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The WIRELESS AGE

Volume 7 Number 6

The Lafayette Trans-oceanic Station Near Bordeaux, France, Showing Eight Towers, Each 825 Feet High

How Vacuum Tubes Are Tested

Radio Operating as a Career

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HATS OFF TO THE NAVY

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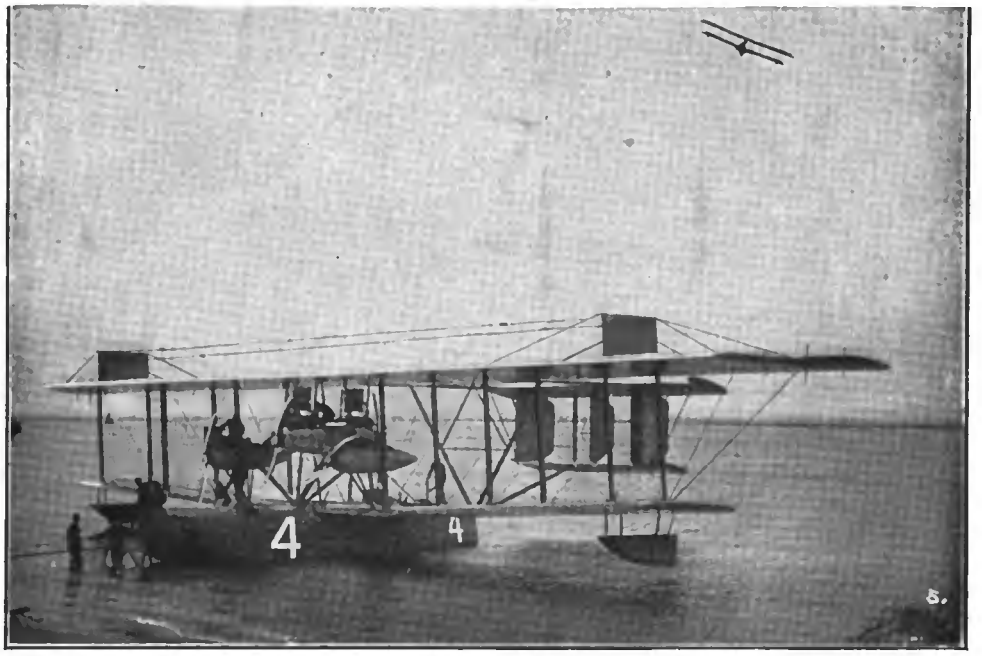
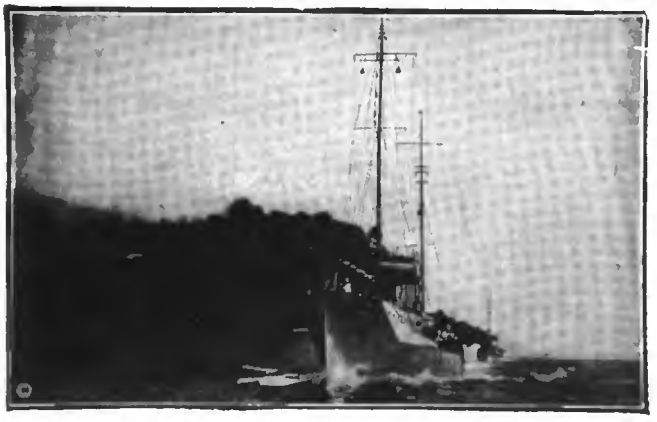
Extract from New York World, June 3, 1919.



NC-4—ELECTROSE Equipped



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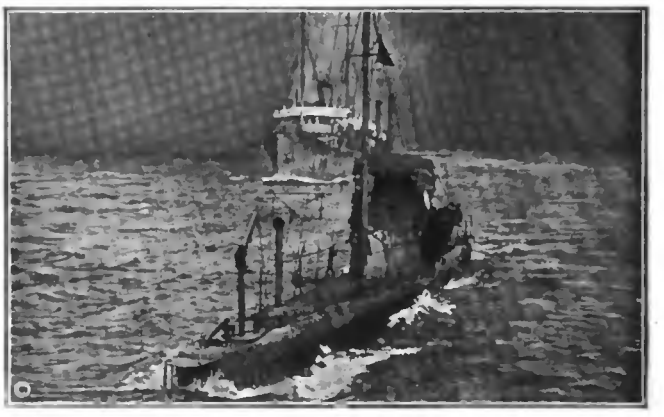

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Medal and Diploma received at World's Fair, St. Louis, 1904

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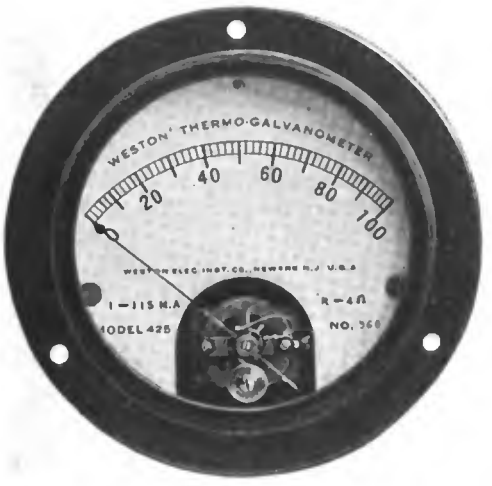

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Edited by J. ANDREW WHITE

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

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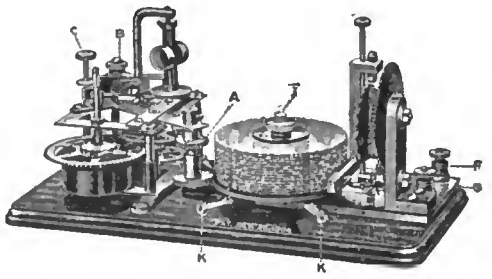

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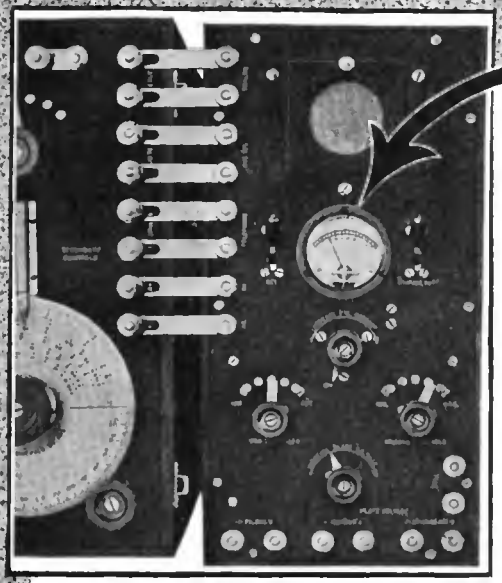

Audion Control Box Showing Type BX Instrument for Measuring Filament Current.

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Radio Equipments require the highest grade of instruments consistent with reliable service and the available space.

The Type B X

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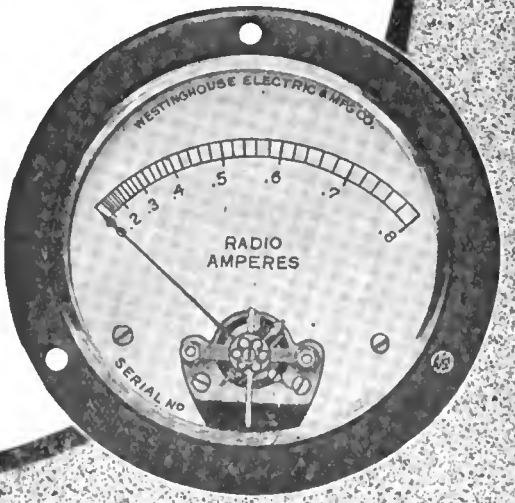

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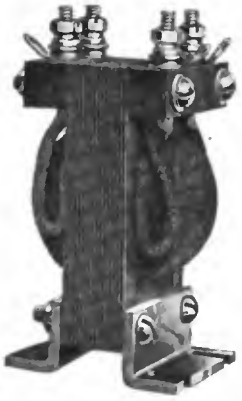

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Are Distinguished for Their
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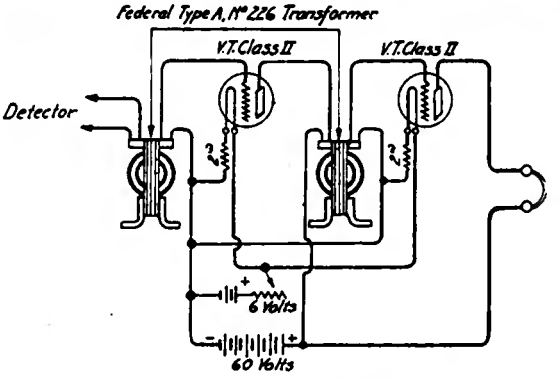

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$12.50 per set

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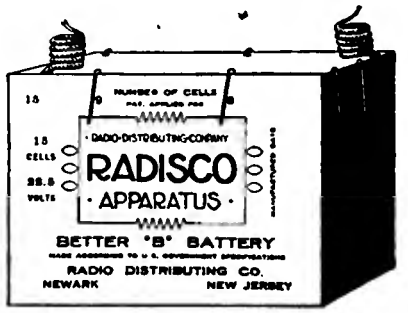
RADISCO AGENTS carry only apparatus of proven merit. Look for the Radisco trade mark on all parts you buy and be sure of getting efficient apparatus.



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1390 Prospect Ave.

CHICAGO, ILL.
Chicago Radio Laboratories,
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The Wireless Shop,
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NEW ORLEANS, LA.
L. A. Rose,
4323 Magnolia Street.

NEWARK, N. J.
A. H. Corwin & Co.,
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NEWCASTLE, PA.
Pennsylvania Wireless Mfg. Co.,
507 Florence Ave.
"8HA"

PHILADELPHIA, PA.
Philadelphia School of Wireless Telegraphy,
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If none of the above agencies are in your vicinity, communicate with

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IN THE WIRELESS FIELD (No. 3)

TWO STAGE AMPLIFIER
Type WI—125A

THE PHOTOGRAPH of the "WICONY" Type WI-125A Amplifier does not show up much better than ordinary amplifiers. An actual inspection of the instruments, however, immediately shows the difference.

We claim, without hesitation, that this instrument is electrically and mechanically the finest amplifier made in this country either for Navy, Army, or commercial account, It is an ultra refinement of the Navy Amplifier and, for those who require the best appearance as well as the best operating results, we offer it at a price which, comparatively speaking, is extremely low.

The above is equally true of our Audion Control Box, Type WI-129A, which contains a filter system so that it can be used on a 110 volt line as well as with a battery.

The price of either instrument is $75.00, which will be refunded without question if the purchaser is not fully satisfied.

AUDION CONTROL BOX
Type WI—129A

WIRELESS IMPROVEMENT COMPANY, Inc.

Radio Engineers, Manufacturers and Distributors,
47 West Street, New York, U. S. A.

If this page is cut out and appended to the same page cut from the editions to follow, a complete file of very interesting information will soon be available. (No. 3)

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Vol. 7. No. 6. MARCH, 1920

THE WIRELESS AGE

WORLD WIDE WIRELESS

America and France Linked by Wireless Telephone

ANOTHER triumph of the wireless telephone is recorded. American engineers have succeeded in talking over the wireless telephone direct from New Brunswick, N. J., to points in France.

A. E. Reoch, plant engineer of the Radio Company of America, reports that the talk to France was accomplished at the New Brunswick wireless station of the company by using the new Alexanderson alternator.

Scientists who discussed the situation predicted that before next Summer wanes it will be possible to obtain a direct wireless connection with London, Paris, Berlin or even Tokio with the same ease as to call up any point on the wired long distance service and hear the human voice perfectly.

Marconi on the Future of Wireless

GUGLIELMO MARCONI, in a signed article in the Nuvo Giornale of Florence on the predicted revolution in wireless communication, says:

"Eventually science will find a way of directing electrical energy without wires in an absolutely straight line. The result will be less expenditure of energy for short distances and hence less expense for messages. Once directive control has been established we shall undoubtedly be able by means of powerful machines to girdle the whole world with waves of electric energy without wires."

