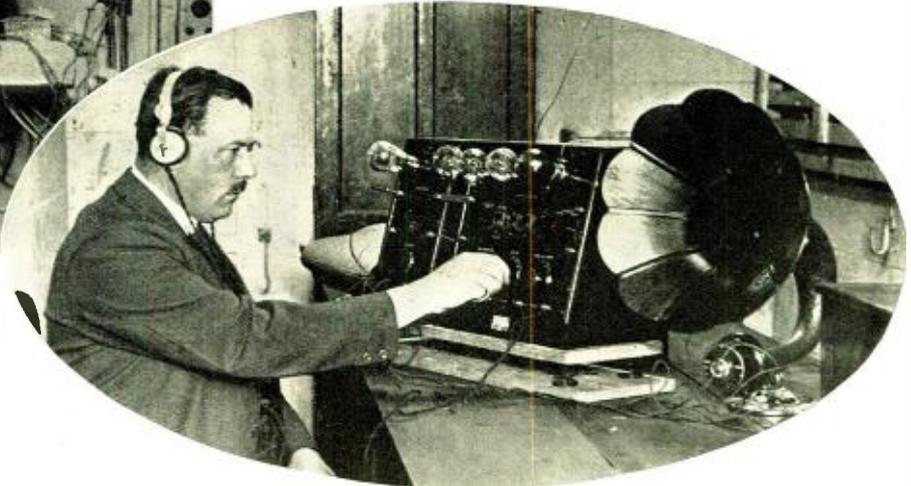


Top view showing mountings on front panel and baseboard

World Wide News



The transmitting and receiving end of the railway radio broadcasting station 6ZZ, on train running between Scotland and England



New South American Plans—Japanese Broadcast Regulations—Soviet's Radio Plans—British Beam Station—Brazilians Use Radio to Conquer Rebels—Presidential Campaign

By C. S. ANDERSON

Managing Editor of WIRELESS AGE

New South American Radio Plans

THE adoption of an entirely new and extensive program for the promotion of radio broadcasting in Latin America by American interests following the abrogation of an agreement under which the American companies had jointly participated in the South American radio business for the past three years with interests of England, France and Germany, has been announced by General J. G. Harbord, president of the Radio Corporation of America, who said the new plans gave the United States its first unrestricted opportunity to utilize fully its resources in developing radio in South America. Five of the principal countries of the continent, Argentina, Uruguay, Chile, Venezuela and Brazil will benefit by the new plan.

The program not only includes a change in the system of distributing merchandise, which enables the American company to direct its radio activities with far greater efficiency than the previously existing arrangements had permitted, but it involves in addition the introduction of a practical method for the support of broadcasting which will be first applied, as a trial, to the powerful broadcasting station

located at Buenos Aires, Argentina.

General Harbord explained that negotiations with other radio companies in South America had been in progress for several months, the outcome of which was the dissolution of the original local organization known as Radio Sud America. He pointed out that one radio company in England, France and Germany together with the Radio Corporation of America had originally formed this organization as the sole distributing agency for the sale of radio apparatus of English, French, German and American manufacture, but this arrangement did not prove sufficiently flexible to enable the participating members to conduct their individual business on a basis best suited to the technical and commercial development of the art and industry in South America.

"The cancellation of this former agreement marks the beginning of a new era in our South American radio activities," General Harbord said. "We are now in a position to carry the banner of the United States' leadership in radio below the Equator. We have been somewhat retarded in the South American field due to the restrictions imposed by the four-sided compromise which has been in force since the end of the war."

"One of the outstanding advantages of the plan which was made effective following our release from Radio Sud America, is a system giving direct contact with the South America radio market from New York thus eliminating the expense incidental to carrying on operations through intermediate distributing centers. With newly organized outlets forming a part of the distribution circuits, terminating at Buenos Aires, Montevideo, Sao Paulo, Rio de Janeiro, Valparaiso, and other leading cities, every new development in broadcasting apparatus will be made available to South Americans practically simultaneously with their introduction in the United States.

"There is every reason to believe that Latin America will continue to show an increasing interest in radio broadcasting. Particularly is this true now that a way has been devised to give her the advantage of apparatus embodying all the latest improvements contributed by engineers and scientists in the United States. Such cities as Rio de Janeiro, Buenos Aires, Montevideo, Sao Paulo and Valparaiso, and other centers of art and education scattered throughout the republics of Latin America are some of the great reservoirs which broadcasters may tap for a variety of program matter to be

broadcast to millions of homes where the light of radio has not yet entered.

"Unlike North America, distances between cities are greater and a large percentage of the population resides in the vast farming regions. Radio broadcasting must break down these barriers of space which isolate town and village from the cities. Wire facilities, too, are not within as easy reach of the people of South America as they are in this country. Radio broadcasting will do much to supplement existing means of communication such as the telephone and the telegraph."

Japanese Broadcast Regulations

UNDER the recent regulations established in Japan any person desiring to establish a broadcasting station must file an application with the Minister of Communication specifying in the application details of the installation, estimated cost of construction and furnish an estimate of anticipated receipts and disbursements. Two classes of stations are permitted according to range, the long distance range being within 160 kilometers; 360 to 385 meters wavelength and 1.5 kw. power input is reserved for this class. The short range stations operate within a distance of 30 kilometers, using 250 watts input and work on 215 to 235 meters wavelength. The license fee for the long distance station is 500 yen and the short distance class pays 300 yen.

Receiving sets are also licensed and specifications require a fee of 2 yen, examination and approval by the Electric Technical Laboratory, operation on a specified wavelength and notification to the Director of Communication upon disposal of the set.

Soviet's Radio Plans

SOVIET Russia will soon join the United States and other countries in broadcasting news, speeches and entertainment programs to the public, and the Council of Commissioners is expected shortly to issue a decree permitting the installation of receiving sets in the home at a moderate license fee.

The Government will not only allow radio users to construct their own receiving sets, but will undertake itself to manufacture amateur apparatus for Russia's millions. This will require an entirely new industry, and the Government hopes it will stimulate the development of electrical science and provide work for the State factories, which are now running at reduced capacity.

Engineers, electricians and the general public are invited to submit models of home receiving sets. These will be examined by a jury of experts and a prize will be awarded the designer of the one chosen as best adapted for Russian conditions. The Government desires that the cost of a receiving set shall not exceed \$15.

Up to the present time the Government has confined the broadcasting of official speeches and similar matter to the various provincial Soviets, branches of the Rosta News Service and Communist party organizations throughout the country, which embrace more than 300 receiving stations.

There are forty sending stations in Russia, eight of which have a radius of 2,000 miles or more each. The Government is completing a powerful receiving station at Lioubertzy, the site of the International Harvester Company's plant near Moscow, which will

be capable of picking up the principal American stations.

British Beam Station

THE British Government will cooperate with the Marconi Company in trying out the new beam system of wireless communication.

The Marconi Company will erect a beam station in Britain adapted for communication with Canada and capable of extension to provide beam communication with South Africa, India and Australia.

New Zealand and India has reported that a station of the new type would not meet their requirements, and India has issued an invitation to an Indian company to erect a high-power station in India.

Australia and South Africa are disposed to allow the beam stations to be erected for communication with Britain, to give the new system a trial.

New Wave for Amateurs

A POSSIBLE solution of the congestion of broadcasting wave lengths is anticipated by radio officials as a result of the action of the Bureau of Navigation at Washington in opening four new bands of short wave lengths to amateurs.

The Bureau of Navigation has authorized all district radio supervisors to issue general and restricted licenses to amateurs to permit the use of the bands 75 to 80 meters, 40 to 43 meters, 20 to 22 meters and 4 to 5 meters for CW purposes. At present the amateurs use the band 150 to 200 meters.

The principal object of the opening of the new bands to amateurs is for experimental purposes.



The members of the Rye Beach, N. H., Coast Guard Station utilize radio for entertainment when not engaged in the excitement of rescue at sea



The nightingale broadcasts her song from the forests of Denmark

Brazilians Use Radio to Conquer Rebels

BY radio broadcasting and propaganda of leaflets dropped from airplanes the Secretary of War of Brazil warned the remaining 300,000 civilians in Sao Paulo to "abandon the city, leaving the rebels to their fate."

The Government of Brazil has definitely decided to use heavy artillery against the rebels of Sao Paulo to a degree not attempted heretofore.

Whether it is intended to add aircraft for bombing operations at the same time is not known here.

The appeal of Marshal Setembrino de Carho, which was broadcast, gave warning that military operations against the rebels will soon assume a more stern character.

Television Possible by Radio

EDOUARD BELIN, of France, has the solution of the problem of television.

This is the instantaneous transmission of vision by one machine to another receiving apparatus which may be coupled with the transmitting machine at a distance.

Such a feat requires emission points at the rate of 300,000 a second, which is impossible over telephone or telegraph wires, but can be accomplished by radio.

Belin says some technical details remain to be worked out and construction of the machinery has to be completed, but he considers there are no great difficulties in the way of perfecting the invention.

Radio for German Trains

THIS autumn German express trains will be equipped with combination radio and wireless telephones, enabling the sending of wireless messages, telephoning and the giving of radio concerts while trains are speeding on their way. The wireless telephones will be attuned with regular telephone systems at receiving stations.

For radio messages special compartments will be built in the trains and transmission stations erected at the principal railway depots.

Fighting Forest Fires By Radio

RADIO is playing an important part in fighting the unprecedented forest fires now raging in California. The worst fires in the history of the Forestry Service are burning there all over the state. Up to the time of the last report 33,000 acres had been burned inside the national forests alone, and forty fires are still burning.

Realizing that the state was facing a grave emergency and one where a holocaust might result, Paul G. Redington, United States District Forester at San Francisco, turned to the radio broadcasting station for assistance. It resulted in an immediate personal appeal to hundreds of thousands of listeners-in.

There was an immediate response to the appeal. First the citizens were acquainted with the dangers threatened by the fires then burning, and told what they might do to help the fire wardens put the burning fires down. As a result of this it is estimated that between 20,000 and 30,000 persons at once came to the rescue.

Of course such warnings as the latter had been sent out almost as long ago as we have had forests, but never before did they get to the people as by means of the radio. Not only citizens responded, but the word was carried forward by Chambers of Commerce, Automobile Associations, Boy Scout patrols, and was so successfully achieved that from now on radio will have a definite part in the fighting of fires in forests and woods.

What this will mean may be judged from the fact that in the California situation alone something like 1,000,000 acres of timber land has been threatened to say nothing of what the fires in Montana and Idaho are putting into jeopardy.

The Forest Service has estimated that within the five years over 160,000 forest fires were reported in this country. These fires swept an area of 56,000,000 acres and destroyed timber and property valued at \$85,000,000, exclusive of indirect and intangible damage to young growth, water resources, and recreational facilities.

The Presidential Campaign

POLITICAL speeches by radio during the approaching Presidential campaign, will be short and to the point, according to all indications.

Both the broadcasting companies and the candidates appear to agree on brevity in their orations from the aerial stump.

John W. Davis, Democratic candidate, expressed his view of the matter by quoting an English churchman to the effect that "rarely is a conversion made after the first twenty minutes."

The companies, while agreeing that long speeches will surfeit and alienate their listeners and damage the interests of the candidates, differ somewhat on proposed methods of limiting the addresses.

The American Telephone and Telegraph Company, according to W. E. Harkness, assistant vice president, in charge of Station WEA-F, indicates that no arbitrary time length would be stipulated. Instead the speaker would be expected voluntarily to limit the length of his speech.

Officials of the Radio Corporation of America, however, have suggested to the speakers' bureaus of the Democratic and Republican parties the limitation of speeches to fifteen minutes and to a total of one hour a day. They also suggested that the speeches be restricted to national issues.



The modern "hurdy-gurdy" in Leipzig. A portable loud-speaker outfit furnished music on the streets at a recent public fair

Radio Receivers "Break Jail"

RADIO sets have been banished from the Eastern State Penitentiary following a discovery that convicts were utilizing them to receive dot and dash code messages detailing how narcotics would be smuggled into the prison.

The discovery was made when a visitor was called in by a convict to fix a set in one of the cells. Having a knowledge of code, the visitor, upon adjusting the apparatus, heard a message stating that a rubber ball, filled with drugs, would be tossed over the penitentiary wall on the day the message was received.

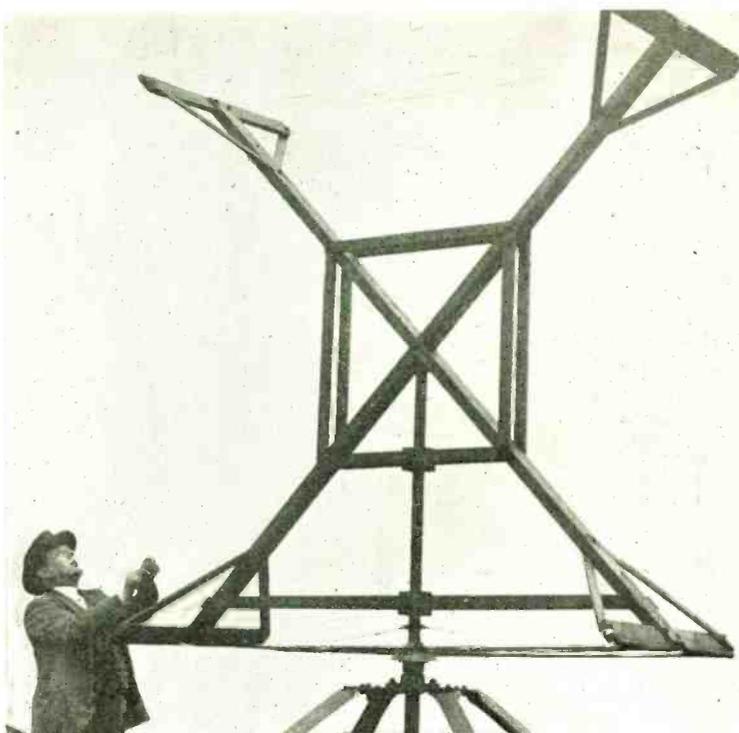
He informed the prison officials and shortly afterwards guards placed on watch saw a rubber ball pop over the wall and land on the grass plot inside the prison. When opened it was found to contain a quantity of narcotics. The order banning radio sets was immediately issued.

Radio Used in Oceanographic Survey

GOVERNMENTAL, scientific and military bureaus are now in conference in Washington laying out an extensive program for an oceanographic survey of the world's waters. Interest is centered in an effort to prevent marine disasters, and make for better transportation and communication over the seven seas.

Although neither the route nor the ship and its personnel has been decided upon, one thing is already determined: That the vessel will be equipped with the latest and most efficient radio and sound apparatus designed. The reasons for this are twofold: Primarily it will enable the scientists to keep in constant touch with stations ashore, ascertain their exact locations by radio compass, and bring them standard time signals essential to hydrographic work; and second, it will make exhaustive study of atmospheric disturbances possible, with regard to communication interference. Static will be traced to its lair, if possible, and its source located.

Through the combined efforts of Army, Naval and other governmental bureaus interested in radio, detailed plans for tests in radio reception and transmission will be undertaken whenever the vessel goes on its cruises, which may extend over a period of several years. Into whatever area the ship goes on first assignment for a thorough study of currents, depths, weather, water life and other scientific phases, radio will be utilized both practically for communication and for scientific investigation.



One of the largest frame aerials in England erected on the roof of the Bush Building, London for the use of the U. S. Shipping Board in trans-Atlantic radio communication

It is the hope of Captain Bassett, hydrographer of the navy, to establish a permanent scientific survey system of the world, and that a schedule of trips and areas to be studied may be laid out soon so that appropriations may be secured and the work undertaken within a year.

Radio Lags in Egypt

RADIO has not as yet aroused any great interest in Egypt, although a few enthusiasts are receiving broadcasts from London, Paris and Rome late at night. Private interests have been striving to organize a local broadcast system, with the approval of the government. Permission will not be granted, however, it is said, until regulations are drawn up, and these will not be attempted until after the Paris conference is held this fall.

New Zealand to Develop Broadcasting Line

IF PARLIAMENT passes the scheme formulated by the wireless interests, New Zealand will take her place in national broadcasting.

A company is being formed to control broadcasting throughout New Zealand by establishing four 5,000-watt stations—two in each island (north and south). The company will comprise the wireless trade, listeners-in, and the Government. A deputation of the promoters received a sympathetic hearing from the Government.

Canadian Railroad Acquires CN From Morocco

THE Canadian National Railways have come into possession of the radio call letters of the Moroccan Government, through the courtesy of the French Colonial office and the Moroccan Government.

The call letters are now adopted by the radio stations owned or used by the Canadian National Railways.

The radio call letters of Morocco were CN. To these the Canadian National Railways will add the letter "R" and the first letter of the name of the city from which the broadcasting is being carried on.

The call letters for each city will be Montreal, CNRM; Toronto, CNRT; Winnipeg, CNRW; Regina, CNRR; Saskatoon, CNRS; Calgary, CNRC; Edmonton, CNRE, and the station to be erected in Vancouver will be CNRV.

Radio Fair to Be Held in Berlin

A LARGE radio exhibition is planned in Berlin in connection with the International Automobile Show to be held from September 26 to October 3. At first it was planned to invite foreign radio manufacturers to participate, but it is said that the slump in the domestic radio trade had been so severe that local manufacturers were not willing to assist in giving publicity to any foreign equipment.

Selected Radio Hook-Ups for the Home-Builder

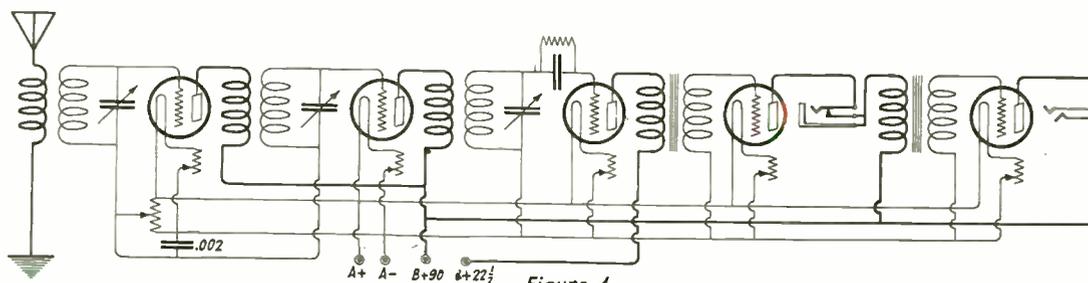


Figure 1

FOR those who are dissatisfied with the available receivers, employing neutralized tuned radio frequency amplification we show the circuit in figure 1. It comprises the same elements as in the tuned neutralized receiver, but incorporates a stabilizing potentiometer across the "A" battery. The filament return leads from the radio frequency transformers are brought to the arm of the potentiometer. The radio-frequency transformers if not already

incorporated in your set can be made up on three-inch Bakelite tubing with as thin a wall as possible. The primary and secondary should be wound on the same piece of tubing and the windings separated by three-eighths of an inch. The primary winding consists of twelve turns of No. 24 or No. 22 D. S. C. and the secondary consists of sixty turns of the same size wire. The grid should be connected to the beginning of the secondary and the plate to the end of primary.

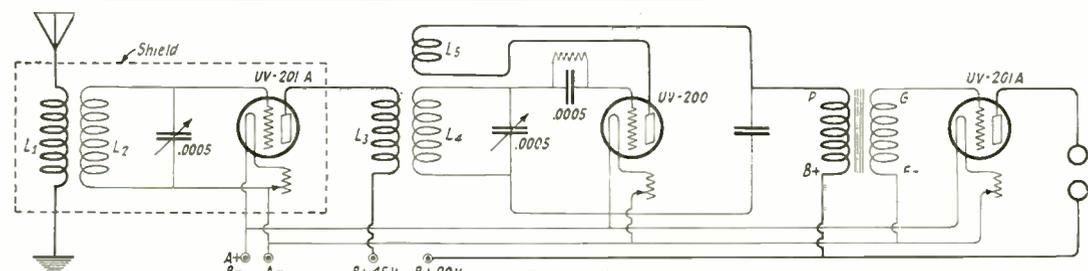


Figure 2

IN the June and May issues of "The Wireless Age," there were given articles on ultra low wave tuners employing an untuned primary circuit, a secondary tuned by a variable condenser and an adjustable tickler coil. Through experiments it was found that it was possible to add a stage of radio-frequency amplification to these tuners. This is shown in figure 2. The part shown behind the shield includes the radio-frequency stage and the remainder of the tuner is just the same as those described previously.

L1 consists of four turns of No. 14 D. C. C. wrapped around a 4-inch form and then removing the form. The turns of wire are then wrapped together with a piece of twine and placed up against the secondary coil L2 which consists of 15 turns of the same size wire wrapped on a similar size form. L3 consists of 6 turns of No. 14 D. C. C. wound on a 3-inch form and placed close to L4 which consists of 18 turns. L5 is a coil 3 inches in diameter wound with 18 turns of No. 18 D. C. C., placed so that it can be rotated.

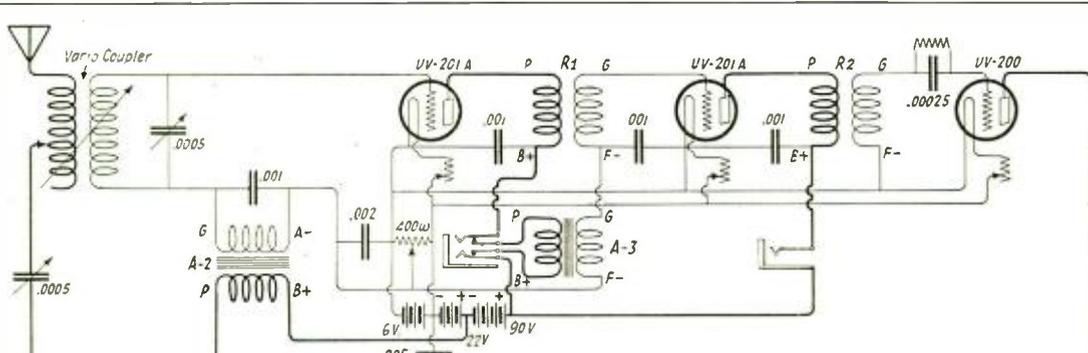


Figure 3

A VERY popular reflex is shown in figure 3. It employs three tubes, two of which are both audio and radio frequency amplifier. R1 and R2 are Acme radio-frequency

transformers. A2 and A3 are Acme audio-frequency transformers. An ordinary 180-degree vario-coupler is used to tune the antenna circuit and grid circuit of the first tube.

AFLOAT AND ASHORE WITH THE OPERATOR



ADD to your list of distinguished radio operators the names of Elmer H. Walter and Charles E. Sullivan, Jr. Put them well to the top for few have ever distinguished themselves more and certainly none have displayed greater heroism.

When the *Boston* was rammed by the tank steamer *Swift Arrow* in a dense fog off Point Judith twenty minutes before the midnight hour, Elmer Walter was on watch. Within a few minutes Sullivan was with him.



Elmer H. Walter, heroic chief operator of the *Boston*

The Captain and officers went below to direct the movements of the passengers into life boats. The three decks above were deserted as was the topmost deck save for the occupants of the radio cabin.

Walter sent out the distress call and the subsequent messages with such clearness and exactness that it brought forth greatly favorable comment from those who heard his signals. He remained cool and collected throughout the ordeal.

When the lights went out, leaving the ship in total darkness except for the lanterns where the boats were being filled far below them, the top deck was no pleasant place to be.

It was necessary for Sullivan to grope his way down to the Captain to convey information and obtain his further orders. His trips necessarily consumed much time and upon his return from each brought discouraging news.

By *W. S. Fitzpatrick*

The passengers and most of the crew were now off—the remaining lifeboats were ready to push away—the hole in the side was big and the dead could be seen pinned in the wreckage.

Then Sullivan was off to the Captain again leaving Walter in the dismal, dark cabin. The windows and open door showed nothing but black fog.

The ship sank to her guard rail—not slowly but very marked. Walter's six years' sea experience told him that such settling of the ship is the usual forerunner of a sudden dive to the bottom. A lurch of the vessel to the port side seemed to tell him the plunge was about to come—still Elmer Walter stuck and continued to work! And there was Sullivan back to help!

Now came more difficult work. There were a thousand people out in the open sea in small boats who must be saved.

But how? The darkness was intense and their small lights could not penetrate the fog. There was grave danger of being run down by the rescuing steamers.

It was up to Walter and he proved equal to the occasion. With quick wit he assigned each steamer a distinctive signal to be made with the ship's siren. Then with Sullivan out on deck listening for the whistles and Walter directing the movements by radio, the *Priscilla* was able to pick up the passengers, a coast guard cutter to come alongside to take off the dead and the *Commonwealth* with naval vessels to make lines fast and tow the *Boston* into Newport.

To Elmer H. Walter and Charles E. Sullivan the passengers owe their lives and the steamship company the safety of their ship.

One would imagine that after such harrowing experiences radio men would not care to take further chances. Still they all "ship over" sometimes without even a day in port.

Mr. Walter, who is a prominent member of the Melrose, Mass., lodge of Elks, is running on the ship which took the *Boston's* place, while Mr. Sullivan, who is a college man and whose father is a professor in a large Southern university, is radio man on a small fishing trawler which makes ten-day

trips to the fishing banks of the North Atlantic.

* * *

LAST month we printed a letter from Mr. R. J. Dean, of Alameda, Cal., in which he requested that we devote some space to old-time operators who have left the game.

The letter prompted others to make similar requests and feeling that all the old-timers would be glad to learn what has become of their former co-workers of the days of crystal detectors and noisy straight gaps, we would like to hear from those who strayed away.

In addition to letting us know where you are and what you are doing, give us an account of some incidents that happened in your time.

* * *

FRANK ROSENQUIST, operator on the yacht *Hussar*, may be addressed in care of the Independent Wireless Telegraph Company, New York City. Donald J. Pieri has just left the position of commercial engineer, Radio Corporation of America, export division, to take up new duties in Chicago, that of manager of the radio department of the Brunswick-Balke-Collender Company. Richard G.



The *Boston's* junior operator, Charles E. Sullivan, Jr.

Cuthbert was in the government service during the war, afterward United States Radio Inspector at Norfolk, Va., later in business in the Bronx, and is now operator on the Shipping Board steamer *Haiti*. W. D. Sunderland was last heard of while in the employ of the Alaska Packers Association with L. W. Sturdevant and S. Gaskey.

Distributed Capacity of Radio

Receiver Coils

By Ralph R. Batcher

Member Institute of Radio Engineers

MANY have wondered how a coil can act as a condenser since it has no plates, and the ends are short circuited by the wire itself. When a coil is connected in any active alternating current circuit, a relatively high voltage is found across its terminals. Since the inductance of the coil offers a high impedance to radio frequency energy, the very small capacity existing between the ends may represent a considerable current loss.

In general, coils may be readily compared as to which may have the greatest distributed capacity, by examining the following details:

1. Distance between end turns (total length).
2. Length of each turn (circumference).
3. Insulation used on the wire.

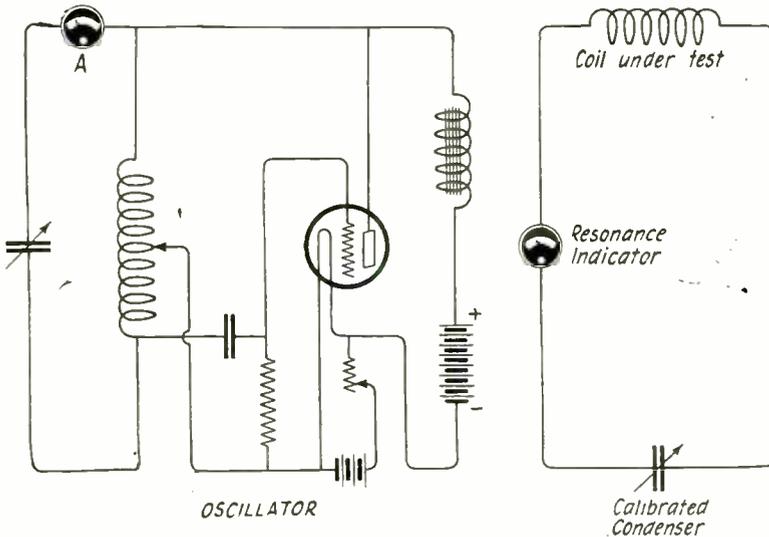


Figure 1—The method of calibrating the distributed capacity of coils

4. Size of wire used.
5. Type of tube on which coils are wound.

To keep the distributed capacity low the coils should be long and of small circumference. The insulation should have a low value for its dielectric constant—that is, cotton is better than silk, and silk is better than enamel. Generally speaking the use of small wire will give a lower distributed capacity. Paper, cardboard or a wood tube if perfectly dry has a lower dielectric constant than bakelite or rubber, etc.

Several formulae have been evolved by which the capacity of a coil can be estimated, notably one by P. Drude (data has been published by Dr. A. N. Goldsmith in Vol. 1, of THE WIRELESS AGE, 269), but they are of a form which require empirical factors

to take in the effect of the tube on which this coil is wound. Since these factors may vary, due to variations in the composition of the material, the formula will not be repeated here.

The question is often asked, "But what do I gain if I keep the distributed capacity low? I have a condenser across the coil anyway."

In some cases nothing is gained by keeping the distributed capacity low, but in the majority of cases it is a factor worth considering. Two effects are to be considered.

(a) A high distributed capacity lowers the maximum wavelength range. In some cases this may

range of a receiver, when coils with large distributed capacity are used.

Probably the single layer coil has the lowest distributed capacity although the spiderweb type of coil is an excellent substitute.

Banked windings have a much higher capacity than a single layer coil having the same inductance. A honey-comb type of coil generally has a lower capacity than a banked wound coil, but still much higher than single layer coils (except possibly in some cases where the coils are wound for very long wavelengths).

The coils should never be varnished, shellacked or coated with any kind of preparation since anything done in this line will increase the capacity.

I have found that the distributed capacity can be measured very readily by the following method in which an

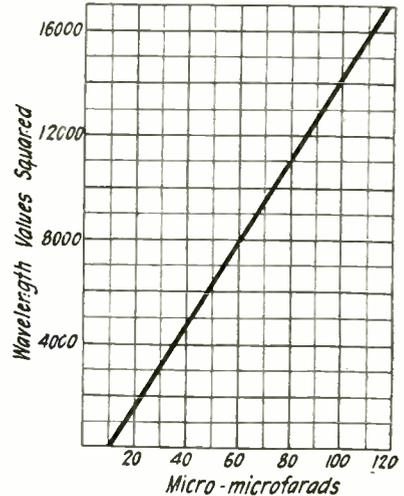


Figure 2—Graph showing distributed capacity of coils

necessitate the introduction of taps on the inductance coil in order to get sufficient wavelength range. Tapped inductances are a source of energy losses and their use is never recommended except as a last resort.

(b) The capacity which is placed across the coil in the shape of a condenser is relatively free from losses, whereas the capacity due to the coil acts the same as if a very leaky condenser is used to tune with. The effect of a good tuning condenser is largely obscured in many cases by the leaky coil capacity across it. The coil capacity may have a dielectric of wire insulation such as enamel, etc., and may be wound on a tube that absorbs considerable energy.

The result is a decrease in selectivity, signal strength and the distance

oscillator and a calibrated condenser are required. A vacuum tube oscillator is set on some wavelength having a value near the maximum wavelength receivable by the coil under test and the variable condenser. This condenser is then tuned to resonance and the capacity designated C1. The condenser is then adjusted until the first harmonic of the oscillator is received. This harmonic is in nearly all cases readily picked up from any oscillator. The capacity necessary to tune in this harmonic will be somewhat less than one-fourth of the original value used. The value of capacity so determined is designated C2.

$$Cd = \frac{C_1 - 4C_2}{3}$$

3

(Turn to page 80)

A Different Spiderweb Arrangement

More Satisfactory Operation Is Secured by a Slight Departure from Usual Practice

By Charles Magee Adams

THE cheapness and simplicity of spiderweb coils have for some time made them one of the most popular forms of inductance for use in home-made radio receivers. They can be easily wound. The results compare quite favorably with those obtained from much higher priced and more elaborate equipment, and they can be adapted to a wide range of hookups. However, in one of the best known types of these, the two-circuit, employing primary and secondary¹ coils, many

ual practice. But the primary coil A, instead of being mounted on a rotating bracket to permit a change in the coupling between it and the secondary, is also mounted on the stationary bracket and simply separated from the secondary by the cardboard washer B. The two coils are therefore placed in a fixed parallel inductive relation with each other, giving maximum coupling instead of the usual variable relation, and this can be disturbed only by removing the coils from the bracket.

The thickness of the cardboard washer B will of course have to be determined by experiment. In my own case $\frac{5}{32}$ of an inch proved to give the best results—a less amount causing the set to tune too broadly and weakening the signals unduly. But a few minutes trial will show what thickness is best, and once this has been determined the two coils can be mounted together permanently with no fear of reception being interrupted in the middle of a number by the infinite-

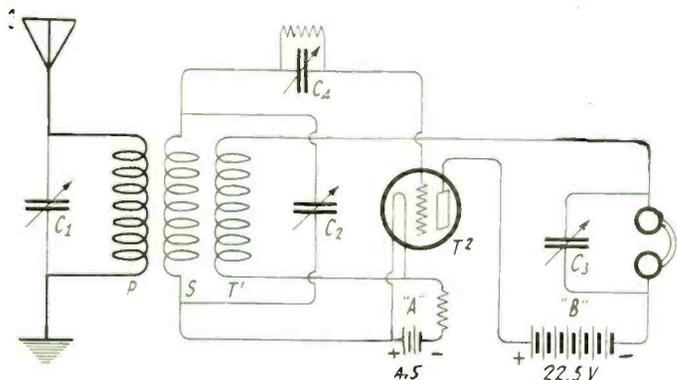


Figure 2—Two-circuit regenerative receiver

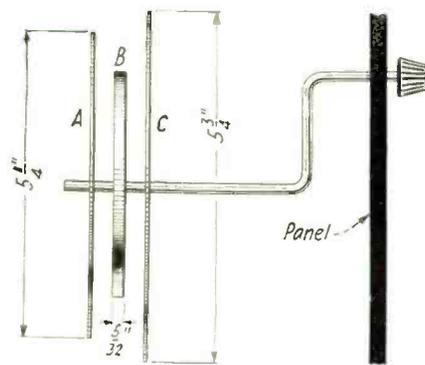


Figure 1—Method of mounting the primary and secondary coils

owners have encountered adjustment difficulties so serious that they have often threatened the usefulness of the set.

In sets of this type the primary and secondary are brought into inductive relation with each other, the degree of coupling between the two circuits being determined by the relation of the two coils. But unlike the tickler or feedback the adjustment of this coupling is so critical that it constitutes a considerable handicap rather than an advantage to satisfactory operation. In the case of my own set, built according to this design, a change of adjustment so slight as to be scarcely noticeable weakened signals to such an extent that they were unintelligible and many other set owners have reported the same difficulty. So, to overcome this and at the same time retain the advantages of the two-circuit hookup, I have devised the arrangement shown in Figure 1.

The secondary coil C, it will be noted, is mounted on the stationary supporting bracket according to us-

simil slipping of the primary which is otherwise the bane of the listener's existence.

The hookup used, as can be seen from Figure 2, is of the usual two-circuit regenerative type. The coils are wound respectively, primary 48 turns, secondary 74, and tickler 35, the size of the forms limiting the number of turns in the case of the first two. The tickler too could be reduced to 30 or even 25 turns with somewhat better results, it seems. The tube used is a UV-199.

With a light socket antenna an extreme range 2080 miles has been attained, and as is the usual characteristic of two-circuit sets the tuning has been quite sharp. WLW, ten miles away, operating on 309 meters, can be cut out completely and KDKA, 350 miles away, operating on 326 meters, brought in clearly. WSAI, also on 309 meters, 6 miles away, can be cut out and KPO brought in, 2080 miles away, operating on 423 meters.

What's in a Name?

Introducing our proposed new name

The Radio Magazine

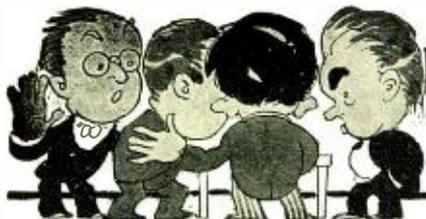
How do you like it? Here's your opportunity to tell us and perhaps win a \$10.00 gold piece.

\$20.00 in gold For Best Letters

\$10.00 in gold for the best letter, not to exceed 200 words, on why you think our new name "THE RADIO MAGAZINE" is a good one for your favorite radio magazine, or—

\$10.00 in gold for the best letter, not to exceed 200 words, on why you think we should retain our present name "Wireless Age"

Choose either side. Contest open to all of our readers. Prize winners will be announced in our November issue. The contest ends September 30. Address all letters "Title Contest," Wireless Age, 326 Broadway, New York City.

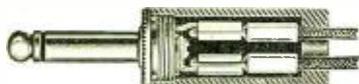


NEW APPLIANCES AND DEVICES

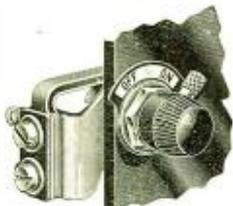


One-Phone Plug

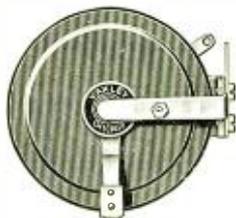
THE YANLEY MFG. CO., Chicago Ill. has developed a new one-phone plug. Heavy bronze springs grip cord tips full length. Phones are instantly connected without use of tools. Cords cannot be disconnected until handle is removed. All



bakelite insulation prevents current leakage. Undercut tip insulation prevents metal deposit and consequent leakage. Ridged brackets prevent tips becoming short circuited. Fits any jack. The short length handle makes this plug particularly desirable for compact portable sets.



The new midget battery switch made by the Yaxley Mfg. Co., is very compact. It has one nut mounting in a single panel hole. Hard rolled bronze springs. Pure silver contacts. Insulated from metal frame. Quick snap-break contact. Escutcheon plate shows "Off and On" position. A switch of this type is an actual necessity for every tube set.



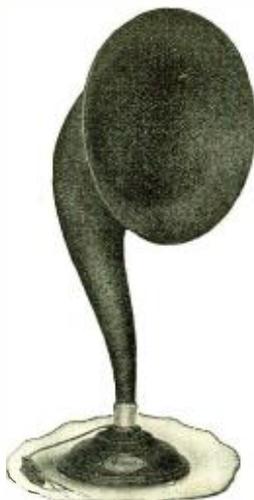
The new rheostat, made by the same company possesses several unusual and attractive features. The small coil with a large number of turns gives fine tuning without use of vernier attachments. It is smooth in operation and produces no microphonic tube noises. It has a one-nut mounting in a single panel hole. It can be turned in any position to suit wiring layout. All connections are soldered through to terminals. The terminals are tinned for ease of soldering. Made in various resistances to meet all lamp requirements. It is furnished with either knob or graduated dial.

Herald Loud Speaker

THE magnet of this instrument is of tungsten steel, hot forged in special furnaces, to insure the proper magnetic permanency that alone gives uniform qualities through a long life. The core is of special heat treated steel. The coil pole-pieces are made of a special steel, heat treated.

Expert workmanship, co-ordinate proportions determined upon after lengthy and intensive research, combine to make the Herald model "B" an instrument which will produce volume of response to the most delicate signals.

Overall height is 25 inches and the bell of the fibre horn is 12 inches. The base is an attractive casting of art metal. The Herald model "B" will operate on any receiving set, provided there is at least one stage of amplification. No adjustment is required. No extra batteries required.



N&K Imported Phonograph Unit

THE new N&K Phonograph Unit is similar in construction to the unit used in the N&K imported loud speaker. It is designed especially for use with the Victrola, but is adaptable to any standard phonograph. It attaches securely to the reproducer arm without screws or any special device.

The N&K unit produces the same mellow, distinct tone that characterizes other N&K products, and gives a very satisfactory volume without distortion. It operates efficiently on voltage from 45 to 150.

It comes packed for the trade in an attractive three-color display carton containing a dozen boxes. Each unit is packed in a handsome individual box with imitation black leather-finish imprinted in gold. This package in itself makes a very handsome counter or window display.

Charmitone Loud Singer

THIS Master-phone enables you to tune in with the super-sensitive stethoscope and to listen in with the horn with perfection on long distance or local programs.

The dial on the Master-phone gives you control over the volume of sound, loud or soft.



The Charmitone patented mechanical features make its operation simple and fool-proof. The workmanship and materials, together with a fine finish and its economical operation, makes it a desirable instrument to possess.

New Lightning Arrester

A LIGHTNING arrester is somewhat like a life-preserver in that it is only called upon to work in an emergency. No one knows, as a certainty, whether or not it will function properly until the emergency has passed. So the D. X. Instrument Co., Inc., of Harrisburg, Pa., makers of Fil-Ko-Parts for radio, realized that the usual unconditional guarantee that goes with all Fil-Ko-Parts for radio would not suffice



in the case of a lightning arrester. They have, therefore, issued for the Fil-Ko Lightning Arrester, a special guarantee which provides that should lightning strike an aerial to which a Fil-Ko Lightning Arrester is attached and damage the radio receiver, they will repair the set or pay the purchaser of the arrester \$100.00. Thus the arrester protects the set, if it works, and the guarantee protects the owner if it doesn't.