Marconi describes a radio telegraphic receiver no bigger than a gramophone by means of which, without any other communication with the atmosphere, he receives all day in his study every scrap of wireless news sent to the European press. He says that very soon with an instrument of this kind "bankers, politicians and business men in general will be able from minute to minute to keep themselves in contact with both hemispheres." He continues:

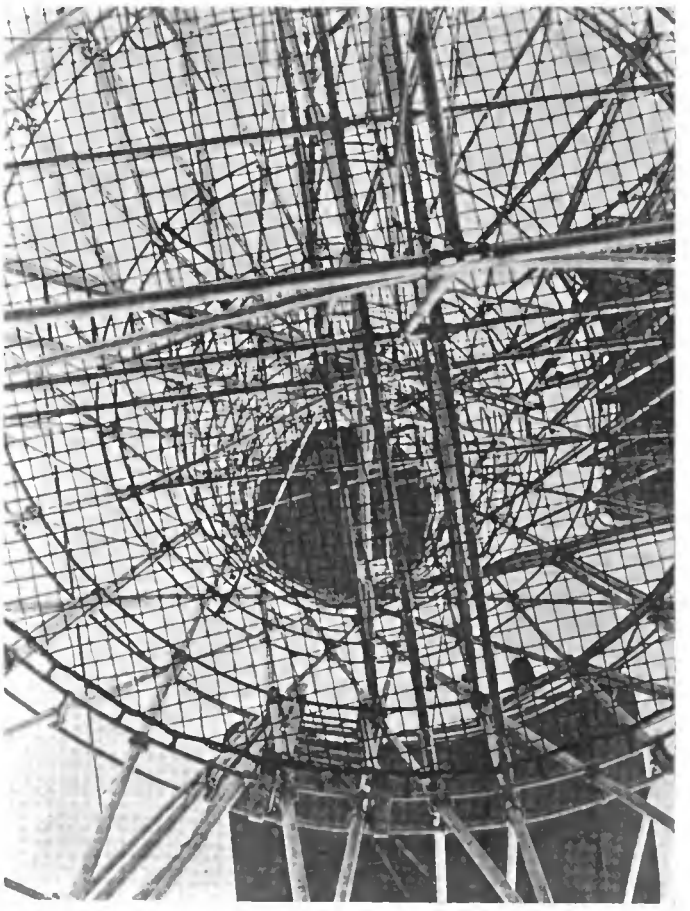
"Very soon, too, that miserable ticking machine on which all newspaper offices depend will yield place to this mighty invention, which is suitable for news sending, news receiving and simultaneous communication with any number of receiving stations.

"With that installment of radio telegraphic receivers throughout the civilized globe in every public school, university and library, the prevailing languid interest of the public in international happenings will be immensely stimulated."

An English Home Wireless Telephone

A COMPANY is offering for sale in Great Britain a "home wireless telephone" apparatus contained in a box light enough to be carried by a leather handle. It is said the outfit is capable of receiving messages from all the principal wireless stations in Europe.

It needs only to be placed on a table and the sounding telephones connected and it is ready for use. No external "aerial" is required. It costs $150.



This mystic maze becomes clear when it is explained that it is a view from the inside through the top of a wireless tower aboard the U. S. S. Army Rifle

Ban on German Wireless to American Press Lifted

AMERICAN correspondents in Berlin have had restored to them the privilege of using the direct wireless to America, as a result of vigorous protest by several newspaper men against the application to them of Paragraph 197 of the Versailles Treaty.

In answer to the protest which the American correspondents sent to the German Foreign Office and which was then placed before the naval sub-commission headed by Admiral Charlton, of the Inter-Allied Control Commission, the Foreign Office was advised that there is no objection to restoring the use of the wireless to the American press.

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Congress Considers New Navy Radio Bill

CONSIDERATION of the Greene resolution sponsored by Secretary of the Navy Daniels authorizing the use of naval radio stations for commercial and press messages was begun March 1 by the House Committee on Merchant Marine and Fisheries.

The resolution states that in view of the recent executive order of the President returning all radio stations taken over by the Government to their owners and removing war-time restrictions, it is unlawful under the act of August 13, 1912, for the naval radio stations to handle commercial messages except where there is no commercial radio station operating continuously for general public service within 100 miles.

A strong effort has been made to induce Congress to authorize the Naval Communication Service to continue to handle commercial messages, not as a competitor of the private companies but as an aid to them, taking only such business as they cannot care for and at such rates as they have fixed.

Officers of the naval radio service have prepared a bill which gives the Government the right to transmit messages over its installations when communication through other channels is congested or for any reason interrupted. The measure also excludes private companies from the Canal Zone, certain of our Pacific possessions and unless authorized by the Government, from American possessions in the West Indies. All these areas will have a Government radio service and the naval coast stations will also be allowed to handle commercial messages between ships and the shore.

The plan also involves the transfer of radio control from the Commissioner of Navigation in the Department of Commerce, to a national radio commission of four members.

Savannah Gets New Navy Wireless Station

THE new wireless station in Savannah will be situated on the Ogeechee road site.

At present the station only has one 125-foot tower; the new station will have two.

The city contributes the site for the station. The new plant will be modern in every way with a California bungalow style of building.

Buffalo to Have New Government Radio Building

THE government is proposing the erection of a new radio building in Buffalo. According to a circular, sealed proposals for the building were sought.

The building, which is to be erected on army land adjacent to the lighthouse department grounds, will be two stories in height, of frame construction.

Movies Picture Operation of Wireless Telephone

THE wireless telephone is being presented as a scientific feature of the Goldwyn-Bray Pictograph. In the stress of the world war, the mechanism was perfected by which the human voice talks across the ocean, and the Bray Pictures Corporation shows how the marvel is accomplished. The device for transmitting electric waves which travel great distances is pictured so that even a child can understand how the electric waves are made to carry sound.

Wireless 'Phone Messages Between Berlin, Sweden and Moscow

TRIALS of the wireless telephone between Berlin and Karlsborg, Sweden, a distance of 435 miles, and between Berlin and Moscow, a distance of 1,055 miles, have proved successful, according to accounts of the tests in the Berlin press.

Wireless Reports Shipwreck Off Newfoundland

TWENTY-ONE men perished as a result of sinking off Newfoundland of the British steamer Bradboyne, formerly the War Panther, according to wireless advices received at the Marine and Fisheries Bureau.

A lifeboat from the steamship Oxonian, attempting to rescue the crew of the Bradboyne, was swamped, with loss of the second officer and five members of the crew. Fifteen men perished when the Bradboyne sank.

Captain G. D. Rees and second officer Bellas of the Bradboyne were picked up by the steamer Monmouth. The Oxonian wirelessed she was returning with 26 members of the Bradboyne's crew.

France Plans Colonial Wireless

THE head of the French government wireless department has worked out in detail a plan which, if it is adopted, will put France in wireless communication with all French territory the world over.

What he proposes is a continuous line of wireless stations of about 3,700 miles range which will include Tahiti, New Caledonia, Indo-China, Djibuti, Senegal, Martinique and France.

France, of course, would be the center of this world-wide system of communication, and would do its part with one station of medium power for the transmission of messages to North Africa and three stations of sufficient power to reach respectively the United States, Martinique and Brazil, and West Africa and Djibuti.

In addition to the four stations in France, the plan calls for three double stations, which means a large station and a medium one respectively, in West Africa, at Djibuti and in Indo-China; stations of high power at Martinique, Tahiti and New Caledonia, and stations of medium power in Morocco, Algeria, Tunisia, Congo, Madagascar and French India.

Peru Opens Two New Stations

THE Peruvian Department of Internal Affairs has announced that the radio stations which have been under construction for some time past at Eten and Trujillo are now in operation. This gives Peru a service without interruption from north to south, with stations at Paita, Eten, Trujillo, Lima, Callas, Pisco, Chala, Arequipa and Ilo. Radio stations were first established to provide communication between the capital and the eastern Mentana and Iquitos on the Amazon. This line, with relays at Pto. Bermudez, Masisea, Orellana and Requena, all points on the Ucayali river, has been in successful operation for the past decade and has proved of the greatest benefit, as a number of weeks are ordinarily consumed in making the overland trip from Lima to Iquitos, the head of river navigation in the Amazon basin.

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Wireless Saves Man's Life at Sea

HOW a man's life was saved by wireless communication which changed the courses of two ships was told on the arrival at Baltimore of the Shipping Board steamer West Hartley, from Avonmouth and Manchester.

While the West Hartley was bound out from Baltimore on her last trip, Ignacio Minan, forty-eight years old, was taken seriously ill. There was no doctor on board, and Captain E. J. Preston, believing that a surgical operation was needed to save Minan's life, got into communication with the transport President Grant, eighty miles astern, bound for New York. The two ships turned about and met.

Minan was unconscious when the transfer was made in a small open boat. The operation was performed aboard the President Grant.

Sister Missing 13 Years Found by Wireless

LOCATED by a wireless telegraph dispatch sent out from her brother's amateur plant, Cleo Archer, 17 years old, lost for 13 years, has been restored to her mother's home in Toledo.

Two weeks ago Lester Archer sent out a wireless call to all amateur plants within the radius of 800 miles, asking them to help locate his sister. Eventually he was informed that she could be found on a farm near Rockford, Ohio. Young Archer went to the farm of Ellis Williams and claimed his sister, who had been removed from a children's home near Lima, Ohio, thirteen years ago and had been sought by her mother in many cities.

U. S. Weather Reports by Wireless

THE sending of weather forecasts by wireless telephone to Wisconsin farmers is a plan now being worked out by the United States weather bureau station at the University of Wisconsin, to carry information concerning sudden changes in weather more rapidly.

Such a plan will eliminate telegraph service and slow telephone communication to individual farmers. Farmers within a radius of 100 miles of Madison, who install an inexpensive wireless telephone receiving outfit, such as is now built commercially, will be able to receive the new service at a certain time every morning. No code need be learned for the wireless telephone message is received like a wire telephone message.

The present plan is for the weather bureau to send the weather report to the physics department at the university, to be sent out from the university wireless telephone station to all persons who wish to receive the service.

Shipping Losses Prevented by Wireless at New York Port

WHEN the most severe storm of late years struck the North Atlantic Coast recently, early warnings are credited with having prevented serious losses to shipping. The gale sweeping in from the sea reached a velocity of seventy-two miles at Block Island. Wireless requests for position were received in New York from thirty-nine ships which were uncertain of their bearing at sea.

Storm damage was general all along the coast from Boston to the Chesapeake. From practically every resort along the Jersey Coast came similar reports of damage to boardwalks, bath houses and beachfront buildings.

(Copyright 1920 by the Wheeler Syndicate, Inc.)

"The Wireless Disturbance"—Not mysterious enough, however, to be considered a possible message from Mars.—By Fontaine Fox

German Wireless News Service

THE first German paper to install a wireless plant for collection of news is the Danzig Gazette. The first dispatches have arrived without mutilation.

This is the first concrete result of the Giesberts plan to establish an entire chain of wireless stations connecting the larger papers of Germany.

Two Timely Topics—

25-Mile Radiophone Transmitter Using Marconi V T's for 200-Meter Amateur Work.

The Coil Aerial—Its Use as a Direction Finder

—in the April Wireless Age

www.americanradiohistory.com

Commercial Radio Across Atlantic and Pacific Opens

First Direct Communication Between United States and Great Britain Inaugurated with Congratulatory Messages—Service to be Extended

COMMERCIAL wireless telegraphic communication direct from the United States across the Atlantic and Pacific oceans was realized for the first time at 12:01 o'clock on the morning of March 1st. The huge trans-oceanic wireless stations were turned over by the Government to the Radio Corporation of America at the stroke of midnight, February 29th.

The first wireless message since war control was lifted was sent through the New Brunswick (N. J.) station. The message marked an epoch in wireless history. Never before has there been established direct communication between the United States and England. Before the war the United States communicated with England by way of Canada. During the war the only wireless communication with England was under Government control.

Edward J. Nally, president of the Radio Corporation of America, issued the following statement:

"While the radio stations were controlled by the Navy Department, it was not possible for us to develop the full commercial possibilities of the wireless. The Radio Corporation of America, which took over the Marconi Company and all radio inventions and improvements of the General Electric Company, is now free to go ahead with the large plans for the development of a wireless service that will bring quick communication with all parts of the world.

"It will take some time to make the necessary readjustments. On the first day of the return of the wireless we devoted ourselves to communication between New York and Great Britain. In the near future we will develop the service with Norway.

"From San Francisco we are providing service with Honolulu and Japan. Later on, we will develop wireless communication with China, South America and the West Indies. Work is already being done in connection with a super-high power plant in South America."

Within a few weeks, the Radio Corporation expects to reopen the Tuckerton (N. J.) plant, which has been put out of commission by storms. This plant, which was partly under French ownership, was purchased some time ago and will be used for commercial communication with the high-power station at Lyons, France. Commercial communication with Norway will be by way of two stations in the neighborhood of Cape Cod. The duplex circuit will be employed. The Marion (Mass.) station will send to Stavanger, Norway, while Chatham, Mass., will receive messages sent from Naerboe, Norway. All four of these stations will have the same modern high-power equipment as the New York-Wales system.