Besides this extraordinary guarantee, the Fil-Ko Lightning Arrester has many other attractive features. The body is made of polished Bakelite, the best, most moisture-proof dielectric and is shielded by a

polished aluminum "umbrella" that keeps dust, water and other conductive matter from causing leakage losses in that part of the antenna circuit.

For the first time, a compression type rheostat that can be switched off without being turned off is obtainable. It overcomes the only slight inconvenience that the



compression rheostat has, that of the number of turns required to turn it on or off—and the better the filament control device and the finer the adjustment it allows, the greater the number of turns that are necessary. The Fil-Ko-Stat, allowing as it does, infinite control of current flow, formerly had to be turned off like all other compression rheostats, but can now be left at approximately the correct adjustment, and the "A" battery be disconnected by means of the little, nickel-plated switch that attaches to the regular Fil-Ko-Stat mounting screws on the front of the panel. No extra holes need be drilled. The instrument is guaranteed by the D. X. Instrument Co., Inc.

The Pacent Balcon

THE PACENT ELECTRIC COMPANY, Inc., of New York, manufacturers of the widely used Pacent radio essentials, have recently developed and placed on the market a new balancing condenser. This new condenser, known as the Balcon, is especially designed for use with tuned radio frequency circuits or any other circuit where a capacity balance is desired.



The Balcon consists of two nickel plated electrodes, their ends being 3/16" apart and enclosed in a 1/4" glass tube. Around the outside a piece of split brass tubing 3/4" long is fitted so that it may be moved from one end of the glass tube to the other. This forms a condenser of very low capacity, the glass tube forming the dielectric. The maximum capacity is obtained when the center of the brass tube coincides with the center of the space between the electrodes. The metal parts are nickel-plated and are mounted on a small radion base.

Electrad "Verni-Tuner"

ELECTRAD Incorporated has recently placed on the market the above unit which has a multiplicity of uses.

It is guaranteed to tune up to 550 meters without an aerial in any sensitive circuit, and the many combinations possible are the following: Combined primary and secondary for radio frequency circuits; for all

reflex circuits; for the Electrad Circuit of combined reflex and tuned radio frequency; three-circuit regenerative sets, Ultra-Audion, Erla, and others.

It is completely assembled and is wired up with aerial, ground and output binding posts for panel mounting. The tube sockets are Bakelite, and the condenser has solid Bakelite ends and aluminum plates with micrometer gauged turned brass spacers. All metal parts are nicked and polished. The primary is untuned. All tuning is accomplished by the 11-plate .00035 variable condenser which is bridged across the secondary.

The manufacturers say that the Verni-tuner also adapts itself to use in a wave-trap circuit.

Radio and Family Education

(Continued from page 36)

eleven miles each way to a school house, pitifully inadequate even when they got to it, I am positively compelled to reach the conclusion that some day radio will carry to all such homes, to parent and child alike, the education which is so very difficult to get in the regions of long distances and sparse settlement.

Not long ago I visited, with much difficulty, a lighthouse on a picturesque spot far out on Long Island. Here, almost entirely cut off in winter time, lives a sturdy Swedish family. There is no such thing as school possible for these children of the lighthouse keeper during half of the school year. But with a bright eye the keeper of that polished beacon light to mariners pointed to his aerial and his crude radio set. It was slung from the top of the lighthouse downward to his house—and he used home-made wooden insulators, too! But what he lacked in high priced equipment, nature made up for him, in his location, for he got good results, and told me of the long winter nights when he and his little brood sat around the stove, with wild storms howling outside, and heard "just everything!" "I can't get my children or my husband to bed any more!" said the sun-tanned mother.

I have already described in another article in the August issue of THE WIRELESS AGE, the radio cooking school which I founded and which is conducted by the big Chicago Gas Company for the women of Chicago. This is the example which I hope will incline others everywhere to provide radio household education. The idea of a study course in cooking, given via radio, took instantly, and has made amazing progress. I predict that soon there will be such radio cooking and housekeeping schools in many large cities. There has already been talk of a Radio University, which I hope will come to pass, for it is certainly practical. The enormous and deserved suc-

cess of the correspondence schools is an indication of the popular passion for education; also the overcrowded night courses at universities, the summer schools—Columbia has over 10,000 summer students—and the night high schools.

We need to make education still more universal, because it is known that not more than ten persons out of every one hundred ever gets to high school, and even the college presidents are saying that the colleges are too crowded. It seems appalling, but it is true that there are 4,200,000 illiterate people in the United States in spite of our free educational system.

Radio is ideally fitted for the very broad educational work to be done. It is like the Postal Savings system which reaches people the savings banks can't reach, because post offices are everywhere. The radio is everywhere, too, and its work will not interfere with other educational work. There are now over 3,000,000 radio sets in use; a "circulation" greater than that of any of our greatest magazines.

I believe that group radio study classes will be formed in village and farm districts, if the proper material is broadcast, and if it is made possible to secure recognition or credit for radio educational work. Some universities have already made moves in this direction.

There are some surprising educational by-products of radio. Education, after all, is not mere book learning and fact-cramming. Radio is a means of quickening interest and widening perspective—results which have a very high educational value. Our "provincialism" has been demonstrated over and over again, but it is hard to blame our isolated population for it. Distances have been too great to traverse to develop intercourse and social life. The rural telephone is fine for business and social gossip, and the movie is excellent for those who are able to get to the village. But what of the long hours when the isolated people can't leave their homes? That is the very time when radio can help to broaden them.

Education is the obsession of the American man, woman and child, whether a lighthouse keeper or a mountaineer in Kentucky with no roads but the dry creek bed and no library within 200 miles. What, I have thought, would a Lincoln, who traveled many miles to borrow one book, have not done to get such an aid to his education as radio?

Radio can serve a real need—the need of educating the little folk at the family hearth and the extension of the educational work of our universities.

Win a Prize In the Subscription Contest

Last chance to learn how to earn cash and radio parts as prizes—you earn while you learn

THE contest closes September 15th. The winners will then receive their prizes, and also cash or parts, which they have earned with the subscriptions secured up to that time. But for those who have not entered the contest, I have a good offer that each one can profitably accept *right now*.

Just write a letter to the Boys' EDITOR. Tell me whether you want a complete set; parts to go with a set you now have; or just what you do want. I will see that you get it.

I have 35,000 names of people who have bought radio sets. Each one of the 35,000 will like to know more about THE WIRELESS AGE. Some of those people, in fact, have been taking the magazine, but forgot to renew their subscriptions. Those 35,000 people live in every part of the country. Some of them live in your own town or city.

When I have received your letter telling me what you want in radio, I will write to you and tell you how many subscriptions you must get in order to earn what you want. Even ONE subscription will get you a radio part.

I will teach you how to sell subscriptions. That is important. I will then give you a calling list, supply you with samples and send you out as a full-fledged salesman. You must be a good salesman, and well trained, before we can put the magazine in your hands as a responsible staff-representative in your district.

When I know that you have the right stuff in you, I will give you the

appointment for your section and then establish a credit account in your name. You can draw cash from that account or get what you want in radio parts at wholesale prices.



Maurice W. Brink, of Trenton, N. J., who is out to win a prize in our contest

First Prize — Paragon RB 2 \$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 who wish to earn their own radio sets.

This is not a temporary affair. The job is open to you as long as you feel that I am giving you the proper attention and a good clean-cut proposition.

Men who make their living by subscription selling have accepted my plan whole-heartedly, and have joined the staff on the basis outlined here.

One special feature deserves attention. To furnish an extra incentive, and to put a little sport into this plan, I have made a contest of the whole affair, and all who want to get in the running must do so at once. Later, I will arrange other contests, but this present one is the big event.

I am giving a Paragon RB 2 \$135.00 Receiver for first prize. This prize goes to the one who sends in the most subscriptions by September 15th.

For second prize, I am giving a Thompson Magnaphone \$35.00 Loud Speaker to the one who sends in the next largest number of subscriptions by September 15th.

And the third prize is an N&K \$8.50 Headset for the one who sends in the third largest number of subscriptions by September 15th.

The prizes will be given in *addition* to what you receive for the subscriptions. If you win a prize, your subscriptions will bring you cash or radio parts just the same. You are paid for your time even though you don't win a prize!

Burt Evans

—Boys' Editor.



On the Side Lines of the Industry

THIS MONTH

Mail Order Service—
 The Ford Class of Receivers—
 Entertaining Advertisers—
 Storage Battery Broadcasting—
 Fraudulent Practices—
 Something New in Hook-Ups—
 A New Radio Organization—
 Looking Over Some Industrial Booklets.



Left: W. J. Henry, Peerless Radio Corp.; Center: Dr. L. H. Baekeland, President American Chemical Society; Top: Powel Crosley, Jr., Crosley Radio Corporation

MAITLAND and Spencer Roach, two live young men, have built a successful mail order business in radio on the sound basis of dependability and honest value. Operating in Philadelphia, they have reached out across the country to those who live in out-of-the-way places and thus performed a service. This is worth mention because some mail order houses have exploited the disadvantages of habitants far removed from reliable merchants, and under the guise of service, have too often enjoyed the profitable practice of fleecing the public through misrepresentation. A rather dubious business method, but one that has seemed to flourish.

"WE are building and will continue to build the Ford class of radio equipment—the pocket-book class of merchandise."

With these words, Powel Crosley, Jr. president of The Crosley Radio Corporation brought to a close the second annual convention of Crosley jobbers who had gathered in Cincinnati from every section of the United States.

More than 100 representatives of the nation's leading jobbing houses were in attendance and all departed after the two-day convention, well satisfied with the results of the meeting and determined to prepare for the Crosley Sales Campaign.

A discussion of the Crosley line and a thorough presentation of merchandising problems was the main subject of the meeting. Mr. Crosley particularly stressed the means by which surplus stocks could be moved.

Progressive merchandising, backed with radio expositions and business conventions lays the foundation of a successful radio industry. The result will be reflected in public confidence.

AMONG THE FIVE HUNDRED AND TWENTY-FIVE delegates who sailed on the *S. S. Republic*, July 3rd, bound for the International Convention of the Associated Advertising Clubs of the World at Albert Hall, London, England, were one hundred members of the "Poor Richard Club," Philadelphia, one hundred and twenty-five members of the Advertising Club of New

York, one hundred members of the Advertising Club of Chicago—the balance being from San Francisco, Houston, St. Louis, Denver, as well as various representative points in the East.

For the entertainment of these delegates a Brunswick-Radiola was installed on board ship. This Brunswick-Radiola, the first to be utilized in this capacity, is the new product of the Brunswick-Balke-Collender Company and combines both phonograph and radio units in one cabinet.

A special program for the entertainment of those on board the *S. S. Republic* was broadcast each evening from seven-thirty to eight-thirty over Broadcasting Station WOO, operated by John Wanamaker, Philadelphia. By special permission of the officials of the United States Lines, the radio station on board ship was shut down during the period of broadcasting each evening to insure a clear reception of the program.

"THE Storage-Battery Station of the East" is the new designation of Broadcasting Station WDAR, Lit Brothers, Philadelphia, which recently changed its source of transmission power from motor generators to storage batteries.

The new broadcasting power equipment of Station WDAR consists of a 1,760-volt battery made up of 880 cells of a new type of Philco Diamond-Grid Battery designed especially for radio broadcasting and receiving services.

The cells are made up in pressed-glass containers mounted in supporting trays of 20-volt units. The glass containers have high and low water-level lines molded on the sides so that a glance tells whether or not cells are in need of water. One cell in each 10-cell tray unit is provided with a visible built-in charge indicator. The "A" battery used in the Lit Brothers' installation for heating the filaments of the oscillator and modulator tubes consists of 20 large cells of the Philco Diamond-Grid "PMS" type.

THE Pacent Electric Company lays great stress upon the careful inspection and testing of their apparatus before it leaves

the factory. In their new factory the testing department has been considerably enlarged and improved in every way. In one corner of the factory there is a model room. In this room may be found practically every kind of radio apparatus ever designed. It is used by Mr. Pacent and his engineers for their experimental work, and in this room are being developed many new Pacent Essentials, that will make their appearance during the coming season.

CHARGED with using fraudulent and misleading advertising, an operator of a chain of retail radio stores in New York City, was haled before the Magistrates' Court.

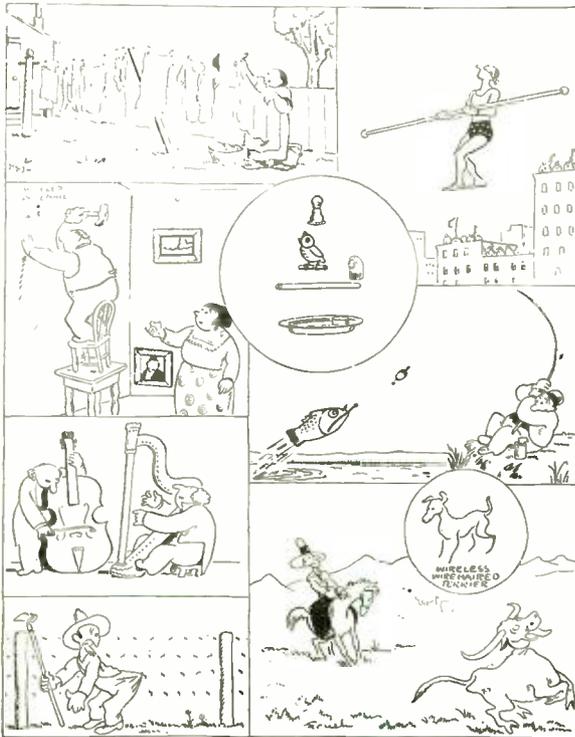
This man was accused of selling a customer a cut-rate amplifying transformer, represented to be an Acme Transformer, and which was almost an exact duplicate.

In some sections competition in the retail radio business is tremendous and many dealers supply standard brands at prices which are often less than cost. Most standard parts are sold at cut prices and at no profit. In nearly every other business, demand tends to raise prices, but in radio, demand seems to bring the price down, apparently due to the scramble for business. Just how long the condition can exist it is hard to say, but there is no doubt that the public will soon realize that it is cheaper in the end to pay a little more and get the service they surely need.

E LAINE PANDIA RALLI, daughter of Mrs. Constantina Pandia Ralli, of Willowbrook Lane, Stamford, Conn., was married at the Little Church Around the Corner, in New York City, to Thomas Smith Leoser of Morristown, N. J. The bride is a medical student and is finishing her course of training at Bellevue Hospital. The bridegroom is a graduate of Lehigh University, 1916. He spent two years in the service during the war and was Corporal in the 107th Field Artillery. He served one year in France. Mr. Leoser is the chief engineer of the Eagle Radio Company at Newark, N. J. After a two-month honeymoon, Mr. and Mrs. Leoser will make their home in New York City. (Turn to page 86)

RADIO LAUGHS

The Wireless Age



—Life.

Portable or Not Portable

THE advantages of a portable set have long been harped upon. Now the one great disadvantage of its portability is being discussed by French fans as the result of a recent incident at the radio section of the Paris Fair. Dr. Titus Konteshweller, who has been advertising his portable set, left the set under his desk one day while he walked out for a moment. When he came back the set was gone. French constructors are wondering whether such incidents may not have the effect of discouraging the purchase of sets that are so easily portable.

WEAF Gets a Heart Breaking Appeal

WEAF'S mail frequently contains odd requests but this one from Elgin, Illinois, is particularly so, as its writer has had previous experience.

Station WEAF. Please broadcast:

"I am a widower 38 years of age, height 5 ft. 7 in., weight 160 lbs., light hair, blue eyes; looking for a good wife. I am a cabinet maker by trade. If lonely write H. E. Lawrence, care Station WEAF, 195 Broadway, New York City.

The Psalm of Radio

Radio is my hobby; I shall want no other.
It maketh me to stay home at night.
It leadeth me into much trouble.
It draweth on my purse.
I go into paths of debt for its name's sake.
Yea, though I understand it perfectly, it will not oscillate.
Its concerts and speeches, they comfort me.
Yet it will not work in the presence of mine enemies.
I anoint the coils with shellac;
But the tube spilleth over.
Surely the radio bug won't follow me all the days of my life,
For if it does I will dwell in the house of poverty forever.

—J. D., *World Wide Wireless*.