The first three messages from the New Brunswick Station follow, in the order in which they were sent:

Godfrey C. Isaacs, Managing Director, Marconi's Wireless Telegraph Company, Ltd., London:

May this message, which opens commercial wireless telegraph service between America and England, mark an epoch in history from which the achievements of the future shall date. Communication is the leverage which shall lift the world to better understanding and thus lead to closer ties of friendship between all nations. It is the mission of our respective companies to so strengthen and improve the wireless service that distance shall be made negligible and communications practically instantaneous.

EDWARD J. NALLY.
President Radio Corporation of America.

President of the Chamber of Commerce, London:

Now that the war controls have ceased and the Radio Corporation of America has been honorably discharged from the service, we foresee closer and quicker business association, and we are confident that this new means of prompt communication and understanding will enable the business men of New York to work more closely with the business men of London, not merely to the advantage of themselves, but for the greater progress and benefit of civilization.

ALFRED E. MARLING, President.
New York Chamber of Commerce.

Imperial Commercial Association, 4 Callum Street, London, E. C. 3.

Upon the occasion of the opening of commercial wireless service between the United States and Great Britain, the Merchants Association of New York desires to extend to the Imperial Commercial Association of London its cordial greetings and its good wishes for the continued growth and success of your esteemed organization, and further to express the hope that the hearty co-operation with our association which has existed in the past may continue in the future.

WILLIAM FELLOWES MORGAN.
President, The Merchants Association of New York.

Mr. Nally received this reply to the first message:

Edward J. Nally, President, Radio Corporation of America, Woolworth Building, New York City:

Your first message by the new direct wireless service between America and England expresses exactly the desires animating the activities of every one here. We are certain that this day will pass into history as one upon which was forged a most valuable link of communication between the English-speaking peoples of two great continents. The British nation whole-heartedly desires the closest possible friendship with the United States of America, and my company, imbued with the national sentiment, will spare no pains in contributing to the fulfillment of this desire by assisting in the provision of practically instantaneous means of communication.

GODFREY C. ISAACS, Manager Director.
Marconi's Wireless Telegraph Co., Ltd.

Smaller stations reverting to private ownership include those of the United Fruit Company at New Orleans and Boston, the Mutual Telephone Company in the Hawaiian Islands, the International Radio Telegraph Company at Brooklyn, and Newport, and the Marquette and Bessemer Dock & Navigation Company, at Conneaut, O.

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Interplanetary Radio Signals?

Varied Views On the Question Whether Inhabitants of Mars Have Been Trying to Signal Us By Radio

ARE there intelligent beings on the planet Mars, and have they been persistently signaling us by radio across several hundred million miles of interplanetary space? This is the question which has been agitating the scientific world for the past few months.

Interruption of the Marconi wireless instruments by mysterious undecipherable signals, which were noted before the war and have been publicly referred to since, were discussed by Marconi in an interview published by a London newspaper on January 27th.

"We occasionally get very queer sounds and indications, which might come from somewhere outside the earth," said Signor Marconi. "We have had them both in England and America. The Morse signal letters occur with much greater frequency than others, but we have never yet picked up anything that could be translated into a definite message.

Guglielmo Marconi, who has protested against the interpretations put upon his original statement that mysterious radio signals may arise in any point of inter-planetary space

"The fact that the signals have occurred simultaneously at New York and London with identical intensity seems to indicate that they must have originated at a very great distance. We have not yet the slightest proof of their origin. They might conceivably be due to some natural disturbance at a great distance—for instance, an eruption of the sun—causing electrical disturbances."

Asked whether possibly attempts were being made by another planet to communicate, Marconi said:—"I would not rule out the possibility of this, but there is no proof. We must investigate the matter much more thoroughly before we venture upon a definite explanation."

He added that the mysterious sounds are not confined to any particular diurnal period. They are equally frequent by day and night.

Marconi said that Morse signal letters occur with much greater frequency than others, but nothing has been picked up that could be translated into a definite message.

"They are sounds," Marconi added. "They may be signals; we do not know. They are not what operators call atmospherics, and we have nothing to guide us at present as to how they are caused. We do not get them unless we set up a special wave length, very much greater than the wave length ordinarily used. Sometimes there may be a long wait before we hear anything, or we may hear these sounds in twenty minutes or half an hour. They occur when we are using a wave length of approximately 100 kilometers (100,000 meters), which is three or four times the length used for commercial purposes."

"We have not yet the slightest proof of their origin."

Later, the distinguished inventor of wireless said that investigations are in progress regarding the origin of the mysterious signals, insisting that "nobody can yet say definitely whether they originate on the earth or in other worlds."

Probably no single statement relating to the radio art has caused more widespread comment. Opinions and discussions on the subject have come from all quarters of the globe. In the mass of material which has reached the Editor of WIRELESS AGE, many phases of the question are reviewed. It is impossible to deal with the multiplicity of angles and viewpoints represented, but a few selections have been made to the end of illustrating the diversity of thought on the subject.

Dr. E. F. W. Alexanderson, chief engineer of the Radio Corporation of America, states that no unusual interference or mysterious wireless signals have been noticed by the officials of his company. He believes that the disturbance, if any existed, was purely terrestrial since the persons who have noted it assert combinations of the Morse code have been received.

"It is impossible for the people of Mars or any other planet to know the Morse code," in his opinion. "The supposed signals which are considered unusual probably are produced by some spark station and are being heard at a greater distance than ordinarily because of the clearness of the atmosphere and the absence of static. The fact that the mysterious signals are partly decipherable bears out my contention."

Dr. Charles P. Steinmetz, inventor, and for many years the chief consulting engineer of the General Electric Company, believes it possible to communicate with Mars, but notes: "The probability that these strange wireless messages noted by Marconi really do come from Mars must, to the practical mind of the day, be regarded as a wild dream. It nevertheless opens up interesting scientific speculations, and we know that many of the speculations of half a century ago have now become tangible realities. If the United States, for instance, should go into the effort to send messages to Mars with the same degree of intensity and thoroughness with which we went into the war it is not at all improbable that the plan would succeed. To do so would mean the consolidation of all the electric power in the country into one great plant or sending station. Lofty towers would have to be erected, 1,000 feet high or more, and the cost of the attempt might be a billion dollars."

Dr. Steinmetz notes: "When Mars is nearest the earth the distance is about 50,000,000 miles, but the distance varies, and at certain periods Mars is as far as 250,000,000

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miles away. These changes from extreme to extreme take place within a few years. It has been stated, I notice, that these strange messages apparently come in about 100 kilometer wave lengths, a little less than seventy miles. That is much longer than any wave lengths required for our greatest earth messages, and those lengths could be accurately measured. Now 100 kilometer wave lengths would be quite sufficient to transmit wireless signals through 50,000,000 miles of space or more. It is just about what we might expect in wireless communication with Mars.

"These messages must be received in the Morse code, for telegraph signals must come either short or long, that is, by dots or dashes. What makes them strange is that they are so mixed up that they cannot be understood. The proper thing to do when these strange messages come is to keep a careful record of them. If a number are received with the same degree of intensity in different parts of the world, say in London, New York and Australia, all being of these unusually great wave lengths, we could then reasonably suppose that they must have come from some point outside of the earth as the

Dr. James Harris Rogers, sponsor of an underground wireless system hopes to receive signals from another planet

distances at the various places where they might be received would have no effect upon the result. In addition to noting the intensity of such messages at various places, by keeping a record of them it could be ascertained, when enough had been collected, whether any parts of these undecipherable Morse code messages were similar, that is, if there was a reasonable conformity in sequences of the strange code. If that could be proved, it would evidently indicate that they were sent from an intelligent source, but if no harmony could be found, it would be apparent they must be due to unexplained atmospheric conditions.

"Another evidence for determining whether these messages came from an intelligent source would be to note the force with which they come, as the distance between the earth and Mars changes within a few years. At 50,000,000 miles the signals would doubtless be stronger than when several million miles further away. Provided such records could be kept, we could surely arrive at a very definite conclusion as to their origin. It is true we might not be able to decipher the code, but it would indicate very satisfactorily that messages could be sent from one planet to another and that intelligent beings were inhabiting the planet from which they came."

The Mars theory may be all imagination and a wild dream, according to Dr. Steinmetz, but he values it as an interesting subject and one which is not without its possibilities of success.

E. Leon Chaffee, assistant professor of physics at Harvard University, thinks the so-called messages are nothing more or less than static. He believes: "There are two possible causes for the troublesome messages that have been bothering wireless operators by cutting in on their real messages. One of the most probable causes is extraordinary atmospheric disturbance, perhaps sun spots. The other, which is improbable, is that the interruptions are coming from some high-powered wireless station where experiments are being carried on in Japan or some distant country. That is only a bare possibility."

Interest manifestly outweighs skepticism among radio experts at the Navy Department. Proponents of the theory noted that they would enjoy the advantage of having no competent disputants, at least until science in some way accounted for the mysterious interruptions that had been experienced ever since wireless telegraphy was perfected.

"These interruptions or 'influences' are entirely distinct in their registering effect from influences readily traceable to atmospheric or static conditions," according to Captain W. S. Bryant of the naval communications service. "They record with a feeble or 'mushy' intensity as compared with the clashing effect of static disturbances. I confess that they have been a much greater source of annoyance, however, than of interest. Whether or not they emanate from Mars, as suggested by Marconi, seems to be an open question so far. It is at least one that affords pleasurable exercise for the imagination."

If the inhabitants of another planet do signal us it won't be in the Morse code, according to Prof. Harold Jacoby, head of the department of astronomy of Columbia University.

"Marconi speaks of the Morse signal letters occurring more often than any others," observes Prof. Jacoby, "and that fact alone seems to me to show that these messages are not extra-terrestrial, but come from some place on the earth.

"It is highly improbable that the people of another planet, if there are any such, would be acquainted with the Morse code, which is a complicated system of dashes and dots based on our alphabet. It was invented by Morse and cannot be regarded as universal among civilized peoples.

"Marconi cites the fact that the sounds have occurred with equal intensity in New York as in London as proof that they come from a very great distance. But it seems to me that this is only proof that they come from equal distances. The messages might be sent from some point equally distant from New York and London and yet not from a point beyond the earth."

If wireless messages are being received from some other planet the signals are not from Mars, but most probably from Venus, according to Dr. C. G. Abbot, Director of the Smithsonian Astrophysical Observatory and Assistant Secretary of the Smithsonian Institution. Dr. Abbot makes no claim that the mysterious wireless signals do come from another planet but says, if they do, Mars is eliminated as a possibility because known conditions on that planet probably would not permit the existence of any form of living creature.

Dr. Abbot notes the fact that on account of the greater distance, nearly two and one-half times less radiation from the sun reaches Mars than reaches the earth. It is probably nearly 100 per cent. colder on the average on that distant planet than on the earth. Knowing what low temperatures occur on this earth in the course of the winter season, it will readily be realized what 100 degrees colder would mean.

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Intermittent waves, which seemed to be repeated with persistency, were recorded at the end of January at several wireless stations in Baltimore. The signals did not resemble a code but repeated a formula, over a wide range of wave lengths. It is said that they were heard with equal ease by commercial and amateur stations at a time when London announced that identical "messages" were being recorded in a British station.

Opinions expressed from Johns Hopkins University show scientists are divided on two theories—first, that the emanations are due to celestial disturbances, and, second, that the mystery may be explained by reactions from internal disturbances near the earth's core. Dr. Joseph S. Ames, professor of physics and director of the physical laboratory, thinks the information thus far made public by Marconi on the phenomena he observed is insufficient to provide a basis for scientific discussion.

That the undecipherable signals originate in some other world appears a possibility to J. Loring Arnold, professor of physics at New York University. He states:

"It seems to me not improbable that these unusual sounds may be caused either by some influence of the sun or by some planet's efforts to communicate with us. However, the latter explanation is mere supposition at best, and the great inventor's explanation seems the most logical."

Isabelle M. Lewis of the United States Naval Observatory believes that if Mars is indeed trying to signal to the inhabitants of our planet by wireless, a continual record of the nature and intensity of the disturbance will soon reveal the fact. The next six months should settle the question.

Dr. James Harris Rogers, sponsor of an underground wireless system, believes that within a year wireless communication will be established with Mars. He announces his intention to tune his receiving apparatus to 100,000 meters and hopes to get signals from another planet. He thinks that if Martians are sending their signals they selected this long wave length so as not to be confused by any signals used on this planet.