The Refining Influence of Radio

By H. T. Webster



N. Y. World.

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	KFJX	Iowa State Teachers College, Cedar Falls, Iowa	280	WAAW	Omaha Grain Exchange, Omaha, Nebr.	286
KDPM	Westinghouse Elec. & Mfg. Co., Cleveland, O.	270	KFJY	Tunwall Radio Co., Fort Dodge, Iowa	246	WABB	Harrisburg Sporting Goods Co., Harrisburg, Pa.	266
KDPT	Southern Electric Co., San Diego, Calif.	244	KFKJ	Texas Nat'l Guard, 112 Cav., Fort Worth, Tex.	254	WABD	Parlier High School, Parlier, Dayton, Ohio	283
KDYL	Newhouse Hotel, Salt Lake City, Utah	360	KFKA	Colorado State Teachers' Coll., Greeley, Colo.	273	WABE	Y. M. C. A., Washington, D. C.	283
KDYM	Savoy Theater, San Diego, Calif.	280	KFKB	Brinkley-Jones Hospital Assn., Milford, Kans.	286	WABG	Arnold Edwards Piano Co., Jacksonville, Fla.	275
KDYZ	Oregon Institute of Technology, Portland, Ore.	360	KFKC	Conway Radio Laboratories, Conway, Ark.	250	WABH	Lake Shore Tire Co., Sandusky, Ohio	240
KDZB	Frank E. Siefert, Bakersfield, Calif.	240	KFKV	F. F. Gray, Butte, Mont.	283	WABI	Bancor Railway & Electric Co., Bangor, Me.	240
KDZE	Rhodes Department Store, Seattle, Wash.	270	KFKX	Westinghouse Elec. & Mfg. Co., Hastings, Neb.	341	WABL	Connecticut Agricultural College, Storrs, Conn.	283
KDZI	Electric Supply Co., Wenatchee, Wash.	360	KFLA	Nassour Bros. Radio Co., Colorado Springs, Colo.	234	WABM	F. A. Doherty Automotive Co., Saginaw, Mich.	254
KDZR	Bellingham Publishing Co., Bellingham, Wash.	261	KFLB	Abner B. Wilson, Butte, Mont.	283	WABO	Lake Avenue Baptist Church, Rochester, N. Y.	283
KFAD	McArthur Bros. Mercantile Co., Phoenix, Ariz.	360	KFLC	Signal Electric Mfg. Co., Menominee, Mich.	248	WABP	Robert P. Weidig, Dover, Ohio	266
KFAE	State College of Washington, Pullman, Wash.	330	KFLD	Paul E. Greenlaw, Franklinton, La.	234	WABQ	Haverford College Radio Club, Haverford, Pa.	261
KFAF	Western Radio Corp., Denver, Colo.	360	KFLE	National Education Service, Denver, Colo.	268	WABR	Scott High School, Toledo, Ohio	270
KFAJ	University of Colorado, Boulder, Colo.	360	KFLF	Bizzell Radio Shop, Little Rock, Ark.	261	WABT	Holiday Hall, Washington, Pa.	252
KFAR	Studio Lighting Service Co., Hollywood, Calif.	280	KFLG	Hto Grande Radio Supply House, San Benito, Tex.	236	WABU	Victor Talking Machine Co., Camden, N. J.	226
KFAW	The Itadio Den., Santa Ana, Calif.	280	KFLH	A. T. Frykman, Rockford, Ill.	229	WABV	John H. DeWitt, Nashville, Tenn.	263
KFAY	Virgin's Radio Service, Medford, Ore.	283	KFLI	George R. Clough, Galveston, Tex.	240	WABW	College of Wooster, Wooster, Ohio	234
KFBB	F. A. Buttrely & Co., Harre, Mont.	360	KFLJ	Fargo Radio Supply Co., Fargo, N. Dak.	231	WABX	Henry B. Joy, Mount Clemens, Mich.	270
KFBC	W. K. Azvill, San Diego, Calif.	278	KFLK	Atlantic Automobile Co., Atlantic, Iowa	273	WABY	John Maasall, Jr., Philadelphia, Pa.	242
KFBE	Reuben H. Horn, San Luis Obispo, Calif.	242	KFLM	Christian Churches of Little Rock, Little Rock, Ark.	254	WABZ	Coliseum Place Baptist Church, New Orleans, La.	263
KFBG	First Presbyterian Church, Tacoma, Wash.	360	KFMQ	University of Arkansas, Fayetteville, Ark.	263	WBA	Purdue University, West Lafayette, Ind.	360
KFBK	Kimball-Upson Co., Sacramento, Calif.	283	KFMR	Morningside College, Sioux City, Iowa	251	WBAH	The Dayton Co., Minneapolis, Minn.	417
KFBL	Leese Bros., Everett, Wash.	224	KFMT	George W. Young, Minneapolis, Minn.	231	WBAN	Wireless Phone Corporation, Paterson, N. J.	244
KFBS	Trinidad Gas & Electric Supply Co. and the Chronicle News, Trinidad, Colo.	360	KFMW	M. G. Sater, Houghton, Mich.	266	WBAO	James Millikin University, Decatur, Ill.	360
KFBU	The Cathedral, Laramie, Wyo.	283	KFMY	Carleton College, Northfield, Minn.	283	WBAP	Wortham-Carrier Pub. Co. (Star Telegram), Port Worth, Tex.	476
KFCB	Nielsen Radio Supply Co., Phoenix, Ariz.	238	KFNF	Henry Field Seed Co., Shenandoah, Iowa	256	WBAY	Ermer & Hopkins Co., Columbus, Ohio	423
KFCF	Frank A. Moore, Walla Walla, Wash.	360	KFNG	Wooten's Radio Shop, Coldwater, Miss.	254	WBAX	John H. Stenger, Jr., Wilkes-Barre, Pa.	360
KFCV	Fred Malhafe, Jr., Houston, Tex.	360	KFNJ	Warrensburg Electric Shop, Warrensburg, Mo.	234	WBAY	Western Electric Co., New York, N. Y.	492
KFCZ	Omaha Central High School, Omaha, Nebr.	258	KFNK	Radio Broadcast Association, Paso Robles, Calif.	240	WBBA	Newark Radio Laboratories, Newark, Ohio	240
KFCP	Ralph W. Flygare, Ogden, Utah	360	KFNY	L. A. Drake, Santa Rosa, Calif.	234	WBBD	Darby Battery Service, Reading, Pa.	234
KFDD	St. Michael's Cathedral, Boise, Idaho	252	KFNZ	Peabody Radio Service, Peabody, Kans.	240	WBEG	Irving Vermilya, Mattapoisett, Mass.	248
KFDH	University of Arizona, Tucson, Ariz.	268	KFOA	Montana Phonograph Co., Helena, Mont.	261	WBHJ	J. Irving Bell, Port Huron, Mich.	246
KFDJ	Oregon Agricultural College, Corvallis, Ore.	360	KFOB	Royal Radio Co., Burlington, Calif.	231	WBHJ	Need Electric Co., West Palm Beach, Fla.	258
KFDX	First Baptist Church, Shreveport, La.	360	KFOC	Rhodes Co., Seattle, Wash.	455	WBBL	Grace Covenant Church, Richmond, Va.	283
KFDY	South Dakota State College, Brookings, S. Dak.	360	KFOD	First Christian Church, Whittier, Calif.	236	WBMM	Frank Atlas Produce Co., Lincoln, Ill.	226
KFDZ	Harry Q. Iverson, Minneapolis, Minn.	231	KFOE	The Radio Shop, Wallace, Idaho	216	WBNN	A. B. Blake, Wilmington, N. C.	275
KFEC	Meler & Frank Co., Portland, Ore.	248	KFOF	Moberly High School Radio Club, Moberly, Mo.	216	WBPP	Potosky High School, Potosky, Mich.	246
KFEK	Augsburg Seminary, Minneapolis, Minn.	261	KFOL	Leslie M. Schafoe, Marengo, Iowa	234	WBPR	Peoples Pulpit Association, Rossville, N. Y.	273
KFEL	Winner Radio Corporation, Denver, Colo.	254	KFON	Eonophone Radio Shop, Long Beach, Calif.	234	WBRT	Lloyd Bros., Philadelphia, Pa.	234
KFEJ	J. L. Serogin, Oak, Nebr.	268	KFPB	Edwin J. Brown, Seattle, Wash.	224	WBUB	Jenks Motor Sales Co., Mommouth, Ill.	224
KFER	Auto Electric Service Co., Port Dodge, Iowa	231	KFPD	Cape & Johnson, Salt Lake City, Utah	268	WBVV	Johnstown Radio Co., Johnstown, Pa.	248
KFEV	Felix Thompson Radio Shop, Casper, Wyo.	263	KFQE	Dickenson-Henry Radio Laboratories, Coldwater, Miss.	254	WBWW	Ruffner Junior High School, Norfolk, Va.	222
KFEY	Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho	360	KFGF	Donald A. Boutwell, Minneapolis, Minn.	278	WBXY	Washington Light Infantry, Charleston, S. C.	268
KFEZ	Associated Engineering Societies of St. Louis, St. Louis, Mo.	248	KFGG	Echo Park Evangelistic Assn., Los Angeles, Calif.	278	WBZZ	Noble S. Watson, Indianapolis, Ind.	227
KFFB	Jenkins Furniture Co., Boise, Idaho	240	KGG	Tacoma Daily Ledger, Tacoma, Wash.	252	WBS	D. W. May (Inc.), Newark, N. J.	360
KFFE	Eastern Oregon Radio Co., Pendleton, Ore.	360	KGG	Hallock Watson Radio Service, Portland, Ore.	360	WBT	Southern Radio Corporation, Charlotte, N. C.	360
KFFR	Nevada State Journal, Sparks, Nev.	226	KGU	General Electric Co., Oakland, Calif.	312	WBZ	Westinghouse Elec. & Mfg. Co., Springfield, Mass.	337
KFFV	Graceland College, Lamoni, Iowa	280	KGV	Marion A. Mulrony, Honolulu, Hawaii	360	WCAD	St. Lawrence University, Canton, N. Y.	280
KFFX	McGraw Co., Omaha, Nebr.	278	KHJ	Portland Morning Oregonian, Portland, Ore.	492	WCAE	Kaufmann & Bauer Co., Pittsburgh, Pa.	462
KFFY	Pincus & Murphy, Alexandria, La.	275	KJY	St. Martins College, Lacey, Wash.	258	WCAE	Clyde R. Randall, New Orleans, La.	268
KFGC	Louisiana State University, Baton Rouge, La.	254	KJY	Times-Mirror Co., Los Angeles, Calif.	395	WCAH	Enteklin Electric Co., Columbus, Ohio	286
KFGD	Chickasha Radio & Elec. Co., Chickasha, Okla.	248	KJY	Louis Wasmser, Seattle, Wash.	360	WCAJ	Nebraska Wesleyan University, University Place, Nebr.	360
KFGL	Snell & Irby, Arlington, Tex.	234	KKQ	C. O. Gould, Stockton, Calif.	273	WCAK	Alfred P. Daniel, Houston, Tex.	263
KFGQ	Crary Hardware Co., Boone, Iowa	226	KKJ	Northwest Radio Service Co., Seattle, Wash.	283	WCAL	St. Olaf College, Northfield, Minn.	360
KFGB	Heidbreder Radio Supply Co., Utica, Nebr.	224	KKS	Bible Inst. of Los Angeles, Los Angeles, Calif.	360	WCAN	Sanders & Stayman Co., Baltimore, Md.	360
KFGX	First Presbyterian Church, Orange, Tex.	250	KKL	Warner Bros. Radio Supplies Co., Oakland, Calif.	360	WCAP	Chessapeake & Potomac Tel. Co., Washington, D. C.	469
KFGZ	Emmanuel Missionary Coll., Herrick Spgs., Mich.	286	KLM	Tribune Publishing Co., Oakland, Calif.	509	WCAR	Southern Radio Corp. of Texas, San Antonio, Tex.	360
KFHA	Western State College of Colo., Gunnison, Colo.	252	KLN	Reynolds Radio Co., Denver, Colo.	283	WCAS	William Hood Dunwoody Industrial Institute, Minneapolis, Minn.	280
KFHH	Ambrose A. McCue, Neah Bay, Wash.	261	KLJ	San Joaquin Light & Power Corp., Fresno, Calif.	248	WCAT	South Dakota State School of Mines, Rapid City, S. Dak.	240
KFHI	Fallon & Co., Santa Barbara, Calif.	360	KLZ	Love Electric Co., Tacoma, Wash.	360	WCAU	Durham & Co., Philadelphia, Pa.	286
KFHM	Star Electric & Radio Co., Seattle, Wash.	283	KLN	Walter Henrich, Kukuk Bay, Alaska	263	WCAV	J. C. Dioe Electric Co., Little Rock, Ark.	360
KFI	Earle C. Anthony (Inc.), Los Angeles, Calif.	469	KLO	Electric Lighting Supply Co., Los Angeles, Calif.	360	WCAX	University of Vermont, Burlington, Vt.	260
KFID	Ross Ar buckle's Garage, Iola, Kans.	246	KLP	New Mexico College of Agriculture & Mechanic Arts, State College, N. Mex.	360	WCAZ	Carthage College, Carthage, Ill.	246
KFIF	Benson Polytechnic Institute, Portland, Ore.	360	KLP	Detroit Police Department, Detroit, Mich.	286	WCBA	Charles W. Helmback, Allentown, Pa.	280
KFIL	Windisch Elec. Farm Equip. Co., Louisburg, Kans.	234	KLV	Haie Bros., San Francisco, Calif.	423	WCBC	University of Michigan, Ann Arbor, Mich.	280
KFIO	North Central High School, Spokane, Wash.	252	KLV	Apple City Radio Club, Hood River, Ore.	360	WCBD	Wilbur G. Voltra, Zion, Ill.	345
KFIQ	Yakima Valley Radio Broadcasting Association, Yakima, Wash.	242	KLV	Doubleday-Hill Electric Co., Pittsburgh, Pa.	270	WCBE	Halit Radio Co., New Orleans, La.	263
KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska	226	KLV	Charles D. Herrold, San Jose, Calif.	360	WCBG	Howard S. Williams, Pascagoula, Miss.	288
KFIV	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.	240	KLV	Berkeley Daily Gazette, Berkeley, Calif.	275	WCBH	University of Mississippi, Oxford, Miss.	242
KFIZ	Daily Commonwealth and Oscar A. Huelsgan, Fond-du-Lac, Wis.	273	KLV	Post-Dispatch, St. Louis, Mo.	546	WCBM	Charles Schwarz, Baltimore, Md.	360
KFJB	Marshall Electric Co., Mashalltown, Iowa	248	KLV	First Presbyterian Church, Seattle, Wash.	360	WCBS	Radio Shop of Newark, Newark, N. J.	233
KFJC	Seattle Post-Intelligencer, Seattle, Wash.	270	KLV	Examiner Printing Co., San Francisco, Calif.	360	WCBS	Coppotill Brothers' Music House, Chicago Heights, Ill.	360
KFJD	National Radio Mfg. Co., Oklahoma City, Okla.	252	KLV	Coast Radio Co., El Monte, Calif.	256	WCK	Stix-Baer & Fuller Dry Goods Co., St. Louis, Mo.	360
KFJE	Liberty Theater, Astoria, Ore.	252	KLV	Portable Wireless Telephone Co., Stockton, Calif.	360	WCD	Detroit Free Press, Detroit, Mich.	517
KFJK	Delano Radio & Electric Co., Bristol, Okla.	233	KLV	Los Angeles Examiner, Los Angeles, Calif.	360	WDAE	Tampa Daily Times, Tampa, Fla.	360
KFJL	Hardsacs Manufacturing Co., Ottumwa, Iowa	242	KLV	The Electric Shop, Honolulu, Hawaii	270	WDAF	Kansas City Star, Kansas City, Mo.	411
KFJM	University of North Dakota, Grand Forks, N. D.	280	KLV	Preston D. Allen, Oakland, Calif.	360	WDAG	J. Laurance Marlin, Amarillo, Tex.	268
KFJQ	Electric Construction Co., Grand Forks, N. Dak.	280	KLV	Valdemar Jensen, New Orleans, La.	268	WDAH	Trinity Methodist Church (South), El Paso, Tex.	263
KFJR	Ashier C. Dixon & Son, Stevensville, Mont.	258	KLV	Tulane University, New Orleans, La.	360	WDAK	The Courant, Hartford, Conn.	261

WDAP Drake HotelChicago, Ill. 360
 WDAR Lit BrothersPhiladelphia, Pa. 395
 WDAS Samuel A. WalteWorcester, Mass. 360
 WDAU Slouem & KilburnNew Bedford, Mass. 360
 WDAY Radio Equipment Corporation.....Fargo, N. Dak. 244
 WDBC Kirk, Johnson & Co.....Lancaster, Pa. 258
 WDBL Immanuel Lutheran Church of Valparaiso, Valparaiso, Ind.
 WDBP Superior State Normal School, Superior, Wis.
 WDM Church of the Covenant.....Washington, D. C. 234
 WDEZ James L. BushTuscola, Ill. 278
 WEA Frank D. FallainFlint, Mich. 250
 WEAF American Tel. & Tel. Co.....New York, N.Y. 492
 WEAH Wichita Board of Trade.....Wichita, Kans. 280
 WEAI Cornell UniversityIthaca, N. Y. 286
 WEAJ University of South Dakota.....Vermillion, S. Dak. 283
 WEAM Borough of North Plainfield, North Plainfield, N. J. 286
 WEAN Shepard Co.Providence, R. I. 273
 WEAO Ohio State University.....Columbus, Ohio 360
 WEAP Mobile Radio Co.Mobile, Ala. 360
 WEAR Evening News Publishing Co.....Baltimore, Md. 261
 WEAU Davidson Bros. Co.Sioux City, Iowa 360
 WEAY Iris TheaterHouston, Tex. 360
 WEB Benwood Co.St. Louis, Mo. 273
 WEBB Edgewater Beach Hotel Co.....Chicago, Ill. 360
 WEV Huriburt-Still Electrical Co.....Houston, Texas 263
 WEW St. Louis University.....St. Louis, Mo. 280
 WFAA Dallas News and Dallas Journal.....Dallas, Tex. 476
 WFAB Carl F. WoeseSyracuse, N. Y. 234
 WFAM Times Publishing Co.....St. Cloud, Minn. 273
 WFAH Electric Supply Co.....Port Arthur, Tex. 236
 WFAN Hutchinson Elec. Service Co., Hutchinson, Minn. 360
 WFAV University of Nebraska.....Lincoln, Neb. 275
 WFI Strawbridge & Clothier.....Philadelphia, Pa. 395
 WGL Lancaster Etec. Sup. & Const. Co., Lancaster, Pa. 248
 WGAN Cecil E. Lloyd.....Pensacola, Fla. 360
 WGAQ W. G. Patterson.....Shreveport, La. 252
 WGAW Ernest C. Albright.....Altoona, Pa. 261
 WGAZ South Bend Tribune.....South Bend, Ind. 360
 WGI American Radio and Research Corporation, Medford Hillside, Mass. 360
 WGL Thomas F. J. Howlett.....Philadelphia, Pa. 360
 WGN Chicago Radio Laboratory.....Chicago, Ill. 448
 WGR Federal Tel. & Tel. Co.....Buffalo, N. Y. 319
 WGY General Electric Co.....Schenectady, N. Y. 380
 WHA University of Wisconsin.....Madison, Wis. 360
 WHAA State University of Iowa.....Iowa City, Iowa 484
 WHAD Marquette University.....Milwaukee, Wis. 280
 WHAG University of Cincinnati.....Cincinnati, Ohio 222
 WHAH Hafer Supply Co.....Joplin, Mo. 283
 WHAK Roberts Hardware Co.....Clarksburg, W. Va. 258
 WHAM University of Rochester (Eastman School of Music), Rochester, N. Y. 283
 WHAR Seaside HouseAtlantic City, N. J. 275
 WHAS Courier-Journal and Louisville Times, Louisville, Ky. 400
 WHAV Wilmington Elec. Spec. Co.....Wilmington, Del. 360
 WHAZ Rensselaer Polytechnic Institute.....Troy, N. Y. 380
 WHB Sweeney School Co.....Kansas City, Mo. 411
 WHK Radio Co.Cleveland, Ohio 283
 WHN George SchubelNew York, N. Y. 360
 WIAB Art A. Johnson's Garage.....Rockford, Ill. 252
 WIAC Galveston TribuneGalveston, Tex. 360
 WIAD Howard R. MillerPhiladelphia, Pa. 254
 WIAK Journal-Stockman Co.....Omaha, Neb. 278
 WIAO School of Engineering of Milwaukee, Milwaukee, Wisc. 246
 WIAQ Chronicle Publishing Co.....Marion, Ind. 226
 WIAS Home Electric Co.....Burlington, Iowa 283
 WIK K. & L. Electric Co.....McKeesport, Pa. 234
 WIL Continental Elec'l Supply Co., Washington, D. C. 360
 WIP Gimbel Bros.Philadelphia, Pa. 509
 WIJD Jackson's Radio Eng'g Laboratories, Waco, Tex. 360
 WIJG Norfolk Dairy NewsNorfolk, Neb. 283
 WIJK Clifford L. WhiteGreentown, Ind. 254
 WIJM D. M. PerhamCedar Rapids, Iowa 268
 WIJAN Peoria StarPeoria, Ill. 280
 WIJA Capner PublicationsTopeka, Kans. 360
 WIJAR The Outlet Co.....Providence, R. I. 360
 WIJAS Pittsburgh Radio Supply House.....Pittsburgh, Pa. 286
 WIJX Union Trust Co.....Cleveland, Ohio 360
 WIJD Denison University.....Granville, Ohio 229
 WIJY Radio Corporation of America, New York, N. Y. 405
 WIJZ Radio Corporation of America, New York, N. Y. 405
 WKAA H. F. Paar.....Cedar Rapids, Iowa 278
 WKAD Charles Looff (Crescent Park), E. Providence, R. I. 240
 WKAF W. S. Radio Supply Co.....Wichita Falls, Tex. 360
 WKAN United Battery Service Co.....Montgomery, Ala. 226
 WKAP Dutee W. Flint.....Cranston, R. I. 360
 WKAQ Radio Corporation of Porto Rico, San Juan, P. R. 360
 WKAR Michigan Arri. College, East Lansing, Mich. 280
 WKAW Laconia Radio Club.....Laconia, N. H. 254
 WKY WEKY Radio ShopOklahoma, Okla. 360
 WLAG Cutting & Washington Radio Corporation, Minneapolis, Minn. 417
 WLAH Samuel WoodworthSyracuse, N. Y. 234
 WLAH Naylor Electrical Co.....Tulsa, Okla. 360
 WLAP W. V. JordanLouisville, Ky. 380
 WLAQ Arthur E. Schilling.....Kalamazoo, Mich. 283
 WLAV Electric ShopPensacola, Fla. 254
 WLAW Police Dept., City of N. Y., New York, N. Y. 360
 WLAX Putnam Electric Co.....Greencastle, Ind. 231
 WLW University of Minnesota.....Minneapolis, Minn. 360

WLBL Wisconsin Dept. of Markets.....Stevens Point, Wis. 423
 WLW Crosby Manufacturing Co.....Cincinnati, Ohio 261
 WMAC Clire B. Meredith.....Cazenovia, N. Y. 261
 WMAF Round Hills Radio Corp.....Dartmouth, Mass. 360
 WMAH General Supply Co.....Lincoln, Neb. 254
 WMAK Norton Laboratories.....Lockport, N. Y. 273
 WMAJ Trenton Hardware Co.....Trenton, N. J. 256
 WMAQ Chicago Daily News.....Chicago, Ill. 448
 WMAV Alabama Polytechnic Institute.....Auburn, Ala. 250
 WMAW Kingshighway Presby. Church, St. Louis, Mo. 280
 WMC Commercial AppealMemphis, Tenn. 500
 WMU Doubleday-Hill Electric Co., Washington, D. C. 261
 WNAC Shepard StoresBoston, Mass. 278
 WNAD University of Oklahoma.....Norman, Okla. 360
 WNAL R. J. Rockwell.....Omaha, Neb. 266
 WNAP Wittenberg CollegeSpringfield, Ohio 275
 WNAR C. C. RhodesButler, Mo. 231
 WNAT Lenning Brothers Co.....Philadelphia, Pa. 360
 WNAW Henry Kunzmann.....Box 167, Fort Monroe, Va. 360
 WNAX Dakota Radio Apparatus Co., Yankton, S. Dak. 244
 WNYC Municipality of New York.....New York City 526
 WOAC Page Organ Co. (H. P. Maus).....Lima, Ohio 266
 WOAE Midland CollegeFremont, Neb. 280
 WOAF Tyler Commercial College.....Tyler, Tex. 360
 WOAG Apollo TheaterBelvidere, Ill. 273
 WOAH Palmetto Radio Corporation.....Charleston, S. C. 360
 WOAI Southern Equipment Co.....San Antonio, Tex. 385
 WOAN James D. Vaughn.....Lawrenceburg, Tenn. 360
 WOAO Lydradn Mfg. Co.....Mishawaka, Ind. 360
 WOAT Boyd M. Hamp.....Wilmington, Del. 360
 WOAV Pennsylvania Nat. Guard, 112th Inf., Erie, Pa. 242
 WOAW Woodmen of the World.....Omaha, Neb. 526
 WOAX Franklin J. Wolf.....Trenton, N. J. 242
 WOC Palmer School of Chiropractic, Davenport, Iowa 484
 WOI Iowa State College.....Ames, Iowa 360
 WOO John WanamakerPhiladelphia, Pa. 509
 WOQ Western Radio Co.....Kansas City, Mo. 360
 WOR L. Bamberger & Co.....Newark, N. J. 405
 WOS Missouri State Market'g Bu., Jefferson City, Mo. 441
 WPAB Pennsylvania State College.....State College, Pa. 283
 WPAC Donaldson Co.Okmulgee, Okla. 360
 WPAJ Doolittle Radio Corp.....New Haven, Conn. 268
 WPAK North Dakota Agricultural College, Agricultural College, N. D. 283
 WPAL Avery & Loeb Electric Co.....Columbus, Ohio 286
 WPAM Auerbach & Guettel.....Topeka, Kans. 360
 WPAU Concordia CollegeMoorehead, Minn. 286
 WPAZ John R. Koch.....Charleston, W. Va. 273
 WQAA Horace A. Beale, Jr.....Parkersburg, Pa. 360
 WQAC E. B. Gish.....Amarillo, Texas 234
 WQAE Moore Radio News Station.....Springfield, Mo. 275
 WQAF Sandusky RegisterSandusky, Ohio 240
 WQAL Coles County Tele. & Teleg. Co., Mattoon, Ill. 258
 WQAM Electrical Equipment Co.....Miami, Fla. 283
 WQAN Seranton TimesSeranton, Pa. 280
 WQAO Calvary Baptist Church.....New York, N. Y. 360
 WQAQ W. Texas Radio Co. (Abilene Daily Reporter), Abilene, Texas 360
 WQAS Prince-Walsh Co.....Lowell, Mass. 266
 WQAX Radio Equipment Co.....Peoria, Ill. 248
 WQJ Calumet Rainbow Broadcasting Co., Chicago, Ill. The Radio Club.....Laporte, Ind. 224
 WRAF Northern States Power Co., St. Croix Falls, Wis. 248
 WRAM Lombard CollegeGalesburg, Ill. 244
 WRAN Black Hawk Electrical Co.....Waterloo, Iowa 236
 WRAO St. Louis Radio Service Co.....St. Louis, Mo. 360
 WRAV Antloch College.....Yellow Springs, Ohio 242
 WRAW Avenue Radio Shop.....Reading, Pa. 238
 WRAX Flexon's Garage.....Gloucester City, N. J. 268
 WRC Radio Corporation of America, Washington, D. C. 469
 WRK Doron Bros. Electrical Co.....Hamilton, Ohio 360
 WRL Union CollegeSchenectady, N. Y. 360
 WRM University of Illinois.....Urbana, Ill. 360
 WRR City of Dallas, Police and Fire Signal Dept., Dallas, Texas 360
 WRW Tarrytown Radio Res'ch Lab., Tarrytown, N. Y. 273
 WSAB Southeast Missouri State Teachers College, Cape Girardeau, Mo. 360
 WSAC Clemson Agricultural Col., Clemson College, S. C. 360
 WSAD J. A. Foster Co.....Providence, R. I. 261
 WSAI United States Playing Card Co., Cincinnati, O. 309
 WSAJ Grove City College.....Grove City, Pa. 229
 WSAN Allentown Radio Club.....Allentown, Pa. 229
 WSAP Seventh Day Adventist Temple.....N. Y. City 263
 WSAR Doughty & Welch Elec. Co., Fall River, Mass. 254
 WSAY Port Chester Chamber of Commerce, Port Chester, N. Y. 233
 WSAZ Chase Electric Shop.....Pomeroy, Ohio 258
 WSB Atlanta JournalAtlanta, Ga. 429
 WSL J. & M. Electrical Co.....Utica, N. Y. 273
 WSY Alabama Power Co.....Birmingham, Ala. 360
 WTAC Penn Traffic Co.....Johnstown, Pa. 275
 WTAJ Louis J. GalloNew Orleans, La. 268
 WTAG Kern Music Co.....Providence, R. I. 258
 WTAJ The Radio ShopPortland, Me. 236
 WTAL Toledo Radio & Electric Co.....Toledo, Ohio 252
 WTAM Willard Storage Battery Co.....Cleveland, Ohio 390
 WTAP Cambridge Radio & Electric Co., Cambridge, Ill. 242
 WTAQ S. H. Van Gorden & Son.....Osseo, Wis. 254
 WTAR Reliance Electric Co.....Norfolk, Va. 280
 WTAS Charles E. Erbsstein.....Elgin, Ill. 286
 WTAT Edison Electric Illuminating Co., Boston, Mass. 244
 WTAU Ruegg Battery & Electric Co., Tecumseh, Neb. 242
 WTAW Agricultural and Mechanical College of Texas, College Station, Tex. 280

WTAX Williams Hardware Co.....Streator, Ill. 231
 WTAY Oak Leaves Broadcasting Station, Oak Park, Ill. 283
 WTAZ Thomas J. McGuire.....Lambertville, N. J. 283
 WTKA Kansas State Agricultural College, Manhattan, Kans. 273
 WWAB Hoernig, Swern & Co.....Trenton, N. J. 226
 WWAD Wright & Wright (Inc.).....Philadelphia, Pa. 380
 WWAE Lawrence J. Crowley.....Joliet, Ill. 227
 WWAO Michigan College of Mines.....Houghton, Mich. 244
 WWI Ford Motor Co.....Dearborn, Mich. 273
 WWJ Detroit NewsDetroit, Mich. 517
 WWL Loyola University.....New Orleans, La. 280

Canadian Stations

CKLC Wilkinson Electric Co., Ltd., Calgary, Alta. 400
 CJCD T. Eaton Co., Ltd.Toronto, Ont. 410
 CFCU Jack V. Elliot, Ltd.Hamilton, Ont. 410
 CFCF Chas. Guy Hunter.....London, Ont. 430
 CHCS The Hamilton Spectator.....Hamilton, Ont. 410
 CHYC Northern Electric Co., Ltd., Montreal, P. Q. 341
 CFCF Marconi W. T. Co. of Can., Ltd., Montreal, P. Q. 440
 CKCO Dr. G. M. Geldert.....Ottawa, Ont. 400
 CHNC Toronto Radio Research Society, Toronto, Ont. 350
 CKKH Canadian National Railways.....Ottawa, Ont. 435
 CJCM J. L. Phillippe Landry.....Mont Joli, P. Q. 312
 CHXC J. R. Booth, Jr.....Ottawa, Ont. 435
 CHCE Western Canada Radio Supply, Victoria, B. C. 400
 CKY Manitoba Telephone System.....Winnipeg, Man. 450
 CKCO Vancouver Daily Province.....Vancouver, B. C. 410
 CFCA Star Publishing & Printing Co., Toronto, Ont. 400
 CFAC The Calgary Herald.....Calgary, Alta. 430
 CKAK La Presse Publishing Co., Ltd., Montreal, P. Q. 430
 CFCH Abitibi Power & Paper Co., Ltd., Iroquois Falls, Ont. 400
 CJCF The News Record.....Kitchener, Ont. 295
 CJGJ London Free Press Printing Co., Ltd., London, Ont. 430
 CFRQ Queen's University.....Kingston, Ont. 450
 CFCQ Radio Specialties, Ltd., Vancouver, B. C. 450
 CFCJ Sparks Company.....Nanaimo, B. C. 430
 CJCA The Edmonton Journal, Ltd., Edmonton, Alta. 450
 CFCK Radio Supply Co., Ltd., Edmonton, Alta. 410
 CJCE Sprott Shaw Radio Co.....Vancouver, B. C. 400
 CFCL Centennial Methodist Church.....Victoria, B. C. 400
 CJCS The Erening Telegram.....Toronto, Ont. 430
 CFYG Victor Wentworth Odium.....Vancouver, B. C. 400
 CFXC Westminster Trust Co., New Westminster, B. C. 400
 CKCI Le "Soleil" Limitee.....Quebec, P. Q. 295
 CFQC The Electric Shop, Ltd., Saskatoon, Sask. 400
 CHBC The Albertan Publishing Co.....Calgary, Alta. 410

British Stations

2LO London 365
 5IT Birmingham 475
 5WA Cardiff 350
 5BM Bourne-mouth 388
 2ZY Manchester 375
 5NO Newcastle 400
 5SC Glasgow 420
 2BD Aberdeen 495
 6SL Sheffield (relay station) 303

French Stations

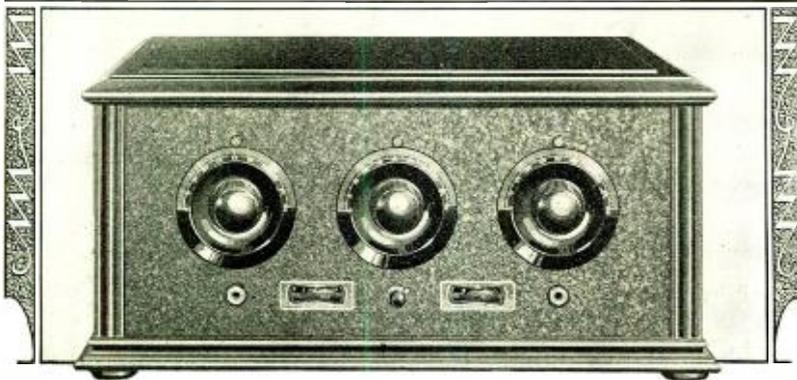
YN Lyon 740
 FL Paris (Eiffel Tower) 2,600
 ESP Paris 450
 8AJ Paris 1,780

Cuban Stations

PWX Cuban Telephone Co.....Habana 400
 2DW Pedro ZayasHabana 300
 2AB Alberto S. de Bustamante.....Habana 240
 20K Mario Garcia V&eiacute;z.....Habana 360
 2BY Frederic W. Borton.....Habana 260
 2CX Frederic W. Borton.....Habana 320
 2EV Westinghouse Elec. Co.....Habana 220
 2TW Roberto E. Ramirez.....Habana 230
 2HC Heraldo de Cuba.....Cuba 275
 2LC Luis CasasHabana 250
 2KD E. Sanchez de Fuentes.....Habana 350
 2MN Fausto SimonHabana 270
 2MG Manuel G. Salas.....Habana 280
 2IQ Raul P&eiacute;rez Falcon.....Habana 150
 2KP Alvaro D&eiacute;z.....Habana 200
 2HS Julio PowerHabana 180
 2OL Oscar ColladoHabana 290
 2WV Amadeo SaenzHabana 210
 5EV Leopoldo V. Figueroa.....Colon 360
 6KW Frank H. Jones.....Tuluncu 340
 6KJ Frank H. Jones.....Tuluncu 275
 5EV Leopoldo V. Figueroa.....Colon 360
 5DW Eduardo TerryCienfuegos 225
 6BY José GanduzoCienfuegos 300
 6AZ Valentin UlivarriCienfuegos 205
 6EV Josefa AlvarezCienfuegos 225
 7AZ Pedro NoésueCienfuegos 225
 7BY Salvador DiondaCienfuegos 350
 8AZ Alfredo BrooksSantiago de Cuba 240
 8BY Alberto BarveloSantiago de Cuba 250
 8FU Andrés VinnetSantiago de Cuba 225
 8DW Pedro C. AnduzSantiago de Cuba 275
 8EV Eduardo MateosSantiago de Cuba 180
 8GT Juan F. Chibas.....Santiago de Cuba 260

EISEMANN

ELECTRICAL EQUIPMENT



Announcing the 6-D Receiver

TYPE 6-D embodies the most modern developments in radio engineering, together with unusual design and workmanship. It meets the most exacting requirements of discriminating buyers.

The outstanding characteristics of this new Receiver are extreme selectivity, extraordinary distance range and exceptional clarity. Tuning is very simple. The 6-D is a non-oscillating Receiver, and no potentiometer or stabilizer is employed.

Step into a radio store and examine this new Receiver. Ask for a demonstration, and see for yourself its many superior qualities.

SPECIFICATIONS

Circuit: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification.

Tubes: Five in all. Jacks provided for either five or four tube operation.

Batteries: Either storage or dry-cells.

Cables: Complete set supplied for "A" and "B" batteries.

Wave lengths: 200 to 600 meters, with uniform efficiency of reception.

Aerial: 75 to 125 feet, single wire.

Panel: Aluminum, with attractive

crystal black finish. A perfect body capacity shield.

Dials: Sunken design. Shaped to fit the hand and permit a natural position in tuning.

Rheostats: Adequate resistance for all standard base commercial tubes.

Condensers: Single bearing, low leakage losses.

Sockets: Suspended on cushion springs which absorb vibrations.

Cabinet: Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

Price, Without Tubes
and Batteries, \$125.00



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Reliable Dealers

EISEMANN · MAGNETO · CORPORATION

General Offices: 165 Broadway, New York

DETROIT · SAN FRANCISCO · CHICAGO

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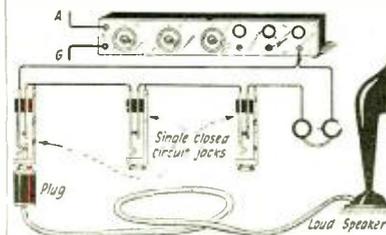
Information Desk

(Continued from page 71)

Mr. R. E. Cochran writes: "Having noticed on the market a device which enables one to use the house current in place of 'B' battery I would like to know if you can supply me with a circuit and list of parts needed to construct this which will eliminate the very pronounced hum which is present in all lighting circuits."

A device has recently been brought out by the Sabin Electrical Products Co. and was written up in the July issue of THE WIRELESS AGE which can be used either with direct current or alternating current. It is quite impossible for the layman to build such a converter as it requires certain thermo elements which are quite out of the ken of the average person. We would advise the purchase of such an instrument rather than the attempt to personally make one. Incidentally it might be stated that this device has proven satisfactory.

Mr. B. A. Farrell of Atlantic City, N. J., writes: "After reading your last issue I see that it is possible to connect several apartments with one receiving set. I would like very much to get information pertaining to this together with wiring diagrams."



We are reprinting here a circuit diagram which appeared in the June issue of THE WIRELESS AGE representing the use of one radio set to furnish entertainment to several rooms and which can be elaborated to furnish a whole apartment house.

Mr. W. J. Haas of Zion, Ill., writes: "Will you please send me detailed diagram of the panel layouts for the 'D' coil receiver which was published in the June issue of THE WIRELESS AGE."

In the October issue of this magazine there will be reprinted the circuit diagram of the "D" coil receiver together with a panel layout for drilling the holes and the placing of the instruments. The "D" coil receiver has met with such unprecedented favor among our readers that we feel obliged to run another descriptive article on what the receiver has done. Several new ideas on the tuning of the receiver and little hints which our readers have sent us will be incorporated with this article.

Walter G. Bailey, Bremerton, Washington writes of his experience with the "D" coil receiver. "I find upon calibration of my set that it tunes from 435 meters to 800 meters. I have not changed it as yet as I thought I would write you and get your opinion of it. I have tried it out upon an outside aerial 100 feet long."

It seems incredible that your wavelength range should be from 435 meters to 800 meters. If the coils were wound correctly,



Ultradyne Kit

Consists of 1 type "A" Ultraformer, 3 type "B" Ultraformers, 1 Tuning Coil, 1 Oscillator Coil, 4 matched fixed Condensers.

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

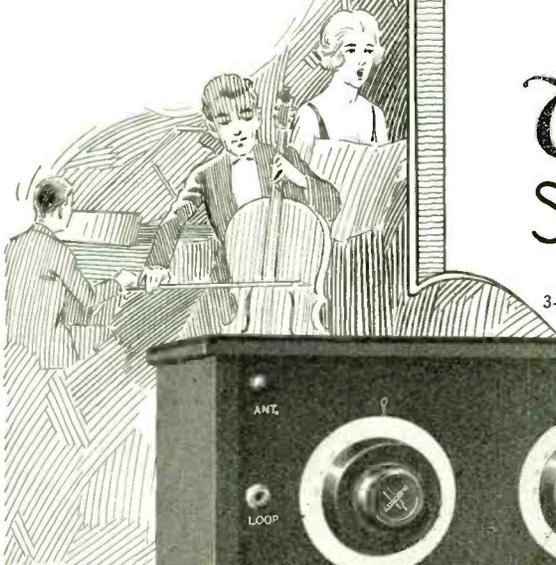
To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers. Ultraformers are guaranteed so long as this seal remains unbroken.

\$26.00



Send for the 32-page illustrated book giving latest authentic information on drilling, wiring, assembling and tuning 6 and 8 tube Ultradyne Receivers.

50c



Selectivity

WOR (405 Meters)
 8:00 P. M.—Alabama Physical and Instrumental exercises under direction of Professor Gray.
 8:30 P. M.—Continuation of program by Anna Barvik, soprano. Program—"The Rosary," "Nocturne," "Light," "Four-leaf Clover."
 8:45 P. M.—Violone solos by Lillian Dell.
 8:55 P. M.—Music "While You Dine"

WDAF—KANSAS CITY—III.
 8:30 P. M.—Musical program.
 10:00 P. M.—Dance music and comedy.
 1:45 A. M.—Nighthawk Frolic; Con. Sanderson Orchestra.

PWX—HAVANA, CUBA 400
 7:30 P. M.—Bedtime story for the children.
 Hotel Kimball studio, Springfield.
 7:40 P. M.—French Night at the Hotel Kimball studio; program to be announced by Attorney David Lavigne.
 8:50 P. M.—Concert by Laurilla Dallargone, soprano; Joseph La Prima, bass.

WEAF (192 Meters).
 4:00 P. M.—Bob Fiddikin's Clifford Lodge Orchestra.
 4:30 P. M.—Marjoria Fullerton, coloratura soprano, accompanied by Cleoever Owens. Program—"Ho! Mrs. Piper" (Curran); "The Graces" (Robert); "If No One Ever Marries Me."
 4:50 P. M.—William F. Sweeney, baritone, accompanied by Winifred T. Barr.
 8:00 P. M.—Women's program under the direction of the Women's League of the City of New York.

— A Dominating feature

An Ultradyne receiver operating in New York City easily tunes out the powerful broadcasting of WOR, Newark, N. J.—405 meters and brings in WDAF, Philadelphia—395 meters; PWX, Havana, Cuba—400 meters; WDAF, Kansas City—411 meters.

Regardless of close similarity in wavelength, the Ultradyne selects any station within range—brings in broadcasting clearly, distinctly, faithfully.

The "Modulation System" of radio reception is used exclusively in the Ultradyne. It is the latest achievement of R.E. Lacault, A.M.I.R.E., Consulting Engineer of this company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

The "Modulation System" increases the sensitiveness of the Ultradyne over that of any known receiver. Weakest signals are made to operate the loud speaker.

In addition the Ultradyne incorporates every good feature of the famous Super-Heterodyne.

Ultradyne performance is the envy of the radio industry

Write for Descriptive Circular.

ULTRADYNE

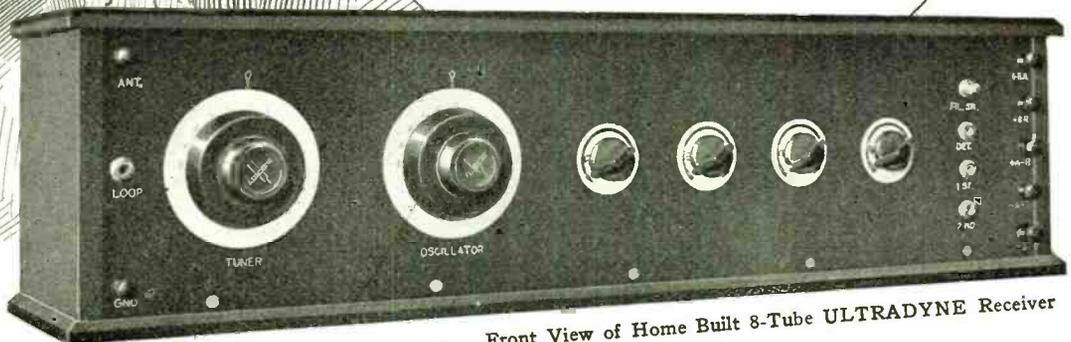
The Improved

SUPER-HETERODYNE

PHENIX RADIO CORPORATION

3-5 Beekman St.