A New York radio engineer, L. J. Lesh, believes it possible to build a gigantic sending station and finally to devise a code for communication with the radio experts on Mars.

Although he believes that one of the methods of constructing a station would be to erect huge antennae suspended by balloons like the British dirigible R-34, he asserts that a still better way would be to use huge and brilliant shafts of light as antennae for the system. Still another idea put forward by him is that two immense sky-high towers be erected with wires or antennae suspended from them.

"Possible but not probable," is the comment on the Mars signaling made by Dr. Samuel A. Sheldon, head of the department of electrical engineering at Polytechnic Institute of Brooklyn.

"It is an interesting conjecture, but I should call it hardly scientific," he says. "Of course we would have to suppose that the Martians are an older and much wiser race than ours, and that they have learned a great deal more about sending wireless messages than anything we know. But even with that supposition a man must have a very vivid imagination to picture a sending station powerful enough to reach across the vast distances that lie between the two planets at their nearest approach.

"What may have caused the mysterious disturbances on Mr. Marconi's instruments has probably had a natural origin. We know there are certain black spots on the surface of the sun which recur periodically, and which are accompanied by electrical storms of unimaginable fury. We also know that these spots have been unusually large and variable during the last few months. What is more likely than that they have sent out radio waves which have jumped the gap between the sun and the earth and disturbed the instruments here and in London with an equal intensity?"

Commander R. L. McConnell of the U. S. Navy, radio supply officer at the Brooklyn Navy Yard, is equally skeptical of the Martian origin of any radio waves that have reached the earth.

He looks upon inter-planetary signaling, however, as an imaginable next step. According to his view, if the Martians have learned of the existence of radio waves, there are only two conceivable methods they would employ for signaling with them—the modulated (that is, the telephone) method and the interrupted or dot-and-dash method. Of these the dot-and-dash method would be the easiest and most probable to be used, as the telegraph was used before the telephone. Of course, their code would not be the same as ours, but it is not at all unlikely that some of their individual signals would correspond to letters of our Morse alphabet.

Charles P. Steinmetz, of the General Electric Co., notes that the Mars theory opens up interesting scientific speculation

"The power plant for such a radio station would have to be an enormous building, covering hundreds of acres. The antennae for such a station would reach half way across North America, and the cables used for it would be as thick as the largest tower of the group of buildings here in the Navy yard.

"That's what the Martians would have to construct on their planet to get their signals across to us. Perhaps they have done so. But it looks very improbable to me that they have."

Elmer A. Sperry, president of the Sperry Gyroscope Company, offers to send signals directly, by means of powerful searchlights, to the planet Mars; and then if there are any inhabitants there they can answer. Two hundred 60-inch searchlights such as were used in the war he thinks would do the trick, although he would wait until 1924, when the planets are nearest one another, before trying it.

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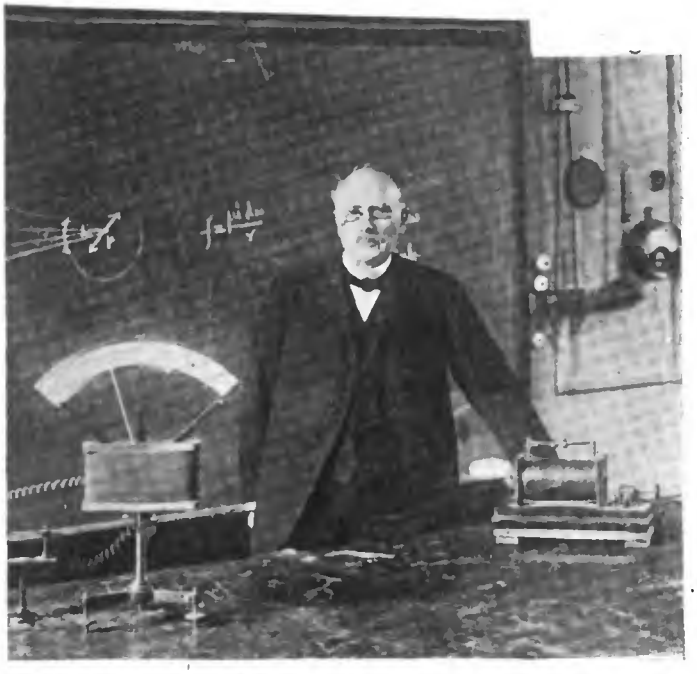
Dr. Louis Derr, of Massachusetts Institute of Technology, with much vigor denies that the messages occur from disturbances on the sun. "The sun is an enormous body that sends out magnetic storms like waves; they don't come in dots and dashes," he says. "You don't expect an elephant to dance a jig."

The wireless messages received at the Marconi station, in the Massachusetts professor's opinion, come from some distant worldly station.

Opinion from those of lesser attainments bulks large in quantity and quality. Many amateurs take the subject seriously; others deal with it in lighter vein. Even the lay public has had a large and generous say, for as one non-technical writer expresses it, "a great public stands respectfully attentive in the presence of specialized wisdom." After balancing skepticisms and desires, this man is forced to "the admission of a magnificent chance, and it is the magnificent chances that give zest to human life."



Prof. Edouard Branly, leader of French scientific opinion, who thinks the discussion of signals from Mars is based upon a highly improbable succession of coincidences

Another notes: "Certain it is that we are not always to be hermits in the great spaces of the skies. Certain it is that some time we shall find a language common to the universe and discover a means of communication. Perhaps the great Marconi is already on the way to the solving of the problem and the abolishment of the distances and the silences that now separate us from the other worlds and their peoples. The first message will be real news."

"The appeal of such a subject," observes another, "is hardly to be overestimated." In agreement with this view is one which characterizes the present "an ideal time in which to bring out this notion because the world is not prepared to believe almost anything except the obvious truth and we can already see an increase of interest in wireless which may stimulate the amateurs—if, indeed, they need stimulating in their fascinating work."

The disturbances may not be the result of efforts by other worlds to communicate with us, says one writer who evidently believes they are caused by the contestants in another great war on some distance planet.

Scores of opinions have been given on the value of the things we can learn from the Martians, who presumably have reached a more advanced civilization, yet through all of these runs the strain of doubt of communication success; a typical expression on this point is this one: "But when it is remembered that our wireless devices are the product not only of mind but of metals, and of long years of experimentation in a dozen branches of science, it's discouraging."

Then there are many who have written in facetious mood. Representative of the comment in lighter vein is the apprehension that the Martians won't care to communicate with us, that "we are not certain that whatever inhabitants the stars may hold would not be too uppish to lean over the cosmic fence and ask us how our gardens are getting on."

Some of the most amazing flights of fancy are to be found in American newspaper editorial comment. In one editorial column it is suggested that the signals "may come from the earth's center for all we know. Planetary transmission is doubted except in the automobile world." In another it is advanced that the undecipherable signals "may be nothing more than radio messages from Bolsheviki Russia explaining the beauties of the Lenine-Trotzky formula for perfect human happiness." In mock seriousness it is also commented: "They probably proceed from the inner consciousness of small nationalities, still clamoring for the right of self-determination."

The assertions of astronomers, eliminating Mars as the source of signals but conceding Venus as a possibility, have brought forth many fanciful constructions of the subject. One editorial complains that most of the earth's population are a bit "fed up" on the warlike planet at the present time "and would welcome more cordially overtures from almost any other planet." Another asks: "What could be a greater or more agreeable change than a transition from the harsh commands of Mars to the gentle influences of Venus?" It is also suggested that, "there appears to be only one way to settle the raging controversy, and that is by referring the decision to the ouija board." One writer pleads that there should be no doubt in the minds of thoughtful persons "that somebody, or some planet, somewhere, is trying to get in touch with the United States Senate," desiring "some pointers on the most marvelously incomprehensible doings that have ever been known." It is also urged that "scientists of this sphere perfect their receiving apparatus and discover a rosetta stone whereby the language of that other globe may be translated." This, presumably, will result in them "telling us what they think about prohibition."

Foreign comment also has some interesting features. Sir Frank W. Dyson, astronomer royal of Great Britain holds the opinion that it is quite possible to get waves from other planets. Sir Richard Gregory, professor of astronomy at Queens College, London, and editor of the scientific weekly *Nature,* thinks the whole proposition "unbelievable as well as a dream." Professor Howe is conservative but not scornful in his observation: "All we know is that electro-magnetic waves are received from an unknown source. The most important part of Signor Marconi's statement is his attribution of the noises to alphabetical letters. It is not inherently impossible that the people inhabiting Mars have a life, language and Morse code similar to ours." Mrs. Ellen Roberts Blackpool, however, is not content to stand by the stereotyped versions and in a London letter to Marconi advances the novel theory that "the spirits of departed wireless operators gone to other planets are trying to get into communication with you."

Italian opinion shows a wide division, Father Alfani, director of the Ximenian Observatory in Florence, terming the spread of rumors on planetary messages "absolutely scandalous," while Professor Domenico Argentieri, in this same city, thought: "Because of the regularity with which the signals have been observed, scientists believe they are due, not to mechanical, but to intelligent force." From Rome, word comes that the Vatican will make an investigation, the theory of planet signals being of such interest that Pope Benedict has directed Cardinal Maffi to make a report.

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Absence of skepticism, too, is notable in the statement of Dr. Hubert Bianchi, M.P., who for many years was director of the Reggio Calabria wireless station. He says "that fifteen years of study and experimenting on the subject, convinced him that the mysterious signals are quite unexplained on the hypothesis either of earth currents or of disturbances arising from atmospheric discharges or even of stray signals from neighboring stations.

"When I began my investigations in 1905," he writes, "I noticed almost nightly, between midnight and 12.45, that our telephone and the Morse key inserted on a coherer wire, were registering rapid rhythmical signals, which could not be deciphered. These were followed by brief intervals of silence. The whole process resembled the regular transmission, only much quicker than normal. My corresponding station at the Villa San Giovanni and Messina never experienced phenomena of this sort."

Out of Germany comes word from Professor Einstein that he personally is "inclined to believe that these wireless interruptions are due either to atmospheric disturbances or secret experiments being carried on by some other system of wireless telegraphy." Professor Arrhenius, of the chair of physics in the Technical Institute at Stockholm, Sweden, thinks the planetary theory unworthy of serious consideration and believes it is more probable that the wireless apparatus may have been influenced by the sun.

The French Academy of Sciences evidently considers communication between the earth and the planets as among the possibilities. It has undertaken to act as judge for a prize of 100,000 francs ($20,000), to be given by the Academy for the best means of making a sign to a heavenly body and the receipt of a reply.

French savants are inclined to attribute the unexplained wireless impulses to earthly causes. Most of the French press treated the whole matter as a joke, under such headings as "Hello, Central give me the moon," but some of the more serious journals devote studied attention to the questions raised by Marconi.

Professor Edouard Branly, inventor of the coherer, thinks that the fact that signals come in letters of Morse code tends to discredit the theory that they are of other than earthly origin. He says:

"If we attribute these phenomenas to solar eruptions, how can we explain that they come in Morse? If we attribute them to inter-planetary sources (admitting that planets are inhabited), we must then admit that their people have reached a degree of development comparable to ours and that their science has led them to construct instruments similar to ours. This would be a succession of coincidences that I would call improbable.

"It might be that solar eruptions were the cause of wireless phenomena, since light has certain effects on electro-magnetic currents. It might be possible that these disturbances caused raps in our receiving instruments, but not letters of the Morse code."

General Ferrié, head of the military wireless, notes:

"We have heard nothing abnormal recently at the Eiffel Tower. We have disturbances which bother our communication, but they are continual. We attribute them to atmospheric variations and sometimes to the magnetic influence of the sun. We call them parasites of radio, but we do not think they are supernatural."

Marconi's original statement, in so seizing upon the imagination of the world, has been so widely discussed and distorted that a supplementary statement has been issued by the famous inventor. In this he says:

"I desire to protest against the interpretations that appear to have been put upon statements which I have made with regard to the possible sources of what are being termed mysterious messages from the unknown.

"Wireless messages are transmitted through the ether by the agency of electro-magnetic waves of definite lengths which can be adjusted, and in order to receive such messages the receivers must be tuned to the particular wave length that is used for transmission.

"At times signals are received which are apparently due to electro-magnetic waves of great length (up to hundreds of miles) and these signals are of the same character as those commonly called X's, or strays. Occasionally such signals can be imagined to correspond to the Morse signals for certain letters, and these signals occur at all seasons and irregularly.

"The sources of such signals are not known. They may be in the atmosphere or outside it and due to electrical disturbances. If outside the atmosphere they may arise in any point of inter-planetary space where it is well known electrical disturbances occur.

"Obviously, since the planet Mars is situated somewhere near inter-planetary space, the source of such signals might be on it or any other planet. There is nothing, however, to show that this is the case nor must any purely fanciful speculations of mine be interpreted to mean that I asserted having received any intelligible or unintelligible messages from Mars or from any other point in space outside the earth."

Hearing Things

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Radio Operating as a Career

Just What to Do in Order to Become a Member of a Dignified, Fascinating and Highly Paid Occupation

By Pierre H. Boucheron

Formerly Naval Radio Instructor

The operator has many chances to study navigation

THE aftermath of war brings a new era of opportunities to the young man contemplating the study of radio telegraphy, either as a profession or as a stepping stone to radio engineering. There has been a great increase in the number of American vessels, and today it is indeed a small and unimportant ship which is not equipped with radio apparatus. At present there is a great demand for radio operators, a demand which greatly exceeds the supply, and which will probably continue for some time to come. It is no uncommon occurrence for a ship to be held up several days at a port, unable to sail on account of the scarcity of competent operators.

This state of affairs is hardly surprising when one considers that the number of American vessels is rapidly approaching the 3,000 mark, as compared with the few hundreds of pre-war days. Today, the Seven Seas are literally dotted with ships of the American merchant marine. Each ship means another opportunity. And this boom is not a temporary one, for it is inconceivable that the United States will relinquish its re-established position in ocean transportation.

This article will therefore concern itself with the advantages, opportunities and profit which may be had with remarkably little effort on the part of the average individual who aspires to become a radio operator, mentioning the most rapid and effective way in which he may prepare himself.

PRIMARY CONSIDERATIONS

First, just what are the desirable qualifications? And are there any assets which materially assist in the business of preparation?

The most desirable age for beginners is within the years from 18 to 25, because during this period the mind readily absorbs new material, perception is more rapid and the senses are keener than at a later age. Particularly is this true in the matter of learning to read the Continental Morse telegraph code. It must not be inferred that an older man cannot learn the profession; it may take him longer to become proficient, but he has one advantage over the young one, for once he learns a subject his developed brain retains the knowledge more firmly than it remains in the more pliable mind of the younger man.

A common school education is sufficient. A high school or college graduate, however, may make more rapid progress, and he certainly will have decided advantages as he advances to more responsible positions.

Experience as a land line telegraph operator or familiarity with the Morse or Continental is an initial asset; ability to read signals on the sounder makes it possible to cut down two months of preliminary training in code practice.

The advanced radio amateur has a very material advantage over any other class of embryo Marconi, and with a little additional prepartion and study may easily secure a government commercial license.

ATTENDING A SCHOOL

There are several ways in which you may become a professional radio operator; your selection should naturally be the one most readily available to you under existing circumstances. For instance, if you are an absolute beginner, the most satisfactory start is to attend a reliable radio institute or school,* securing either day or evening instruction. With resident instruction you will learn the fundamentals of radio theory together with practical operation of all manner of apparatus, and will become proficient in sending and receiving messages. It is most important that you attain skill in key manipulation as quickly and as efficiently as possible, as it is really the stock-in-trade of the professional operator.

Mastery of the code is the most difficult task of the beginner. It is essential that you devote as much time as you possibly can to the practice of sending and receiving. Your progress in learning and the length of time it will take to complete your course depends materially on your sending and receiving speed. To complete a radio course at a resident school requires, roughly estimated, from two to four months and depends entirely on the following conditions:

1. Your previous knowledge of either radio or wire telegraphy.
2. The degree of enthusiasm, the adaptability and the consistency you display in your studies and *code practice.*
3. The extent of your education.
4. The amount of time you are able to devote to study. If it is necessary for you to earn your living while undergoing instruction, attending night classes is the most logical thing to do, although this, of course, may take a longer period of time than day instruction.
5. Your resources while learning, though this is really secondary, as tuition fees are very reasonable compared to other forms of instruction.

HOME STUDY

Although attending a resident school is the most effective way for the novice to begin, it is nevertheless possible to become a proficient operator by home study; in fact a great many professionals have never attended radio schools nor received systematic technical instruction on the subject. The home student must, however, be very careful in code practice as it is very easy to acquire undesirable mannerisms and poor style of operating. Professional operators should be questioned on any points not quite clear, and from them should be learned the proper manner of holding the key, making and spacing telegraphic characters, how to copy signals accurately, and other points which must be specifically brought to the attention of the beginner in person.

It is very essential that the home student erect a com-

*Marconi Institute, New York City and San Francisco; various Y. M. C. A.'s; and the Eastern Radio Institute, Boston.

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plete radio receiving station, and if his means permit him, a sending outfit as well. The experience acquired in the process of installing will prove valuable in the future government examination, and a home station permits its owner to personally "listen-in" on *actual* radio operating and secure the necessary practice in receiving by intercepting and learning to copy press dispatches, weather reports, commercial messages, etc., in the regular operating fashion. The student, too, thus becomes familiar with the various forms of "static" or atmospheric disturbances and he learns to read signals during its presence, which is quite a feat in itself. The importance of learning to read through "static" is recognized by all schools, some of which have specially constructed automatic sending machines so arranged as to mingle artificial "static" among the transmitted signals, thereby teaching the student to copy through this form of interference. By having his own receiving set, the home student also becomes familiar with the art of "weeding-out" unwanted signals as well as reading and copying through a certain amount of interference.

Learning to Receive

Sometimes it happens that after the home student has installed a receiving outfit, provided himself with a good text book on practical radio telegraphy,* and has had several weeks of practice, he finds himself unable to make out three consecutive letters while listening-in with his receiver. If this is the case he should not become discouraged, as this is due to his ear not having reached a point where it is readily able to quickly recognize and retain the meaning of each character while it is being transmitted. There are two general ways of acquiring the necessary receiving speed up to the point where the home student may at least read one or more words out of every five intercepted on his receiving set. One method is by securing the aid of a friend and devoting a certain amount of time to the practice of sending and receiving, each taking turns at sending and receiving. This method, to be of value, must be practiced in a systematic manner and in accordance with a carefully planned schedule. Little benefit is gained by practicing four hours one evening, and not at all during the remainder of the week. It is better to spend one hour each day in conscientious practice and keep it up consistently. Because resident schools are very insistent in the matter of regular code practice their students make good progress; it is required that from three to four hours be devoted to sending and receiving practice each day in the day classes, and from one to two hours in night sessions.

Another method of learning, which may be resorted to in the absence of a fellow-student, is by automatic sending machine.* These are usually operated by a clock spring or a small electric motor which causes a disc, cylinder or tape record to move in such a manner as to accurately reproduce the transmission of dots and dashes, either in connection with a high frequency buzzer and telephone head receivers, or with a telegraph sounder. The beginner may adjust the automatic transmitter so that it will send as slow as two or three words a minute and as the student gradually learns to quickly recognize each individual letter, the speed may be slowly increased up to twenty or twenty-five words per minute, which is the acknowledged practical and commercial speed of radio signaling today.

A word concerning sending and receiving. This concerns the school as well as the home student.

It is often asserted that sending is comparatively easy to learn while receiving is difficult. This is very misleading, for as a matter of fact, it is really quite a stunt to learn to send properly, while receiving is simply a matter of sufficient practice. At the present stage of the game it is really a delight as well as a rarity to hear a good sender, either radio or telegraph. This is largely due to improper sending instruction at the very start, resulting in the operator acquiring slip-shod and careless habits of making certain letters, such as sending *i* for *a; g* for *o; e* for *t;* etc., and unless the receiving operator at the other end has had considerable experience in reading all manner of sending he will be unable to properly copy the message. In consequence, time is lost by repetition, haranguing and the exchange of derogatory remarks, all of which is inefficient. The beginner should therefore be very particular in the manner in which he makes his characters. He should adopt a clear, decisive dot and dash form with the proper letter and word

*"Practical Wireless Telegraphy," Wireless Press, Inc., New York.

*The Omnigraph.

The most satisfactory start is made in attending a relisble radio institute or school, securing either day or evening instruction. The illustration shows a code class at the Marconi Institute

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spacing and time interval. This factor is known and referred to by professional operators as *telegraphic judgment.*

There is also a right and wrong way to hold the key, and the wrong way is not conducive to the making of perfect dots and dashes. Use the first three fingers of your right hand, grasping the forward part of the key knob with the end of your thumb while the other two fingers reach out to the backward part of the knob, thereby insuring firm and yet pliable grip of the key. Also, the up and down motion should be controlled from the wrist and not from the finger ends, as is mostly done. The principle is the same as that employed in the Palmer handwriting method—it is a wrist motion and is meant to relieve the fingers from the strain of too-concentrated muscle action, thereby preventing "writers' cramp" or telegrapher's paralysis. Remember, it is just as easy to form right habits of sending at the beginning as it is to acquire wrong ones. If the right method is acquired at the start it will be retained to the end and clear-cut and easily readable sending will always be possible. On the other hand if the start is made with a careless and slipshod "fist" it will always remain a handicap.

Learning to read and copy radio signals fast and accurately is, after all, not as difficult as it may seem. The most trying and discouraging part for the beginner is from the time he first starts to the point where he can begin to copy a few consecutive words without error; when this point is reached the student takes on new life, so to speak, and he immediately begins to gain confidence in himself, which fact comes in good stead when later he attempts to copy actual signals straight out of the air.

The operator has the chance to visit many parts of the world which are seldom accessible to any but the very wealthy

In training naval radio operators during the war, it was found that the old method of sending plain English taken from a book or newspaper was improper and really retarded the student's receiving speed by giving him a false notion of his progress. This was due mainly to the unavoidable habit of guessing at words or writing down what he thought would be the following word, as well as due to the fact that the student secured practically no practice in receiving uncommon and seldom used letters, such as *x, z, q, j,* etc. In order to overcome this, meaningless and disconnected groups of letters comprising every letter of the alphabet, similar to code and cipher groups containing from four to ten letters each, were used exclusively, and this was kept up until the student had acquired a receiving speed of at least 15 words per minute, at which time he was permitted to, and could readily copy plain language or press items as well. The following are a few examples of code and cipher groups:

CODIAC	STQAINT	13084
NOMADE	NZOLXYO	78620
LASTOR	LZIMNST	59032

It is recommended that where two or more beginners have firmly resolved to learn to read the Continental Morse code, that they make up a series of practice sheets upon which has been written or typed all manner of letter and numeral combinations similar to the above, each sheet containing four, five or eight letters of code and cipher words. By the way, code usually refers to pronounceable words whether they have any dictionary meaning or not, such as LAMBASNOBE and YOKER, while cipher is an arrangement of unpronounceable letter or numeral groups having a prearranged meaning, such as LMXTO ZLNSA AOSLN 67542.

THE THEORY AND PRACTICAL SIDE OF RADIO OPERATING

In addition to being proficient in sending and receiving the Morse Continental code, a professional radio operator must also be familiar with the theory and manner of operating every part of a ship or shore station installation. This can be learned from text books, coupled with a certain amount of actual experience with transmitting and receiving instruments, and this is where the advantage of attending a radio school becomes a factor.

A word of advice concerning this important subject.

Remember that in order to pass the government examination it is not sufficient that you simply learn by rote certain stock radio phrases and explanations and attempt to palm these off in the written examination. This will not do at all. You must actually know what you are writing about and know the subject well. The writer recently heard of several young men who felt very confident about passing the examination, referring to the questions as "the same old dope"; when taking the examination they answered all questions in monosylabic form, giving little or no detail and so abbreviated their answers that the examiners were unable to determine the extent of their knowledge of the subjects. As a result they were given so low a mark average that some failed to secure even a second grade license. It is most essential before you apply for permission to take the examination that you be fully versed in all subjects mentioned in another section of this article, and also that you be prepared to receive and transmit the Continental Morse code at a speed of not less than 20 words a minute—five letters to a word.

GRADES OF LICENSES AND REQUIREMENTS

Before you can become a commercial radio operator, you must be examined as to your professional knowledge by government officials. If found qualified you will be granted a Commercial Radio Operator's License, of which there are three grades. The complete classification of licenses follows:

1. Commercial Extra First Grade.
2. Commercial First Grade.
3. Commercial Second Grade.
4. Commercial Cargo Grade.
5. Commercial Temporary Permit.
6. Experiment and Instruction Grade.
7. Amateur First Grade.
8. Amateur Second Grade.

In this article we shall confine ourselves to the most important commercial grades.