New York



Front View of Home Built 8-Tube ULTRADYNE Receiver

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that is, 10 in the primary and 40 turns in the secondary, we cannot understand how such a wavelength range could be had. At any rate the minimum wavelength would have been nearer 200 than 400. There must have been some mistake in the matter of winding turns on. If you have three 23-plate variable condensers handy, we would recommend that you substitute them for the .001 mfd. and see if this will bring your wavelength range down. In the diagram there was no post shown for the negative of the "B" battery. This should be connected to the positive "A."

We would be interested to learn how your friend was able to calibrate this receiver from a buzzer signal on a wavemeter and yet when it is placed on an outside antenna it will not bring in signals.

Another thing—a hundred foot antenna

is not quite enough for such a circuit with an untuned primary, particularly for distant reception. About fifty feet could be added to this without endangering the selectivity.

Mr. H. F. Tyson writes that he has constructed THE WIRELESS AGE "D" coil receiver and substituted for the .001 mfd. variable condensers the 23-plate size, as he was unable to procure the former. What changes should be made in the windings of the coils?

In order to tune from 220 to 550 meters with a 23-plate condenser you should have about 50 turns in the secondary winding of each transformer or "D" coil. No change is necessary in the primary winding. Using 50 turns on the secondary the receiver will then tune to your broadcast waveband without difficulty.



Not a makeshift—but a real Loud Speaker with the famous "Manhattan Concert Modulator"

IT'S not a makeshift—it's not just a headset in a horn—but a real loud speaker that reproduces all radio programs with excellent musical quality.

The Manhattan Junior has a reproducing unit especially and correctly designed to operate the long air column of the horn. The diaphragm is large and heavy—firmly locked in place—no rubber is used. The permanent magnet is extra large—and no batteries are required for operation.

Hear the Manhattan Junior demonstrated at your nearest dealer—its musical qualities will astonish you.

*Made by the makers of the famous
Red Seal Dry Batteries*

Manhattan Electrical Supply Company

New York Chicago St. Louis San Francisco

Manhattan Junior \$10
A REAL LOUD SPEAKER WITH A "CONCERT MODULATOR"

It has a Concert Modulator

The Manhattan Junior is the only loud speaker in its price class to have that most necessary adjustment—the "Concert Modulator." By means of it, the instrument can be satisfactorily accommodated to set, tubes and the strength of "B" battery current, so that the best results can always be obtained. It also eliminates any possibility of "chattering" caused by overloading from powerful receiving sets.

Bertram Heiser of Detroit, Michigan, says that "I can get no results from my receiver until the third condenser is placed at five degrees or less. Then there is heard a constant oscillation such as is given off by a regenerative receiver. I have checked over the diagram several times but can find nothing wrong unless it be wrong connections in the astatic transformers."

The astatic transformers should be so placed in respect to each other that the cross windings through their diameter are in a straight line and parallel to the panel. Unless they are in this position the fields do not oppose each other and consequently there is intertransformer and interstage coupling, producing uncontrollable oscillation. We advise this change and if necessary the reduction of the "B" battery voltage on the radio-frequency amplifier. Be sure that the minus "B" is connected to the positive "A" for best results.

Elmer G. Jayne of Providence, R. I. writes: "Following the instructions in the June issue of THE WIRELESS AGE I constructed the McIlwain receiver. There is evidently something wrong in my connection as I have been only able to hear KDKA in Pittsburgh and WGY in Schenectady. I used Radiotron UV-201A tubes in the amplifier and UV-200 in the detector. Will a UV-201A in the detector also be of any benefit?"

The reason you do not hear more stations with this receiver is probably due to your inexperience in tuning. Your reception of Pittsburgh alone proves that the set is working properly. A UV-200 in the detector socket will probably prove more sensitive than a UV-201A, and we would recommend it if storage battery consumption means nothing to you. By using five UV-201A's the drain from your "A" battery is about ½ that of four UV-201A's and a UV-200.

Correction

A STATEMENT made in these columns in the August issue that the WD-11's and WD-12's were not designed for radio frequency amplification and therefore cannot be expected to do this well was somewhat misleading. This may have applied to the old type because of the internal capacity of the tube. The present models, with the small 4-wire press and the moulded base, have a low inter-electrode capacity and are just as satisfactory for radio-frequency amplification as for audio.

Radio Shows

THE New England Exposition Service Co. of 196 Worthington St., Springfield, Mass., are promoting two radio shows to be held this Fall, one in Hartford, Conn., and one in Springfield, Mass.

Mr. J. P. McMahon the general manager of these two shows who is co-operating with the Radio Dealers' Association in each city has announced the date of these shows as follows:

Oct. 4th to 11th—Hartford, Conn., at Foot Guard Hall.

Oct. 27th to Nov. 1st—Springfield, Mass., at the Auditorium.

When writing to advertisers please mention THE WIRELESS AGE



The ARISTOCRAT OF AMPLIFIERS

Quality in Radio is No Less Marked Than Quality in People. The Resistance Coupled Amplifier is a Quality Product.

DAVEN COMPLETE AMPLIFIER KIT

3-stage\$13.50
4-stage 17.00

KITS without sockets and condensers

3-stage \$8.50
4-stage 11.00

Read "RESISTORS, THEIR PRACTICAL APPLICATION IN RADIO RECEPTION."

By Zeh Bouck.

Price 15c

Also read, "THE HOW AND WHY OF RESISTANCE COUPLED AMPLIFICATION."

Price 10c

These booklets may be obtained from your dealer.

DAVEN RADIO CORP.
"Resistor Specialists"
11 Campbell St., Newark, N. J.



Look at that Finish!

— And the High Gloss is Everlasting

A beautiful black, high gloss finish is but one of the superior features Spaulding Bakelite-Duresto panels can offer you.

Bakelite-Duresto panels drill and engrave easily without chipping. Will not warp, shrink or split. Highest in dielectric strength. The best that money can buy. Insist on Spaulding Bakelite-Duresto. Your dealer will cut and drill it for you.

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SPAULDING FIBRE COMPANY, Inc.
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MANUFACTURERS
Manufacturers who desire to build quality into their products and who insist on speed and economy in their plants should write to nearest office for complete information on Spaulding Bakelite-Duresto.
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New York—Chicago
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Spaulding
BAKELITE-DURESTO
Panels-Sheets-Tubes & Rods

VACUUM TUBES

In Wireless Communication

By **ELMER E. BUCHER**

The best text book on the market devoted solely to the various applications of the Oscillation Valve

Price, \$1.75

THE WIRELESS PRESS, INC.

326 BROADWAY

NEW YORK

When writing to advertisers please mention THE WIRELESS AGE

The Second Shot?

(Continued from page 33)

fense, I could have got you off, perhaps."

"But I didn't fire a shot. There was no second shot," persisted the prisoner doggedly.

So matters stood at the beginning of the week before the date set for Lewis's trial. Public interest had already lost its keenest edge. His conviction was a foregone conclusion.

Then another bombshell was burst, right in the district attorney's office and under that officer's very nose. A clerk entered the district attorney's private office and said, "There's a nut out here says he's got some new evi-

dence in the Dunellin murder. Says he's got to see you."

"Oh, very well," sighed the district attorney. "Show him in."

"Nuts" were a part of his daily routine, but then, you never could tell.

A ruddy-faced middle-aged man of the traveling salesman type entered.

"Name's Sayre," he announced. "Traveling for Kelly Bros., wholesale groceries, been out on my territory ever since the morning after Dunellin was shot. Just got back. Been hearing a lot about it today for first time. Don't read the papers much. I'm a radio fan. Get most of my news by radio.

"Now, listen. Only one shot was

fired that night, and I can prove it."

"If you can, you'll save Mr. Lewis's life," the district attorney said, still unimpressed. "But how?"

"Well, first, I heard that shot myself over the radio in my own home. I'd been sitting listening to the meeting all the evening. When the meeting closed I didn't get up for a while to shut off my apparatus. I could hear the voices of the crowd goin' out, trampin' of feet and all, real plain. Then it got quiet, and pretty soon I heard two voices, couldn't hear what they said, but they was earnest. Then all of a sudden there was a loud crack in the horn like a pistol shot, just one. I thought it was something to do with the static and thought nothin' of it. But now I know it was that pistol of Dunellin's. Lewis had forgotten to turn off the radio when the meeting closed."

The district attorney was interested at last, but still skeptical.

"All very well as far as it goes," he agreed, "but you are only one witness. We have five equally competent witnesses who swear they heard two reports. If you can prove them liars, I'll have the indictment of Lewis quashed at once."

"Oh, they wasn't liars," Sayre interjected. "They heard two reports, all right. I can prove they did. But there was only one shot."

"An echo, you mean? We proved there was no echo."

"No, I don't mean an echo. Tell you what you do. You meet me in half an hour at the trolley stop where those witnesses heard the two reports. I know that spot, been getting my radio supplies at the little store there. Bring along an officer with a gun and blank cartridges."

The district attorney finally agreed, impressed at last by the man's intelligence and earnestness.

They met at the appointed place right at the curb opposite the corner of the little general store, where the Senator and his companions had stood when the shot was fired. Looking past the store door diagonally across the square they faced the theatre.

"Now, Mr. District Attorney," Sayre directed, "I'm acquainted with the theatre management and made arrangements to have your man here go into the manager's office and fire a blank in front of the open window every time you wave to him."

When the man was stationed the district attorney gave the signal. Two sharp reports came from the theatre. The district attorney looked non-plused. He tried it again, then again and again.

"I wonder if he's firing two shots each time," he demanded. "Is this a hoax?"

Do You Want Improved Reception?



12 plate\$4.50
23 plate\$5.00
35 plate\$6.50

We guarantee you'll find in the Bremer-Tully "Lifetime" Condenser, more advanced features, more vital improvements, more essential advantages than any other.

No matter what circuit you're using this condenser will improve it. This product is electrically perfect and mechanically beyond comparison. The only low-loss condenser that gives real straight line wave length. Better and simpler tuning.

Examine it at your dealer's. Write for "20-point" folder; it gives the details.

Bremer-Tully Leads Again With real low loss tuner

This is the original Bremer-Tully product, already known as the first "tuner," but improved with the new B-T method of inductance winding and the new adjustable untuned primary which gives results heretofore impossible.

Low dielectric losses, windings supported with least possible insulation.

Adjustable untuned primary successfully meets the great problem of the past—that of adapting a tuner to the various types of antennae, circuit requirements, and local receiving conditions.

Adjustments permit greater selectivity or increased signal strength as desired.

A new support providing either panel or base mounting. Single hole mounting can be used if desired.

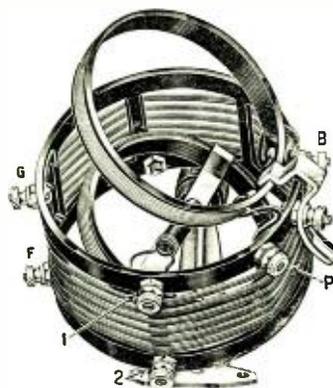
A new adjusted lubricated cone bearing. Binding Post connections—with tinned soldering lugs.

Adjustable to any circuit requiring a tuner.

Two types *Broadcasting*... 215-285 meters

For Short Wave Work... 60-220 "

Price \$5.00



"Better Tuning" (now in sixth edition) packed with each tuner or sent on receipt of ten cents. Tells you why and shows you how.

Complete instructions and diagrams for progressive construction from Crystal to Reflex and Radio Frequency circuits.

Bremer-Tully Mfg. Co., 532 Canal St., Chicago

When writing to advertisers please mention THE WIRELESS AGE



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"New York's Leading Radio House"

Easily Sold—and a good profit for you

Radiola III-A and the Crosley 52 receivers are two of the leading low priced sets now in demand. Radio dealers have found that these sets sell easily—and bring in return real profits.

Standard Receivers such as the popular Crosley 52 and Radiola III-A are nationally advertised and displayed. The manufacturers of these two receivers are spending time, effort and money to help dealers sell sets. Tie up with the worth while products and find out how easy it is to sell Radio the year around. Quick turnover always means profit.



Crosley 52



Radiola III-A

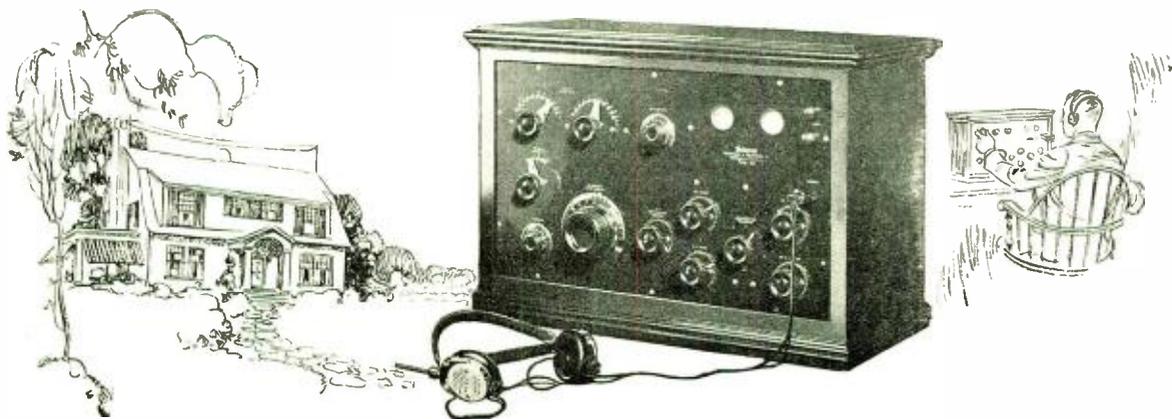
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Federal's Finest—the Wonderful "Fifty-Nine"

Users enthusiastically proclaim the Federal "Fifty-Nine" as "Federal's Finest." The "Fifty-Nine" represents the accomplishment of an ideal after over a quarter century's patient

striving. It gives all the beauty of Federal Tone, Selectivity and Distance Range, plus a simplicity of operation that opens the real thrills of radio to novice and professional alike.

FEDERAL TELEPHONE AND TELEGRAPH COMPANY

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Look for this sign



Federal

Standard RADIO Products

Priced at \$177

With headphones.

For loop reception (No. 61)

\$46 Extra

When writing to advertisers please mention THE WIRELESS AGE



Get those Stations with the DURATRAN!

You can get them on your home-made set—even if you are handicapped by an indoor loop. You can get them clear and strong. Only one thing is needed—the right radio frequency transformer—the *DURATRAN*!

Powerful! The Duratran picks up all standard broadcasting wave lengths—not just a narrow band but the entire band of 225 to 550 meters. And amplifies as much as 20 times. Yet the reception is clear, undistorted, full!

Don't discard your one-tube regenerative set because you can't get the distant stations. The Duratran, the wonderful radio-frequency transformer, will bring them in.

For real satisfaction use the Duratran \$4.00

Dubilier

CONDENSER AND RADIO CORPORATION

ZENITH Super-Portable

A six-tube radio set, completely self-contained. Does not need to be opened to operate. Write today for full particulars and name of nearest dealer.

ZENITH RADIO CORPORATION
McCormick Building, Chicago

20' MAST PREPAID \$10

Install this steel aerial mast for greater range and better results. NEAT SUBSTANTIAL CONSTRUCTION. PRICE, \$10. PREPAID IF REMITTANCE IS SENT WITH ORDER—OTHERWISE C. O. D.

S. W. HULL & CO., 2048 EAST 79th STREET
CLEVELAND, OHIO

When writing to advertisers please mention THE WIRELESS AGE

"No," Sayre assured him. "If he fired two shots you'd have heard four."

"Well, what's the explanation?"

Sayre put on the air of a lecturer.

"I read in my radio magazine a spell ago that a radio wave travels so fast it's practically instantaneous. But sound travels through the air only a little over a thousand feet a second. It's a good 1,500 feet from here to that theatre. In other words, if you stood here and listened to a sound at the theatre over the radio, you'd hear it a second quicker at least than it could reach you in the open air. Then when it reached you through the air you'd hear it again.

"See that radio horn up there?"

Sayre pointed to a horn sticking out over the door of the little general store, right in line between them and the theatre.

"They broadcast the mass meeting to an overflow here all the evening the night Dunellin was shot and the boss hadn't turned his horn off yet at the time of the shootin'. The first shot those witnesses of yours heard came to them instantly over the radio. The second one that you're tryin' to pin on Lewis was the report of the same shot comin' on through the air by freight a second or so later."

Within an hour the district attorney took steps to have the indictment of Martin Lewis quashed.

Oscillation Controlled R. F. Receiver

(Continued from page 54)

wiring diagram exactly. Even with the expert builder of sets it is difficult and often impossible to determine the exact cause of trouble after the set has been wired up. If you already have a detector and two stage audio frequency amplifier that is available, it, of course, may be used in connection with this set and it will simplify construction very much. However, if you wish the complete set behind one panel the list of materials includes these parts. Do not use any shields in making this set as there is no need of protection against body capacity effects. With these excellent condensers the need of any such shielding is obviated. Make all your connections firm and clean using great care that no soldering paste or flux spreads to any apparatus. Be sure also that your connections are not "soldered" with paste instead of solder. Keep all the grid and plate wires well separated. When the set is completely wired connect up the batteries to the binding post on the terminal strip in the rear.

ADJUSTMENT OF TRANSFORMER ANGLES

The following procedure is necessary to determine the proper angle at which the three radio frequency trans-

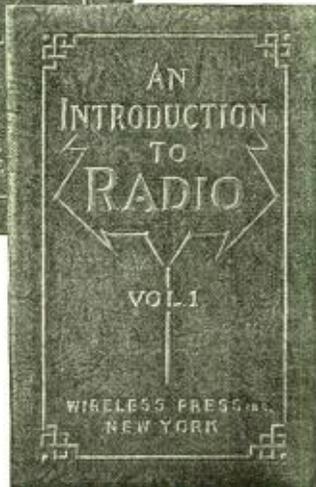
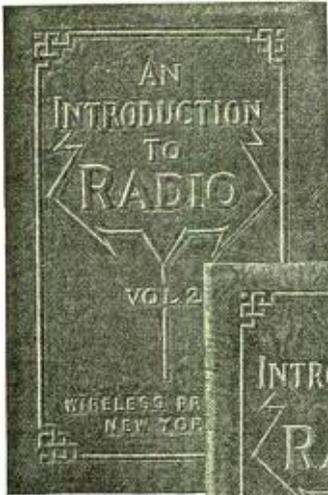
Understand Radio

An Introduction to Radio

For the Whole Family
In Two Volumes—Handy Pocket Size

FREE TO YOU

We want you to know "THE WIRELESS AGE" (America's oldest radio magazine) and our laboratory tested text books. TO GET ACQUAINTED we offer you this fine little set of books ABSOLUTELY FREE with one year's subscription to "THE WIRELESS AGE." \$2.50 A YEAR (Outside U. S., 50c extra). SAVE A DOLLAR.



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Each Book
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\$1.00

ANSWERS YOUR QUESTIONS—Every novice in radio always asks the same questions: What is a radio wave? How is it made? How long does it take to get to me from the broadcasting station? Is there any difference between the dot and dash waves and the music waves? What is a condenser for? What is a variometer? What is the difference between a variocoupler and a loose coupler? How are the ear phones made? What does the crystal detector do? How does a vacuum tube work? What is the grid leak for? Is there any danger that my antenna will be struck by lightning? How can I tune my set to get the loudest signals? What is the difference between radio frequency and audio frequency? What is a potentiometer for and how does it differ from a rheostat? And scores of other questions. All are answered in this book.

Make no mistake. This is a non-technical book. All who can read English can understand it. Funny how hard it is for an expert to talk shop so everyone can understand—there are a number of good technical books, but this is the best book we have ever seen of the hardest kind to do well.

An introduction to Radio. That is just what it is. Mr. (Miss or Mrs.) Reader, we take great pleasure in introducing Radio. After a few hours you can meet the other members of the family and talk radio with them as you can't now.

If you were sailing for France you would study an elementary text book on the French language—here is your book for your trip to radio land, the most fascinating country ever discovered by modern science. Explore it knowingly, as thousands are now doing, with a receiving set and "An Introduction to Radio."

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VOLUME 1
An Introduction to Radio
The Various Instruments Used in Radio Transmitting and Receiving Outfits

VOLUME 2
Technical Terms Explained
How to Set up Receiving Outfits
Primer of the Vacuum Tube
How to Set up Radio Transmitters
International Morse Code and Conventional Signals

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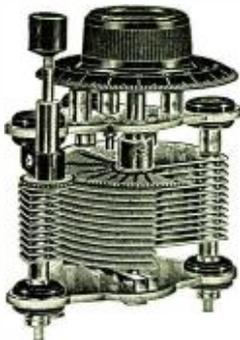
I enclose \$..... Enter my subscription to "The Wireless Age" for one year and send me free a set of "An Introduction to Radio." I also want.....extra sets for some of my friends.

Name
Street
City
State

New Subscriber I am now an AGE subscriber.