COMMERCIAL EXTRA FIRST GRADE: To be eligible for this license, an operator must have previously held a Commercial First Grade License, and have eighteen months or more of satisfactory sea or land service; it is only issued where trustworthiness and efficient service entitles the operator to confidence and recognition. The examination consists of the following subjects:

(a) Adjustment, operation and care of apparatus.

(b) Transmitting and sound reading at a speed of thirty words a minute Continental Morse, and thirty per minute American Morse.

(c) Use and care of storage batteries or other auxiliaries.

(d) Knowledge of International regulations and Act of Congress to regulate radio communication.

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(e) Knowledge of U. S. Naval Radio Regulation.

COMMERCIAL FIRST GRADE: The applicant must pass a satisfactory examination in the following:

(a) The adjustment, operation, and care of the apparatus, including correction of faults and change from one wave to another.

(b) Transmitting and receiving by ear at a speed of not less than twenty words per minute in Continental Morse (five letters to the word).

(c) Use and care of storage batteries or other auxiliary power apparatus.

(d) Knowledge of the International Regulations in force applying to radio communication.

(e) Knowledge of the requirements of the Acts of Congress to Regulate Radio Communication (sections 3, 4, 5, 6, 7 of the Act of August 13, 1912).

The COMMERCIAL EXTRA FIRST GRADE and the COMMERCIAL FIRST GRADE LICENSES qualify holders for employment at any ship or land station of any class.

COMMERCIAL SECOND GRADE: The applicant must pass a satisfactory examination in all subjects prescribed for the first grade, with the exception that the minimum speed in transmitting and receiving shall be not less than twelve words a minute in Continental Morse, and the examination in the subjects will not be as comprehensive as that given first grade operators.

The student operator should provide himself with copies of the following publications which can be readily secured by addressing the Superintendent of Documents, Government Printing Office, Washington, D. C.:

Radio Communication Laws of the U. S.....15 cts.
Radio Stations of the United States.....10 "
Radio Service Bulletin (issued monthly)....05 "

(The above bulletin can be subscribed for at the rate of twenty-five cents a year).

Most of these publications are usually supplied by radio companies employing operators, but it is well for the aspiring professional to procure them himself and become familiar with their contents before attempting to take the examination.

WHERE AND HOW TO SECURE LICENSES

Commercial Radio operator's licenses as well as amateur licenses of all grades may be secured after due examination by applying to any of the following named places, where are situated representatives of the Department of Commerce:

Radio Service, Customs House, Boston, Mass.
Radio Service, Customs House, New York City, N. Y.
Radio Service, Customs House, Baltimore, Md.
Radio Service, Dept. of Commerce Bldg., Washington, D. C.
Radio Service, Citizens Bank Bldg., Norfolk, Va.
Radio Service, Customs House, New Orleans, La.
Radio Service, Customs House, San Francisco, Cal.
Radio Service, Customs House, Seattle, Wash.
Radio Service, Federal Building, Chicago, Ill.
Radio Service, Federal Building, Detroit, Mich.

REMUNERATION, ADVANTAGES AND OPPORTUNITIES

The present salary of the ship radio operator is $125.00 a month for senior operator and $100.00 for junior. In addition to this, operators are given first-class accommodations and meals, which is easily equivalent to an additional $50.00, when one considers the present high cost of living. While these figures represent the standard operating wage, operators may also earn additional money in other ways. For instance, on some cargo vessels where there is need of but one operator, the steamship company will arrange to have the operator act as supercargo in addition to his radio duties. For this combination position he receives a total monthly pay of $140.00 or more, depending on the importance of the voyage. This work requires very little preparation and is of a light clerical nature such as the making out of crew lists, manifests of cargo, store lists, etc. On other vessels, either passenger or cargo operators may check freight while at foreign ports. This consists of merely standing or sitting near the ship's hold and keeping count of the quantity and nature of the various items discharged or taken on board. This work pays from 40 to 50 cents an hour. On many passenger ships, too, the OCEAN WIRELESS NEWS is published as the daily newspaper of the sea. The operator in such cases is in effect an editor of the day's news transmitted from shore, and he is allowed a liberal commission on sales of the paper to passengers.

Misleading statements are often made concerning the recognized status of the radio man on board ship, so a few words about this matter is perhaps not out of place. The United States Shipping Board Emergency Fleet Corporation states in its contract with the radio companies the following:

"Radio operators shall be treated as officers, but without executive authority, and shall be provided accommodations suitable for an officer."

It is very essential that the home student erect a receiving station

This means that the radio man is accorded all rights and privileges of a merchant vessel officer, except that he has not the authority to give executive orders to any member of the crew unless he has been specifically instructed to do so by the captain or other accredited officer of the ship. This, of course, is quite natural, since the operator is in a class by himself and is not versed in any of the ship's routine.

The opportunities of the sea-going operator are manifold. In the first place, he has the chance to visit many parts of the world which are seldom accessible to any but the very wealthy. The radio operator having spare time at his disposal while at sea can study various subjects connected with his profession, such as radio traffic problems and the higher branches of radio engineering. By doing this, he may, after a few years of faithful service and study, be advanced to such positions as inspector, constructor, chief operator, assistant superintendent, representative, manager of coastal station, and various other well paying posts connected with high power transoceanic shore stations. Or, if he so desires, and wishes to follow the sea as a profession, he may study navigation.

There is certainly a great deal to be said in favor of radio operating as a profession, and few land vocations can boast of as fascinating and profitable a career as that of radio.

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Testing Marconi V T's

The Electrical and Mechanical Tests That Are Necessary to Insure Efficient Tubes

WITHOUT doubt, there are but few of the readers of this magazine who have considered the care and effort that is required to produce uniformly good vacuum tubes. A summary of the tests through which the Marconi VT's pass will be of interest to those who use vacuum tubes in their experimental work.

In addition to the electrical inspection, these tubes are also carefully inspected for mechanical defects to insure that the internal elements as well as the glass and base itself are all properly constructed and in line.

The electrical inspection—which is made to determine the operating characteristic of the tube—calls, first, for a filament which will pass a certain standard current under given conditions; second, the plate voltage required for the tubes must not fall below or exceed given values; next, the insulation resistance is measured between the plate and grid and filament terminals, this latter measurement being made only after the tube has been operating for a considerable period of time at normal current.

The sensitivity of the tube as a detector is also carefully noted and checked against a standard in the test laboratory, and finally the tubes are connected in a circuit as shown in figure 1, for the oscillation test, where they must oscillate at a wave length of 250 meters, in a satisfactory manner, at a plate potential not greater than that required for the greatest sensitivity as a detector.

The Class II tubes are all subjected to a plate potential of 350 volts, which they must withstand for a certain

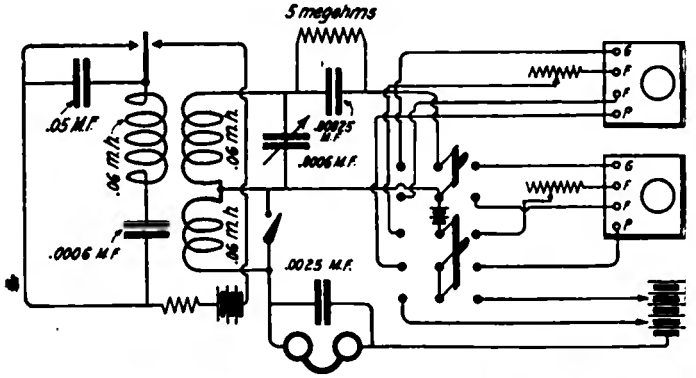

Figure 1—The circuit for the oscillation test at 250 meters

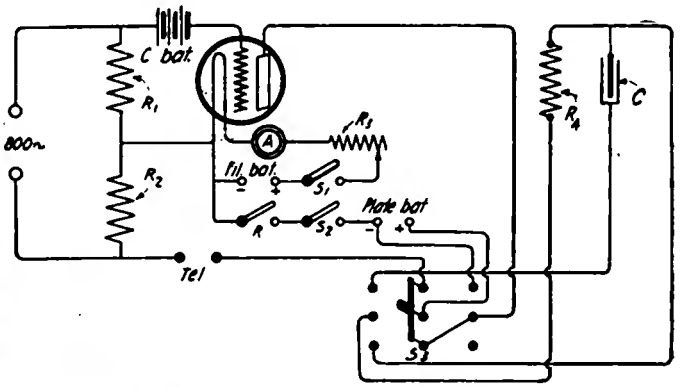

Figure 4—Circuit diagram of the Miller'a bridge

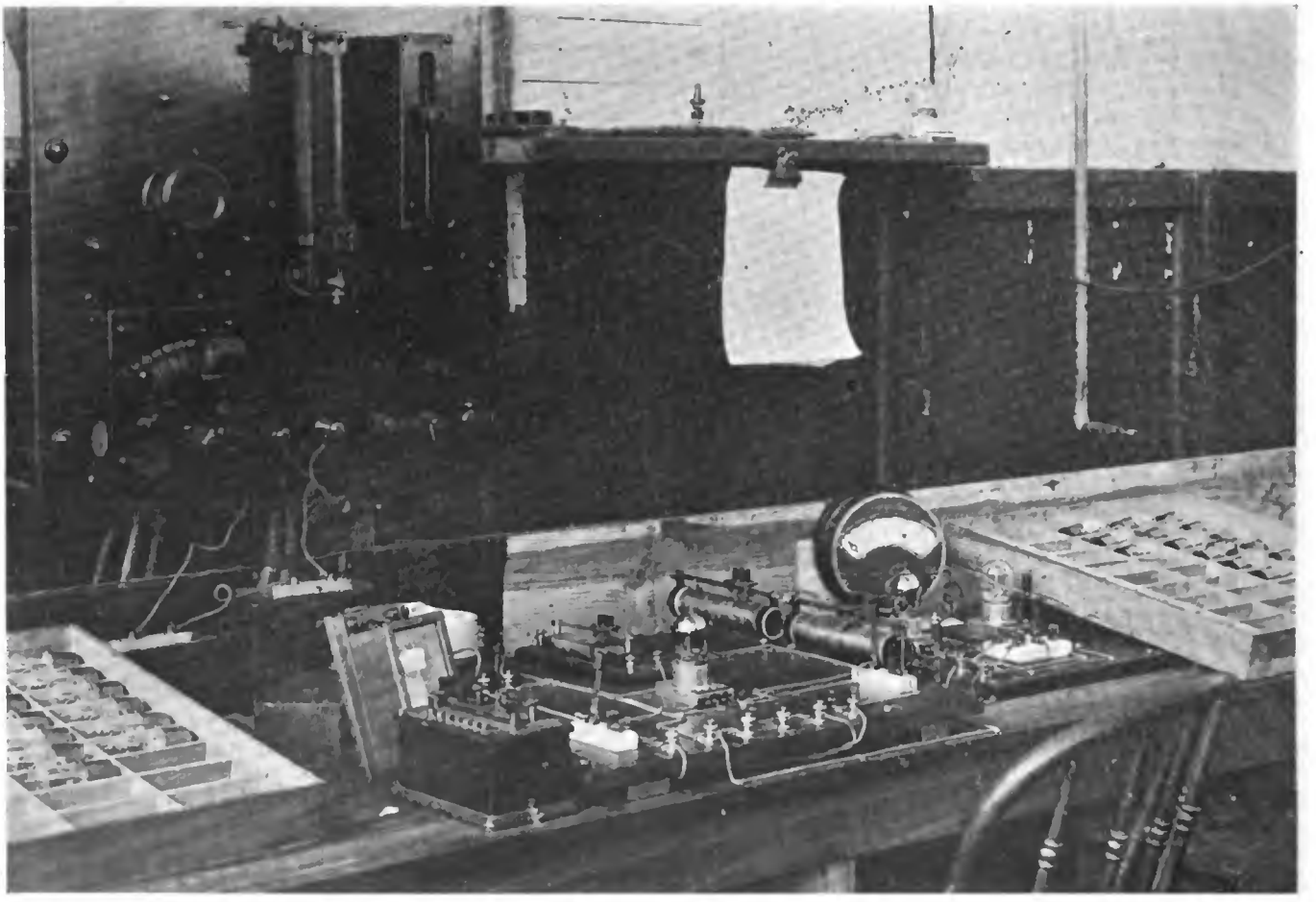

Figure 2—Tbe layout used in the test for Class II tubes, subjected to a pl :te potential of 350 volts