A-9-24

The NEW Heath NON-DIELECTRIC Condensers



OLD fashioned dielectric end plates (insulating material) which waste condenser efficiency just as leaky piston rings waste gasoline, completely discarded in the new HEATH CONDENSERS. Grounded end plates of aluminum entirely do away with the old difficulties of dielectric loss and warping of plates. No shielding necessary. All metal, except for the small pieces of hard rubber in the end plates which separate the rotor from the stator plates. Therefore extraordinarily rigid—*Minimum Loss.*

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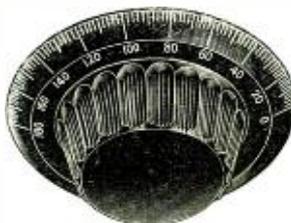
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Bakelite base into which re-enforced phosphor bronze, self cleaning contacts are securely embedded. Binding posts are slotted hexagon nuts. HEATH standards of materials and workmanship.....Price 75c



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Ordinary adjustments reduced by separate geared adjustment to hair-breadth distinction. The most highly perfected vernier so far developed.



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Specially designed easy grip-knob, beautifully proportioned, highly polished and clearly incised. Brass bushing centered by precision machinery to positive accuracy for perfect balance. Made in 2 inch, 3 inch and 4 inch diameters. A typical HEATH product.

Write Today for Literature

HEATH RADIO & ELECTRIC MFG. CO.
203 FIRST STREET, NEWARK, N. J.

formers should be set. Adjust C4 so that the dial reads 20, tune in a strong signal, preferably the readings of 15 to 20 on C2 and C3. Keep both transformers No. 1 and No. 2 approximately parallel to each other. Vary the angle carefully until no oscillation beat, which may be a whistle or click, can be heard when crossing the signal with dial C1, that is, when rotating the dial back and forth. When the angle is properly adjusted and C4 is placed at 0 no oscillation will occur in any wavelength. Transformer angles, however, should be kept as near vertical as possible. Bind the transformers down toward the horizontal just enough to stop oscillation with C4 adjusted to 0. When this adjustment is made the receiver is operating at its most sensitive and stable condition. Control C4 should be rotated toward 100 for increased signal strength which should always be adjusted below the point where distortion or a peculiar type of regeneration occurs. This adjustment of C4 may require a preliminary readjustment of tuning dial C2. When hunting for stations adjust C1, C2 and C3 to the same reading. Using both hands rotate C2 and C1 very slowly keeping their readings the same and following each adjustment with a readjustment of C3. In order to interpret the results of this receiver, it is necessary to recognize the sounds which you hear in your receivers. When a circuit is oscillating a beat or whistle will be heard which will vary from a high pitch to a very low pitch as the receiver is brought to resonance with the signal and again from low to high pitch as you pass the signal. Do not confuse this with a beat or whistle of unvarying pitch which cannot be changed in pitch by rotating C1 and C2. This is caused by external transmitters.

Distributed Capacity of Radio Receiver Coils

(Continued from page 62)

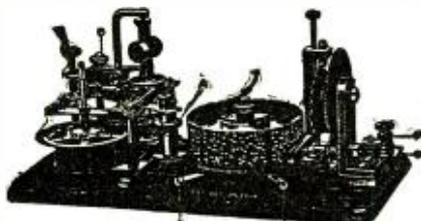
This method involves much less work and computation than the one generally recommended which requires plotting a curve between the wavelength and the resonance capacity squared, and extending the curve until it crosses the axis.

To illustrate these methods the following measurements were made on a receiving set tuning coil having 93 turns of No. 20/38 litz on a 2.25 inch tube. The method making use of the cross sectioned paper is shown in figure 2.

$-\lambda$	λ^2	Cap.
231	53360	43 MMF.
300	90000	65.5
400	160000	111. = C ₂
800	640000	474. = C ₁

Learn the Code at Home with the Omnigraph

"Just Listen—The Omnigraph will do the teaching"

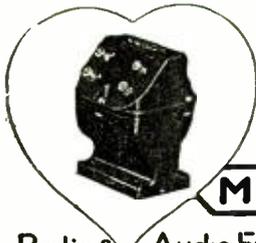


THE OMNIGRAPH Automatic Transmitter will teach you both the Wireless and Morse Codes—right in your own home—quickly, easily and inexpensively. Connected with Buzzer, Buzzer and Phone or Sounder. It will send you unlimited messages, at any speed from 5 to 50 words a minute. THE OMNIGRAPH is not an experiment. 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.
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If you own a Radio Phone set and don't know the Code—you are missing most of the fun

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Type A-9 Shelltype
Ratio 5 to 1
\$6.00
Audio F



Radio & Audio Frequency
TRANSFORMERS

*"The Heart of a
Good Receiver"*

Your dealer will tell you why Marle Transformers do not howl or distort. Uniform amplification up to as many as 3,500 cycles.

MARLE ENGINEERING CO.
ORANGE, NEW JERSEY

Bradleystat
REGISTERED U.S. PAT. OFF.
PERFECT FILAMENT CONTROL

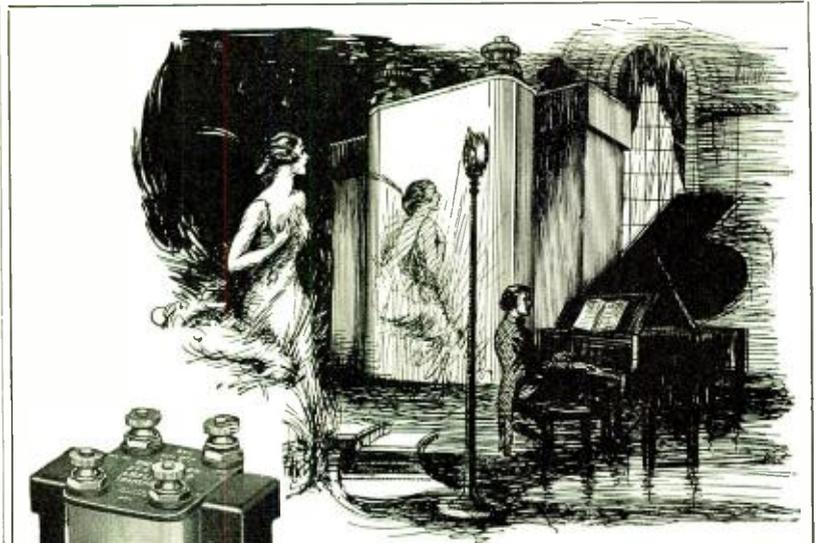
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PERFECT BATTERY SWITCH

Allen-Bradley Co.

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**SUPER
TRANSFORMER**
(audio frequency)

*The Mirror
of the
Broadcasting Studio*

"Why, Charles, that musical reproduction is perfect. Can that be our old set? It looks the same but how different it sounds. We were never able to get such perfect music before. It seems as though the artists were right here in the room. What *have* you done?"

"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

Get all the fun there is to be had from your wireless set.
Learn to read dots and dashes and double your pleasure.

The Marconi-Victor Records
provide the ideal instruction

SIX DOUBLE FACED RECORDS—TWELVE LESSONS

From the alphabet to press and code work. Actual operating conditions reproduced. Satisfaction guaranteed.

Price \$5.00 per set

WIRELESS PRESS, Inc.

326 Broadway, New York



A Manufacturers' Exposition

WHICH WILL BE ATTENDED BY THE PRINCIPAL RADIO JOBBERS AND DEALERS OF THE UNIVERSE

De Luxe Exhibits by Nationally Known American Manufacturers

FIRST TIME IN AMERICA

Representative Displays By The Famous Manufacturers Of
 ENGLAND ∴ FRANCE ∴ BELGIUM
 ITALY ∴ SWITZERLAND ∴ AUSTRIA

Blanks for the Big Amateur Set Builders' Contest are Now Ready

Six Silver Trophies and Twenty-five Cash Prizes. No Entry Fee.
 Send for entry blank without delay.

Direction of
U. J. HERRMANN and JAMES F. KERR
 Business Office, Hotel Prince George, New York City.

It is noted that both of these methods give the same results within the experimental error.

The first three measurements plotted on cross section paper, as in figure 2, intersect the capacity axis at 10 micro-microfarads, indicating that the coil has a distributed capacity of that amount.

Utilizing the method disclosed in the above description results as follows: the oscillator was set at 800 meters and the capacity required to tune the coil to resonance was found to be 474 mmf. The first harmonic of the oscillator was found with a capacity of 111 mmf. Then according to the formula:

$$C_d = \frac{474 - 4 \times 111}{3} = 10 \text{ mmf.}$$

"Selling" the Movies by Radio

(Continued from page 37)

For many years I have been dealing with the general public in my newspaper and theatrical associations, but I have never encountered such spontaneous audiences as are made up of radio listeners. They are positively Pals. At least I found them so and when dozens, I may say hundreds, wrote me asking that I induce some of the film stars of my acquaintance to appear before the microphone. I was happy to comply with their requests.

One of the first of the well known stars whom I approached was the world's premier comedian, Charlie Chaplin. I sought him out in his luxurious suite in the Ritz Carlton Hotel, New York, where he was staying for a few days while negotiating contracts with the firm that distributes his pictures throughout the world. Charlie greeted me cordially and it may be of interest that by actual count there were 31 newspaper reporters and special writers in his reception room which was flanked by cameras. Before his smile of greeting faded, I quickly sprung on him the idea of making a radio talk. If there are among my readers any who know Chaplin even casually, they at least, will appreciate the effect such a request had upon the celebrated fun-maker. He was nonplused.

In all my acquaintance there is no more modest person than the immaculately attired, gentlemanly, diminutive Englishman whom the theater-going world knows as a clown de luxe. Retiring is not the word for he is positively shy. As he started his alibi I was fortified by the composite spectre of those hundreds of thousands of my radio Pals who would welcome news of a talk broadcast by Chaplin.

Briefly, he finally agreed to journey over to WOR at Newark, N. J., and it will be an added compliment for



The \$17.50 Style
 Write for details of
NATANN CHARGER
 NATANN CO.
 20 Front Street. Brooklyn, N. Y.

EMPIRE
Oiled Tubing
 Real Radio Sets of today—the kind that last long and work best—are insulated with genuine Empire Oiled Tubing.

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Get Directly at Them

Are the contacts in the sockets of your radio set easily accessible for ordinary and necessary cleaning?

With Na-ald DeLuxe Sockets in use you need neither sandpaper or an extra reach to keep contact strips and tube terminals bright and clean.

Just rotate the tube three or four times. Instantly the dual-wipe laminated contacts remove corrosion, making a bright perfect connection. This action is on the side of the tube terminals away from the soldered ends. "It's the contact that counts."

Make your Superheterodyne set free from socket trouble by using Na-ald De Luxe Sockets.

Sockets and panel mounts for all tubes. Prices 35c to 75c. Send for catalog.

ALDEN MANUFACTURING CO.
Dept. A SPRINGFIELD, MASS.



Keep
Contacts
Clean

NA-ALD



New!

Remember—These parts are new this season! Be Sure to see them at your dealer's.

Improved Reception

The One Big Thing in Radio That Interests Everyone!

FIL-KO-STAT
SCIENTIFICALLY CORRECT RADIO RHEOSTAT
with Battery Switch



\$2

Improved Reception Through "Tube Tuning" with a Scientifically Correct Radio Rheostat.

There have always been plenty of rheostats that served to open and close the "A" battery circuit, but until the Fil-Ko-Stat was made it was impossible to adjust the filament heat to the most efficient operating point, giving maximum audibility in phones or loud speaker. Only the Fil-Ko-Stat, designed to give improved reception, allows infinite control of filament current, making possible louder, clearer signals from distant and local stations in any Radio Receiver using any type of tubes. And now—the NEW model (insist on the NEW model at your dealer) gives even finer control than ever before. It's \$2 including the battery switch attachment. And it's unconditionally guaranteed.

FIL-KO-LEAK
SCIENTIFICALLY CORRECT VARIABLE GRID LEAK
its calibrated



\$2

Improved Reception Through Maintaining Correct Grid Bias with a Hand Calibrated Grid Leak.

Likewise, there are many forms of grid leaks, some variable, others fixed. The Fil-Ko-Leak, however, is the only grid leak that can be set for a specified resistance and adjusted for best results. It's hand calibrated (and double checked) over the operating range for all tubes—1/4 to 5 megohms. Markings can be read through a panel peep-hole, and it's also equipped for table mounting [bracket packed with each instrument]. Guaranteed perfect electrically and mechanically, it gives scientifically correct control of grid potential—for \$2.

FIL-KO-LIGHTNING ARRESTER
SCIENTIFICALLY CORRECT RADIO LIGHTNING ARRESTER
with the 100% Guarantee



\$1.50

Leakage Losses You Never Thought of are Eliminated by this Scientifically Correct Radio Lightning Arrester.

Even were the Fil-Ko-Lighting Arrester no better than the average, it would still be worth far more because it comes to you with a guarantee that is virtually an insurance policy. You get \$100 or we repair or replace your set if damaged through fault of the arrester. But the Fil-Ko-Arrester is better. It eliminates all leakage losses from aerial to ground, all radio impulses reaching the antenna are sure to pass through your radio set, insuring maximum reception. Hermetically sealed Bakelite insulation is protected by an umbrella-shaped shield that keeps off dust, moisture and other conductive matter. You get positive protection for \$1.50.

FIL-KO-SWITCH
SCIENTIFICALLY CORRECT "A" BATTERY SWITCH
Simple—Sturdy—Sure



50¢

There's also the Fil-Ko-Switch, at 50c. It won't improve reception—but it's one of the few battery switches that won't impair it. Made of non-magnetic metal, wipe-action contacts, assuring sharp, clean "make and break", entirely insulated from nickel-plated brass housing and knob. Scientifically correct to avoid current leakage and extra capacity. Carries the usual Fil-Ko-Part for Radio guarantee!

Improved Reception Through Scientific Tube Tuning.
A book that will help you get better results; tells all about vacuum tubes and how to control them as to get more DX, greater volume, longer tubes and better life—maximum regeneration and clearest signals. Write to Dept. WA 924 for free copy.

MADE AND GUARANTEED BY



HARRISBURG — PENNSYLVANIA

Foreign Representatives Radio Stores Corporation NEW YORK OFFICE 220 W. 34th St.

If your dealer does not carry these FIL-KO-PARTS for Radio, send his name, with your requirements for parts wanted, direct to the factory.

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If you have the January, February, March, April, August, October, 1923, copies of THE WIRELESS AGE send them to us and we will extend your subscription one month for each issue.

DEPT. "M"

THE WIRELESS AGE

326 BROADWAY NEW YORK CITY

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Why thousands of radio fans enjoy him

Because thousands of storage batteries are on the job, brimful of energy, gaining clear, satisfying radio reception for every word and inflection.

With a Tungar, the carefree battery charger, in your home you can keep your battery tuned up to get every single note of music, every recitation, speech or song. Tungar charges the battery overnight from the house current.

Sold by Electrical, Auto-accessory and Radio dealers.



Tungar is one of the many scientific achievements contributed by the G-E Research Laboratories toward the wonderful development of electricity in America.

Tungar Battery Charger operates on Alternating Current. Prices, east of the Rockies (60 cycle Quiffs)—2 ampere complete, \$18.00; 5 ampere complete, \$28.00. Special attachment for charging 12 or 24 cell "B" Storage Battery \$3.00. Special attachment for charging 2 or 4 volt "A" Storage Battery \$1.25. Both attachments fit either Tungar.



Tungar

REG. U.S. PAT. OFF.

BATTERY CHARGER

Tungar—a registered trade mark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company
Bridgeport, Connecticut

GENERAL ELECTRIC

48 E-10

CRESCENT LAVITE RESISTANCES

ABSOLUTELY NON-INDUCTIVE

12,000, 48,000, 50,000, 100,000 Ohms

List \$1.50 Each



Special Sizes to Order
USED IN ALL CIRCUITS AND RESISTANCE COUPLED AMPLIFIERS
Dealers write for discount
CRESCENT RADIO SUPPLY CO.
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The Traffic Cop of the Air

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!

Guaranteed to tune out any interfering station. The price is \$8.50. Shipment is made parcel post C. O. D. plus a few cents postage. If you prefer, send cash in full with order and we will ship postage prepaid. Send us your order today.

FERBEND
Wave Trap

FERBEND ELECTRIC COMPANY
18 E. South Water St.
Chicago, Ill.



radio listeners to learn that Chaplin's radio talk was his only public "appearance" or utterance while he was in the East and it was his microphone debut.

He declined more than 600 invitations from a diversity of sources, many of which it would have been an investment for him to accept; but he did entertain the radio audience and I had the honor of introducing him to you all.

Baby Peggy is another of Filmdom's elect who first addressed the radio Pals under my auspices. Of course she is a darling, and I might fill several pages telling of intimate experiences with this wonder child of fame and fortune. Just one incident will suffice to illustrate her unspoiled sweetness and childlike simplicity.

My daughter, Angela, Baby Peggy and I were en route to the radio station the day following Peggy's fifth birthday. Both kiddlets were huddled in a corner of the huge motor and were inclined to be sleepy. To keep her fit for the imminent radio talk, I was chatting away and casually asked Peggy, "How old are you, dear?" She answered, "Mr. Tosker, I'm just done being four." How I hope she will never be done being her own sweet little self and I do feel that she will always be so!

Dick Barthelmess, Conrad Nagel, Miriam Battista, Mabel Normand and Marion Davies are among well known screen favorites I have presented to the radio fans and the long list includes such personalities as, Owen Moore, Claire Windsor, Bryant Washburn, Lou Tellegen, Mickey Bennett, Tom Terris, Elliott Dexter, Kenneth Webb, Charles Ray and ever so many others whose names are literally household words.

I get a lot of fun and much satisfaction out of my radio work. I have endeavored to put a flavor of humor into the talks on current motion pictures. Also, as in every human endeavor, pathos has bobbed at times. A pathetic incident of my radio work was made known to me in a letter I received from the matron of a home which houses nearly 700 blind persons. This good woman wrote me that the prayers of her afflicted charges had recently been offered for my success because my radio talks were the only existing link between them and the motion pictures. Another letter, this one carrying a smile, was received from an indulgent mother who wrote inquiring where she might purchase for her boy, a cap such as the movie cameramen wear, "one with the peak in the back."

So you see, behind the scenes of a big radio studio, are to be encountered the same lights and shadows that you, my radio Pals, out there on the air, are daily grinning and hearing.

When writing to advertisers please mention THE WIRELESS AGE



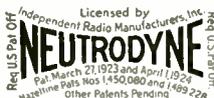
THE NEW HOWARD 5-TUBE NEUTRODYNE

This remarkable Set has created a sensation. Beautiful black walnut cabinet—special Howard parts throughout and guaranteed to give excellent results.

WRITE TODAY FOR FULL DESCRIPTION AND PRICES

HOWARD MANUFACTURING COMPANY

4248 Northwestern Avenue
Chicago, Ill.



WHEN you own a Radiodyne the world's foremost entertainers and educators serve you. With this efficient receiving set you can bring operas, sermons, lectures, dance music, etc., right into your home clear and distinct on loud speaker no matter where broadcasted or where you live.

Uses Light Socket for Antenna

Radiodyne Outside or Inside Aerial for Daytime

"I have no outside antenna. I just plug into the light socket. Picked up Omaha last Sunday morning at ten o'clock when the temperature was 95 and the sun shining."
Frank Williams, Winona, Minn.

"Received Cuba, Canada, New York and California on loud speaker with 70 foot ribbon antenna in attic. Also have a single 75 foot wire outside for daytime, volume and distance."
L. G. George, Fairmount, Ill.

Write for illustrated folder which describes the RADIODYNE in detail. Every radio fan will be interested in this new type receiver.

Western Coil & Electrical Co., 316 Fifth St., Racine, Wis.

When writing to advertisers please mention THE WIRELESS AGE



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 waiting. Over 6,000 operators have already graduated from the Radio Institute of America. But the radio industry is just in its infancy. There are more demands for operators than there are trained men to meet the demand.

Conducted by the Radio Corporation of America, the Radio Institute offers the soundest instruction and the most logical means of employment after graduation. Write for information concerning our classes.

Home Study Courses

Conducted from New York City. Full instruction for those who cannot attend our New York or San Francisco resident school.

- A. Complete Home Study Course. From beginnings of magnetism through code and commercial practice. Prepares you for U. S. operator's license.
- B. Advanced Home Study Course. For the advanced radio student and experienced amateur. Specializes in C. W., I. C. W., telephone and radio measurements.

Send the coupon for full information

Radio Institute of America

(formerly Marconi Institute)
Established 1909

Western District Resident School
San Francisco, Cal.

HOME STUDY DIVISION

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.....

Address.....

New Models BRISTOL RADIO RECEIVERS

Incorporating the Patented Grimes
Inverse Duplex System

Watch for further announcements in all leading radio
publications.