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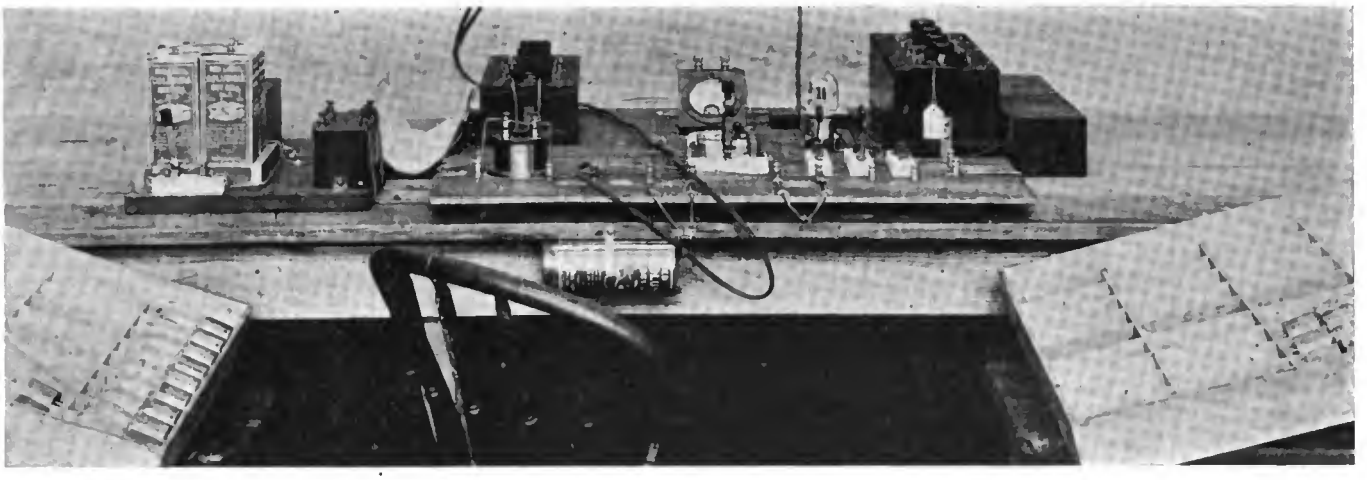

Figure 3—The instruments which make it possible to obtain the amplification constants, the internal resistance, and the voltage amplification of a tube when used with a resistance in its plate circuit

period of time or be rejected. Figure 2 is a photograph of the layout for this test. To the right is seen the plate circuit voltmeter (shunted) as well as the rheostats for the regulation of plate potential. Filament current rheostat is shown directly behind the left hand vacuum tube and the galvanometer for indicating grid current is shown beneath the generator board and directly behind a shunt resistance, the latter being connected across the terminals of the galvanometer in order to protect it in case of shorted connections within the tube under test. Figure 3 shows a photograph of a Miller's bridge set up by the use of which it is possible to obtain the amplification constants, the internal resistance, and the voltage amplification of a tube when used with a resistance in its plate circuit. A circuit diagram of the Miller's bridge is shown in figure 4. The action and operation of this bridge is described in Volume 6 of the Proceedings of the Institute of Radio Engineers. In figure 5 is shown a set-up for the oscillation test and for the detector test. A standard Navy short wave receiver as well as a standard Navy vacuum tube control box as manufactured by the Marconi Company and General Electric Company, respectively, are used in this test. A damped oscillation is supplied by the small oscillation generator on the left.

To summarize, all tubes are first tested for gas and classified as either soft tubes (Class I—detectors and oscillators) or as hard tubes (Class II—amplifiers, oscillators and detectors). The soft tubes are then tested for sensitivity as detectors, and either passed or rejected. The hard tubes are tested for amplification constant, and for oscillations, and either accepted or thrown out.

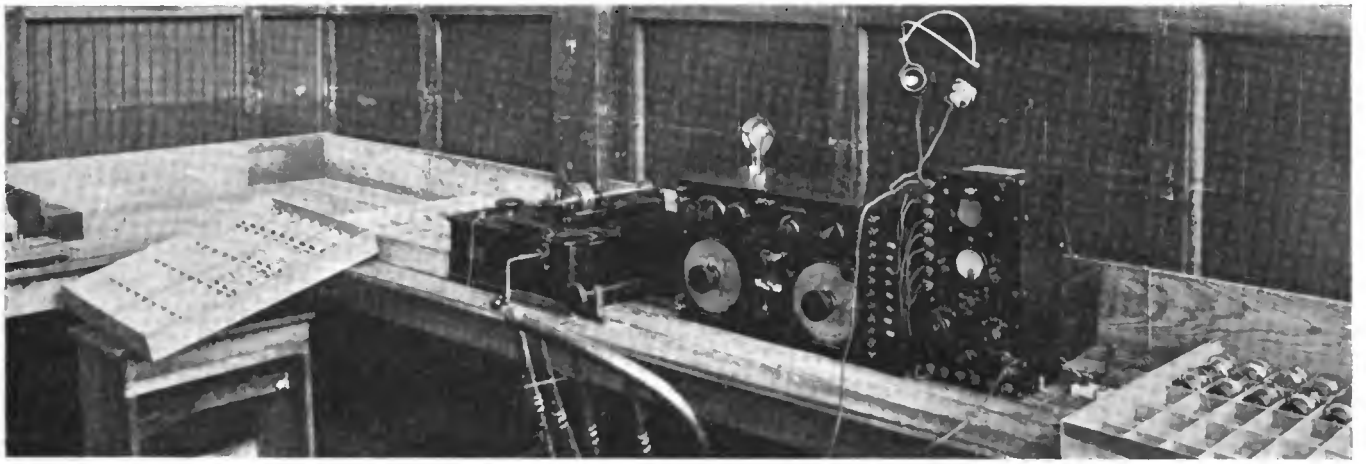

Figure 5—Apparatus for making the oscillation test and the detector test

If You Were the Editor—

It is an axiom in any magazine publisher's office that every reader is certain that the publication would be improved if the ideas he holds were adopted.

We like this spirit. We want to hear those who think THE WIRELESS AGE is not quite as good as it should be.

Let us have all those fine suggestions. It will be worth your while, for we are going to give you whatever it is you think you want.

The majority will rule, but all reasonable requests for departments or articles will be given most careful attention. —THE EDITOR

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Condenser Construction

TO those who have in mind the construction of condensers the method used by Dubilier will be of interest. The principal object of his method is to provide a condenser in which the terminal connections will fall at points spaced to such an extent that the liability of an electrical discharge between terminals at different potentials is minimized, and to avoid the necessity of employing special insulating barriers or plates between the terminal connections.

Figures 1, 2 and 3 are respectively top, side, and perspective views of a condenser, made in accordance with this method. Figures 4, 5 and 6 are views which correspond respectively to figures 1, 2 and 3, but which show another method of making connections.

With reference to figures 1 to 3, a condenser is shown consisting of several conducting plates separated by mica sheets, the plates and sheets being assembled into a rectangular shaped block. Groups of conducting plates are connected in paralliel so as to form several sets of plates insulated from each other, these being of opposite polarity and connected in series to divide up the potential to which the condenser is to be subjected to such an extent as to prevent a failure of insulation or a breakdown in any portion of the insulation.

Terminals for each set of plates are provided by extending the edge portions of the plates a short distance beyond the face of the block. The terminals of the different sets are then connected so as to place the requisite number of plates in series with each other.

In order to prevent a discharge between terminals which are to be at different potentials, these terminals and their connections are brought out at different points around the sides of the block so that each terminal will be spaced a relatively large distance from the others. In figures 1 to 3 this is accomplished by bringing out the terminals of successive sets on different faces of the block, the terminals of the sets of opposite polarity in the top layer being brought out for instance at sides 4 and 6 respectively of the block and the terminals of the sets of opposite polarity in the second layer being brought out respectively at sides 3 and 5 of the block, the terminals for the sets of the third layer at sides 4 and 6, and so on. The top terminal on side 6 of the block, may then be connected by a conducting strip to the second terminal on the face 5 of the block. The terminal of the second layer, which is on face 3 of the block may then be connected by a similar ribbon to the terminal of the third layer which is in face 6 of the block. The terminal of the third layer, which is on face 4 of the block, may then be connected to the terminal of the fourth layer which is on face 3 of the block. The terminal of the fourth layer which is face 5 of the block may be connected to the terminal of the fifth layer which is on face 4 of the block, and so on.

It will thus be seen that with the above arrangement the terminal connections extend around the sides of the block in a spiral fashion. In the form shown in figures 1 to 3, the terminals 8 to 12 for instance are spaced a distance equal to the thickness of 3 groups of plates so that the chances of a discharge between such connections are minimized.

If the terminal connection between successive groups of plates be made alternately at opposite sides of the block as has been the usual practice, it is necessary to

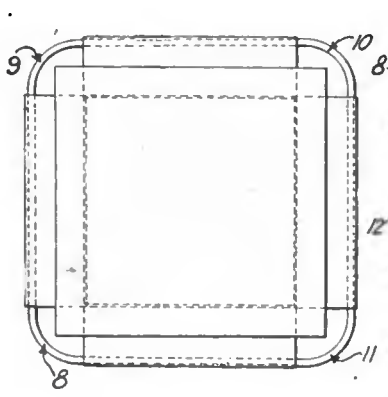

Figure 1

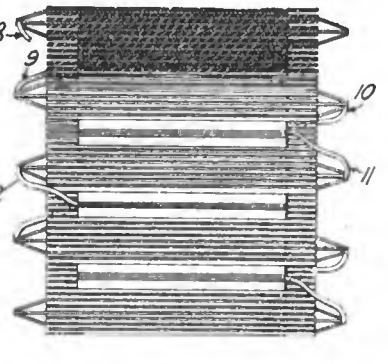

Figure 2

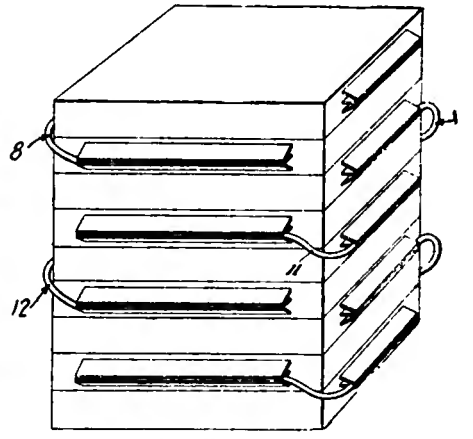

Figure 3

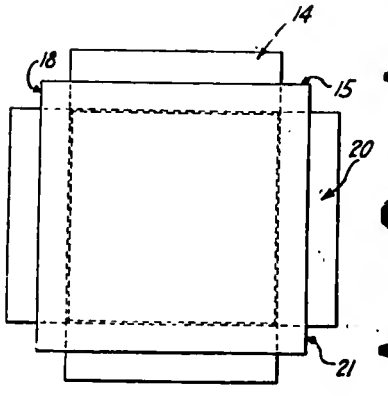

Figure 4

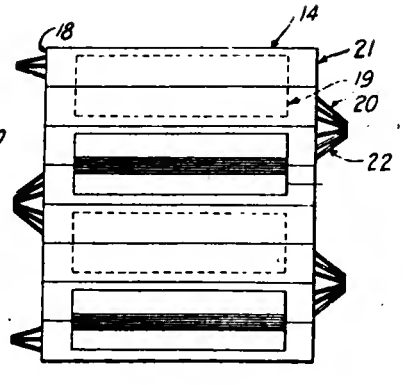

Figure 5

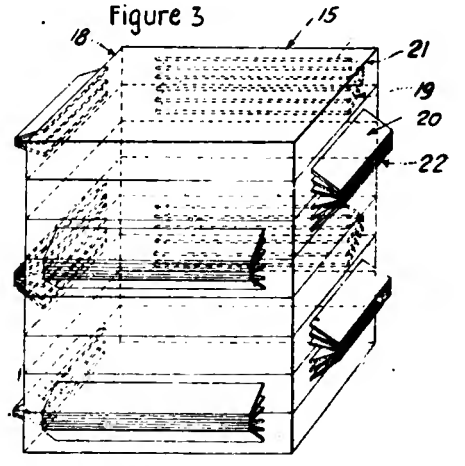

Figure 6

Figures 1, 2 and 3 are respectively top, side and perspective views of the condenser and figures 4, 5 and 6 show another method of making connections

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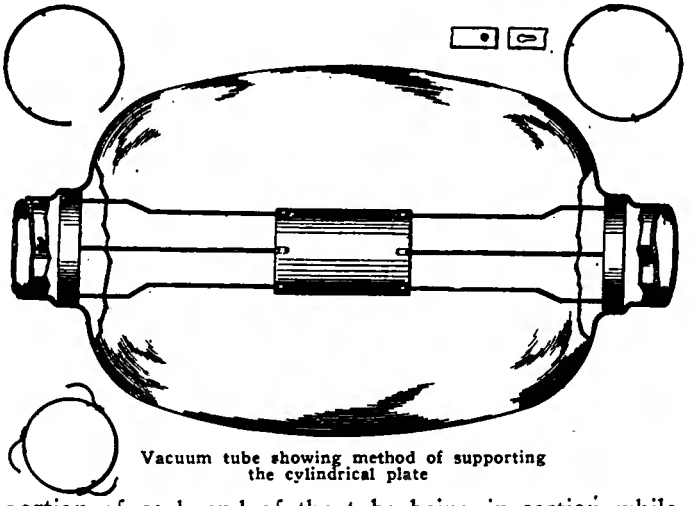
interpose between terminals and connections of different potentials insulating barriers or plates, so as to prevent brush discharge, but these insulating plates aside from the greater expense they entail, are awkward because they leave the condenser terminals in pockets or recesses with the result that such terminals are not readily accessible for making terminal connections. With a condenser constructed as per above outline the greater spacing between the connections obviates the necessity of employing insulating barriers between them, and no more insulation need be interposed between the superposed groups of plates than is used between the different plates of the interleaved groups.