Improved Bristol Audiophone Loud Speakers—gives
greater volume, is more sensitive and still maintains its
round, full tone and its distinctive freedom from dis-
tortion.

Ask for Bulletin No. 3017-V.

Manufactured by
THE BRISTOL COMPANY
WATERBURY, CONN.

Grimes System Insures Natural Tone Quality



SENIOR AUDIOPHONE
15 inch Bell
Price.....\$30.00



JUNIOR AUDIOPHONE
11 inch Bell
Price.....\$22.50



BABY AUDIOPHONE
With Fibre Horn
Price.....\$12.50

On the Side Lines of the In- dustry

(Continued from page 67)

THE Peerless Radio Corporation was organized by Mr. Walter J. Henry, who remains as president and chairman of the board. Mr. Henry for the last five years has been general manager of the Wireless Specialty Apparatus Co. of Boston, one of the companies affiliated with the Radio Corporation of America.

Associated with Mr. Henry in his new venture are two of his former associates in the Wireless Specialty Company, Mr. W. E. Watrous, formerly production manager there, and Mr. Victor E. Rosen, formerly of the engineering department. The treasurer of the Peerless Corporation is Mr. C. N. Taylor, who is also president of the Wellesley National Bank.

OF the really worth while booklets and catalogues published recently, the following may be had by addressing requests to **THE WIRELESS AGE**:

1. A new dial card for logging stations, designed by the American Hard Rubber Co. for the non-technical members of the family.

2. Personal instructions for home set builders, "Phusiformer Possibilities," published by the Pathé Phonograph and Radio Corporation. The cost of producing this booklet requires a charge of 50 cents, but is well worth it.

3. "Small Dry Cell 'A' Batteries for Portable Receiving Sets," written by W. A. Schulte and published by the Burgess Battery Company.

4. A long needed booklet on circuit resistance has appeared in attractive form as "Resistors—Their Practical Applications in Radio Reception." Zeh Bouck has handled this problem well, and the Daven Radio Corporation should anticipate a large distribution.

5. An example of just what ten cents will buy has been demonstrated in the booklet "Radio Receiving Set Trouble Finding" and the "Radio Receiving Set Trouble Chart," written by Edgar H. Felix, who is a contributor to **THE WIRELESS AGE**.

The booklet is divided into three parts: The first deals with maintenance problems; the second with mechanical and electrical troubles, discussed part by part; and the third with faults due to improper manipulation of the receiver's controls. Location of troubles is made quick and easy by means of the "Trouble Chart."

All of these booklets have been read by the editorial department of this magazine and are recommended to readers as valuable assets to satisfactory radio set operation. The booklets, for which a nominal charge is made, contain information that is worth the price asked. Booklets, catalogues, and literature are only reviewed when the contents are informative, and merit comment.

CARTER "HOLD-TITE" JACKS

Made in ten different Spring Combinations



70c

Note the construction of this jack—nothing like it on the market, no matter what you pay. Thousands of satisfied users will vouch for it. Insist on the original—any dealer can supply

Perfect Insulation:
No loss from Leakage
High dielectric Strength
Non-hydroscopic (will not absorb water)
Only the best insulation used.

Offices in Principal Cities
In Canada—Carter Radio Co., Ltd.—Toronto



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Performance plus Beauty

Choose your panel for its insulating value as well as for its appearance.

MAHOGANITE Radion Panels

give you both the supreme insulation and the beauty of polished mahogany. For Mahoganite is not a surface finish but a material which extends from one side of the Radion Panel to the other.

21 Stock Sizes

Mahoganite and Black

6x 7	7x14	8x26
6x10½	7x18	9x14
6x14	7x21	10x12
6x21	7x24	12x14
7x 9	7x26	12x21
7x10	7x30	14x18
7x12	7x48	20x24



Look for this stamp on every genuine Radion Panel. Beware of substitutes and imitations.

RADION

The Supreme Insulation

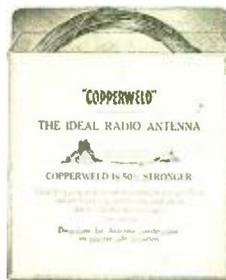
PANELS

Dials, Sockets, Knobs and Insulators:

At All Good Radio Shops or write to

American Hard Rubber Co.
11 Mercer Street New York

See our exhibit at the
FIRST RADIO WORLD'S FAIR
Madison Square Garden, New York
SEPTEMBER, 22-28, 1924

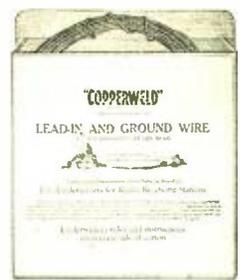


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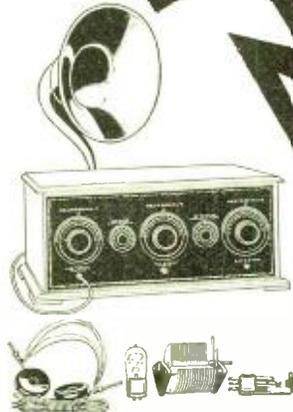


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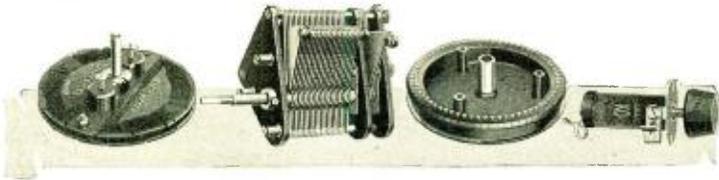
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The World's Largest Store owns and operates Station W.L.S. Wavelength 345 Meters. Tune in

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Standard Insulation —wherever Dials turn

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Send for our Radio Map

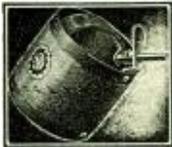
The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.

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Single Wire Antenna Effective for Transmission

By S. R. Winters

THE single wire antenna experi-
mented with by the United States
Shipping Board Emergency Fleet
Corporation, consisted of four 7/8 phos-
phor bronze wires with four SE 165
insulators in each end. The design
took the shape of an inverted "L." A
trip from New Orleans to England
with a one wire antenna on shipboard
indicated that this new design of elec-
tric radiating system had an effective
daylight range of over 200 miles, re-
sults which are responsible for the
conclusion that the one wire antenna
compares favorably with the three or
four wire flat top design.

The most complete tests with respect
to the one wire antenna were recently
made at Boston. These tests included
the various types of antenna embrac-
ing their operations over wave lengths
of 450, 600 and 800 meters. In the
course of these experiments the elec-
tric power was maintained as low as
possible in order to avoid injury to
gaps and keep interference with traffic
at a minimum. The power determined
upon was that which permitted a re-
sonant condition with respect to the
input of electric current, thereby yield-
ing a clear note and the least amount
of strain on the component parts of
the apparatus.

Generally speaking, these trans-
mission tests conclusively demonstrated
the potential value of one wire as a
means of radiating electric energy.
The antenna in this instance consists
of four strands of 7/18 antenna wire,
formed into a cable in the absence of
a manilla core. The omission of the
latter was due to previous difficulties
encountered in forming a single cable
around a manilla core, which condition
should suggest the possibility of a man-
ufacturer producing a fabricated cable
of this kind. Installation precautions
were established by the insertion of a
safety link consisting of one strand of
7/18 antenna wire between the safety
strain insulators and the antenna. This
arrangement was effected to avoid any
possibility of broken topmasts in the
event that this electric radiating sys-
tem should become fouled with hoist-
ing gear or grain fittings. By means
of this provision, should the safety link
break, the strain insulators would be
held by the halyards, permitting the
antenna wire only to fall. Thus the
possibilities of injury to persons on
deck are reduced to a minimum.

The tests with the single strand of
7/18 antenna wire included observa-

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Catalog P-9

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your set with
an AmerTran

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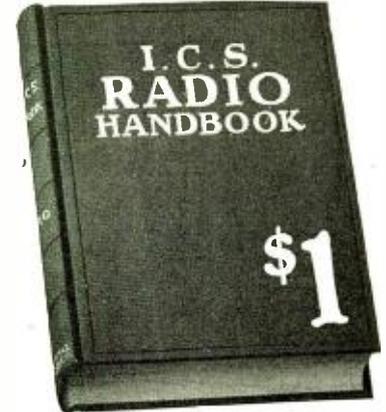
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Different types of receiving and sending hook-ups, electrical terms, condensers, oscillating circuits, coupled circuits, induction coils, antenna systems, electric batteries, generators and motors, protective devices, crystal detectors, arc generators, transmitters, filters, wavemeters, radio experiments, International and Morse codes, commercial receiving sets, etc.

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FREE Wonderful home-construction, tube receiving set, of latest design. Write for "Radio Facts" free Engineer Mohaupt. RADIO ASSOCIATION OF AMERICA Dept. G-9 4513 Ravenswood Ave., Chicago



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Made Broadcast

to sign more for more than one trip. I don't believe the big sleep really would have been as good as had without the sets and the other things. I don't believe they would have been as good as had without the sets and the other things. I don't believe they would have been as good as had without the sets and the other things.

Grounding

...introduce losses. The control dials act partly as shields, and the time reduce the capacitive coupling between the body and the instruments by functioning as the common plate of two condensers connected in series.

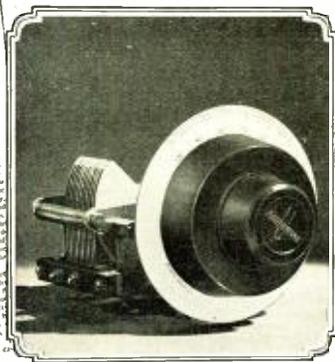
The increased susceptibility of receivers of this type to capacity variations also makes vernier control a necessity. However, as a built-in vernier generally adds to the condenser losses, non-vernier condensers are recommended with vernier dials. The Accuratune dial, a true vernier and possessing the desirable insulated metal scale, was used by the author.

THERE MUST BE NO RADIATION

THE most important consideration in the design of all is the necessity of shielding the receiver from the radiation of the transmitter. This is especially true in the case of the single wire antenna, where the radiation is concentrated in a single direction. A big steel case is one way to shield the receiver, but this is not always practical. A better way is to use a shielded enclosure for the receiver, such as a lead-lined box or a concrete wall. This will prevent the radiation from the transmitter from reaching the receiver and causing interference.

ZEN BOCK in Aug 1924
Radio Broadcast

Geared 80-1



Broadcast Laboratories Endorse Accuratunes

Radio Broadcast Laboratories, employing the most skilled licensed radio experts, use Accuratune Dials on the Broadcast "Knock Out" in preference to built in verniers. No stronger recommendation could possibly be accorded Accuratune Dials.

Accuratunes are actual micrometer dial controls designed for infinite tuning precision. Ten times more efficient than any condenser vernier attachment. Flush panel mounting. Fit all standard condenser shafts. Geared 80 to 1 ratio for accuracy and ease of operation.

Just try one! No description could possibly convey the genuine tuning satisfaction you receive, for this \$3.50 instrument.

At your dealer—otherwise send purchase price and you will be supplied postpaid.

Write for descriptive circular

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ACCURATUNE

80-1
MICROMETER CONTROL

Radio, Ltd.,
Montreal, Canadian
Representatives

tions with both inverted "L" and "T" type of electric radiating systems. It was revealed that more than one-kilowatt of electric energy could be "pumped" into this single strand antenna in the absence of excessive sparking, although the results of these experiments would seem to indicate that this type of antenna would be precluded on vessels equipped with 2-kilowatt transmitting sets. However, it is entirely feasible to use a one-kilowatt transmitter, operating on wave lengths not exceeding 800 meters, with the single 7/18 wire antenna.

Radio amateurs who are contemplating the abandonment of the multiple wire antenna for the one-wire radiating system will doubtless take into consideration the results of these trail-blazing experiments.

The one-fourth inch of bronze cable and the three-eighths inch steel rope exercised a tendency of sparking when more than one and one-half kilowatts of electric energy were impressed on this type of antenna. Of the single wire designs, full power could not be applied to any of these save the antenna composed of four strands of 7/18 antenna wire. Despite the fact that the physical dimensions of the one-fourth inch bronze cable are strikingly similar to the four twisted strands of antenna wire, the conductivity of the former is considerably less.

Broadcasting Answers

MR. GEORGE W. STIMPSON, Query Editor of The Pathfinder Magazine, has broadcast from WRC many of the answers to questions which come in to him.

The following are a fair sample.

Q. What are eyebrows for?

A. Men were given eyebrows to keep the sweat out of their eyes. They were given to women in the interests of exterior decoration.

Q. Why doesn't the stomach digest itself?

A. For the same reason that whisky doesn't make the bottle drunk. The truth is, the walls of the stomach are indigestible, just like a lot of food we get nowadays.

Q. How would the age of a person born on February 29 be computed?

A. In the first place, a person is a fool to be born on that day. Such a person becomes a year older each year just like anybody else; yet he has a real, honest-to-goodness birthday only every fourth year.

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Used and Praised the World Over
3000 Ohm, \$6.50. 2000 Ohm, \$5.00
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Newman-Stern Bldg. Cleveland

latest Development In

RADIO

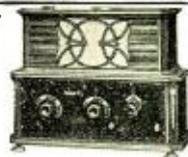
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Non-Oscillating
Principle

Complete Outfits

DOWN

Easy Monthly Payments

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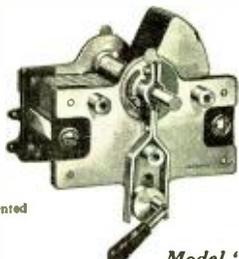


The sets n'r biggest sensation. Carl Pfanzstiel's improvement over Neutrodyne, Super, Reflex, etc. Positively non-regenerative. Brings a new degree of musical quality, selectivity, and simple operation. Solid mahogany cabinets. Accessories included.

Write Today for FREE Trial Offer!
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VERNIER VARIABLE
CONDENSER**

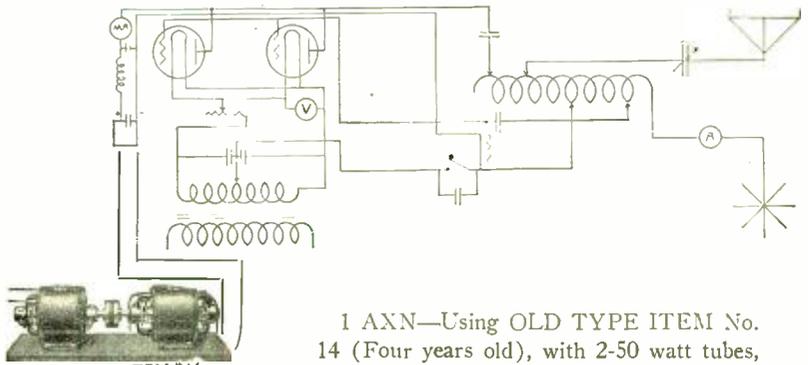
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This is but one of the many instances of "ESCO" products—consistency—dependability and durability.

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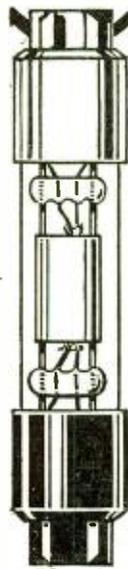
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This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for \$6.00. It is the only battery of its kind equipped with "old rubber case" in its frame against acid and leak-ups. Take advantage of this remarkable introductory offer NOW. (To those who prefer it, we will send FREE a handsome nickel finish Auto Sootie, instead of the "B" Battery. Be sure to specify which is wanted.)

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Practically Unbreakable

They banish noise, tube hiss and interference because the leads are not bunched as in ordinary types. They function in any position—as Detectors, Amplifiers and Oscillators—and you can't break Myers Tubes unless you deliberately try.

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Sizes:	.001	.0005	.00035	.00025
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Estab. 1914

CAMBRIDGE 39

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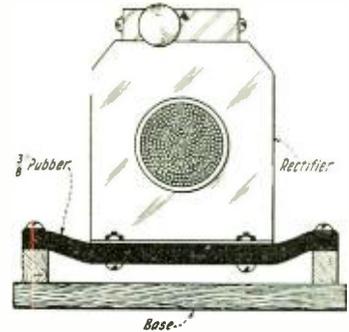
Q. Who was it that killed one-fourth of the people in the world and died before his father was born?

A. This gentleman must have been Cain. When he and his father and mother and brother were the only people in the world, he up and killed his brother, one-fourth of the people of the world. Cain's father, Adam, was not born, but created, therefore Cain died before his father was born.

And so it goes. The BCLs have responded to the spirit of this feature with hundreds of queries.

Noiseless Mounting for Mechanical Rectifier

ONE of the worst features of mechanical rectifiers is the terrific clattering clamor they manage to make while busily engaged in charging the "A" battery. Indeed, so great is the



noise that most fans put their mechanical rectifier in the cellar, others muffle them up in boxes; while some, we are afraid, throw the noise-makers away and buy a "quiet" type.

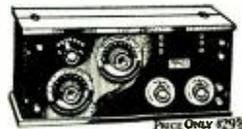
At the present time we belong to the latter class, but once we did have a vibrator "wrecktifier"—only it was fixed up so that it could scarcely be heard in operation.

This was accomplished through use of a rubber suspension mounting as shown in the accompanying end view sketch.

Here the base was the bottom of a dustproof and almost airtight cabinet; the rectifier was suspended at both ends with 3/8 inch rubber strip in the manner shown. Connections to the charger were made with flexible leads and a change-over switch, fuse and meter were mounted on the front panel of the cabinet. Rubber cushions were placed under the cabinet and, with the cover closed, the double rubber suspension together with the muffling effect of the cabinet served to minimize the noise.

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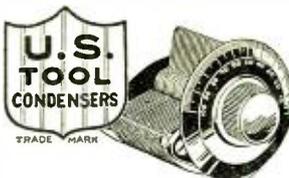
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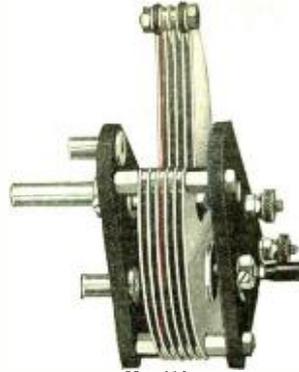
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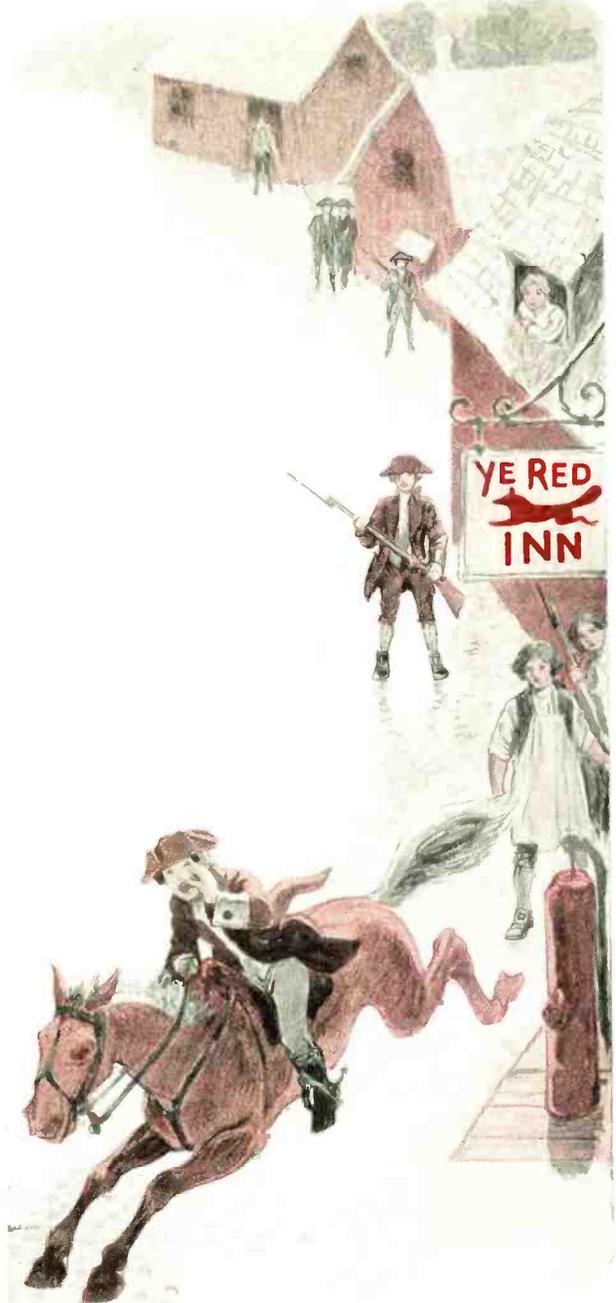
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