Figures 4 to 6 show a condenser of different construction, but in which the same principle of connection is employed. As shown in figure 4, a group of condenser plates may be connected in parallel and provided with a terminal on one face of the block similar to the one previously described. A second group of plates is interleaved with the first but has its common terminal located for instance at the side 18 of the block adjacent to the side 15 which carries the first terminal. The interleaved groups of plates in the second layer may then have one terminal located at the side 15 of the block and the second terminal located at the side 21 of the block, etc. Terminals 14 and 19, 20 and 22, etc. may then be joined together to connect as many of the groups in series as is desired.

Vacuum Tube Construction

A NOVEL means of supporting the electrodes in a vacuum tube has been worked out by T. P. Driver, of London. A cylindrical plate which is supported from both ends is provided at each end with a set of longitudinally extended carrier-bars attached on the one hand to the anode cylinder and on the other to a metal collar which is received in an annular seating formed within the tube, at or near the point where the extending neck of the tube opens into the bulb; the seating at the respective ends of the tube being of such diameter with respect to the adjacent necks as to present, endwise, oppositely-directed annular shoulders adapted to prevent logitudinal displacements of the plate and its attached supports in either direction after their insertion in position, while lateral displacement is prevented by the engagement of the collars with the inner peripheries of the seatings with which one or both of the collars may be adapted to establish expanding spring contact. The accompanying drawing shows a side elevation of a vacuum tube, illustrating the method of supporting a cylindrical plate therein, a portion of each end of the tube being in section while the filament and its supports are omitted.



Vacuum tube showing method of supporting the cylindrical plate

Secret Radiophone

A FUNDAMENTAL requirement of commercial telephony is there shall be no delay in the transmission of signals, that is, a signal must be transmitted immediately upon its production. This requirement precludes the use of code sending as ordinarily understood, for the secret transmission of intelligence by telephone because such sending would necessarily introduce a delay equal to the time required for translation to code.

In order to accomplish the secret transmission of intelligence, H. W. Nichols proposes to so distort the signal transmitted from the sending station that it shall be unrecognizable at points between the transmitting and receiving stations, but by means of auxiliary modifying apparatus at the receiving station the signal is to be restored to its original character. A fundamental condition for this kind of distortion is that the order of the electrical states which make up the signal shall not be changed, although the intervals elapsing between successive states may be changed in any manner desired. If this condition is not fulfilled, the result will be either delay in transmission of the signal, or else superposition of one part of the signal upon another part, making the signal unintelligible.

In the arrangement shown in the drawing signals are produced by the telephone transmitter, distorted by the apparatus intervening between the transmitter and the antenna, transmitted to the receiving station, received and restored to their original forms and finally translated into audible sounds by the telephone receiver. By further reference to the drawing it will be seen that an iron wire is carried along the face of an electro magnet 3, which is energized by a battery controlled by a microphone, which serves to vary the current through the magnet in accordance with speech vibrations. The result of speech vibrations impressed upon the microphone is to vary the magnetic state of the wire as in the magnetic detector or telgraphone, these magnetic states of the wire being permanent and carried along the wire in its motion to the right.

A second electro magnet shown at 6 is affected inductively by the varying magnetic states of the wire and serves to reproduce the vibrations impressed upon it by the first magnet. There will, therefore, be reproduced in the windings of the second magnet a current which is more or less a faithful copy of the current in the first. The magnet 6 is rigidly connected to an arm, which passes through guides and is driven by a cam mechanism. This cam may be driven by the same source of power as is used for the driving of the iron wire and its mechanism. The purpose of this cam driven magnet, is to so alter the wave form of vibrations induced in it with respect to the vibrations induced in the first magnet as to be unrecognizable when transmitted from the antenna as explained later.

It will be obvious that if the motion of the wire is uniform, and if the two magnets are relatively at rest, the signal induced in the second will be practically an exact copy of that produced by the microphone. On the other hand, if there is relative motion of the magnets, it is;

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obvious that the signal induced in the last will be distorted, as the time phase relation between succeeding portions of the signal wave will be modified. In designing and operating this cam driven mechanism it is essential that the relative speeds of the magnets shall never be great enough to superimpose one part of the message upon another. In order to efface the message after it has been delivered to the second magnet, and to place the wire into a condition suitable for the recording of a new signal, a permanent magnet is placed below the wire as shown in the figure.

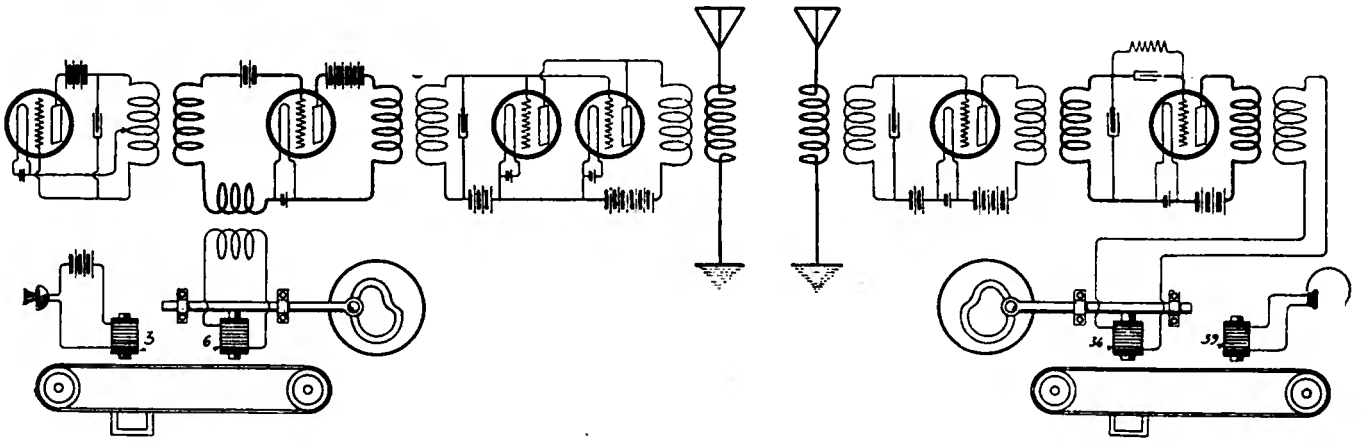

Diagram showing electro magnets and mechanical means for distorting the signal at the transmitter and restoring it at the receiver

The operation of the device is as follows: The distorting devices at the two stations are started in synchronism and in phase by means of a predetermined signal. The cams may be driven by clockwork in order to maintain the necessary degree of synchronism. When a signal is impressed upon the tape by means of the magnet 3 it would normally, if magnets 3 and 6 were at rest and the tape moving uniformly, require a certain definite time to be transmitted to the reproducing magnet 6. If, however, the latter is in motion with respect to the former, the time elapsing between the production of a signal at 3 and its reproduction at 6 will be variable, and therefore the message sent out from the sending antenna will no longer be an exact copy of the impressed message. At the receiving station this message is transmitted to the thermionic elements, being amplified and transformed into low frequency form. It is then impressed upon the receiving magnet 36, whose motion is similar to that of 6. The distorted message is therefore received from the tape in its normal form due to the relative motion of 36 and 39, and reproduced in undistorted form in the receiver.

Improved Condenser Construction

A VERY excellent method of constructing condensers has been developed by Franz Kratz. The salient features of this construction consist of two metal discs placed opposite to each other and having cylinders or pipes protruding inward from their centers, upon which the strips of paper and tinfoil (or whatever the material may be), are wound. In order to obtain a good contact between the metal discs and the two tinfoil strips, these latter are made somewhat wider than the distance between the discs, so that when the winding operation is performed, the one edge of each strip abuts against a disc and is thus caused to coil up and press firmly against it. By the pull exerted on these strips during winding, the discs are prevented from moving apart, so that no rivets, screws, soldering, spring pressure, or any other special means are required to keep the frame together.

Figure 1 represents a section through the condenser, viewed from the side, and figure 2 shows the tinfoil and paper strips as they appear while being wound onto the condenser frame or spool.

Two metal discs or cheeks with protruding ring portions or short pipes are arranged in parallel planes, so that the rings are situated opposite to each other and a certain distance apart. The space between the discs may be bridged by a layer of insulating material, supported by the rings; and upon the roll or spool thus formed the paper and tinfoil strips are wound. The tinfoil strip is made somewhat broader than the distance between the discs so that it is caused to coil up on one edge during winding and is thus pressed firmly against its disc and establishes an intimate contact with the same. By the pressure applied by the tightly wound strips the discs that serve as mountings are prevented from being shifted outward from the middle. This may also be prevented by glueing the rings to the insulation.

Figure 1

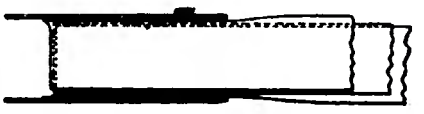

Figure 2

Figure 1—Sectional side view of condenser. Figure 2—Showing tinfoil and paper strips while being wound onto the condenser frame

One of the advantages of this method over other forms of construction is that metal mountings are employed which keep the condenser together without the necessity for any special fixing means, such as rivets.

Another distinct advantage of the condenser is that resulting from the connection of one entire edge of each tinfoil strip to its respective disc and terminal, so that the resistance of the condenser and the inductance which the rolled form of condenser would offer under ordinary methods of construction is eliminated, thus affording a condenser with a low phase angle.

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An Amateur Receiver

MANY amateurs will, no doubt, be interested in constructional details and circuit diagrams of a receiver developed by Ernest C. Mignon. Figures 1, 2, 3 and 4, respectively, show the layout of the receiver and the method of control, this last residing in a metallic ring shown in figure 1, as supported on a shaft coming out in the center of the "clover leaf" coil arrangement and being counter-balanced by a weight, and shown in figure 2, where a cross section has been taken through a line of figure 1. In figure 1, it is seen that not only will the metallic ring revolve so as to be concentric with either one of the three coils, but it is also possible to vary the proximity of the metallic ring to the coils, as indicated in figure 2, wherein the ring and its controlling knob are shown in full and also in phantom.

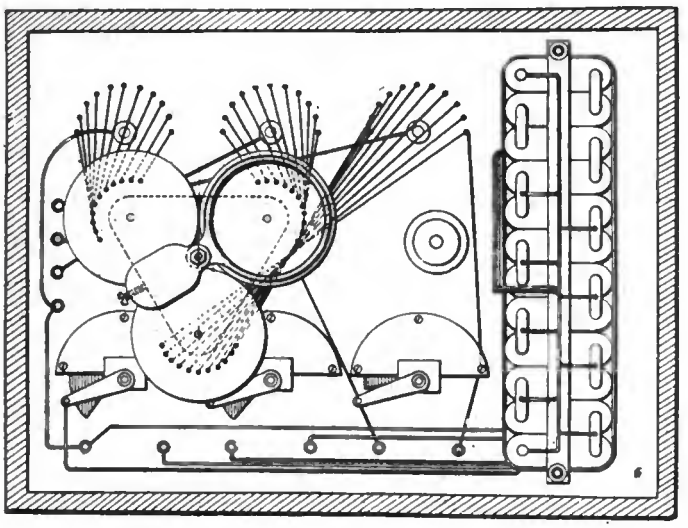

Figure 1—General layout of the new amateur receiver

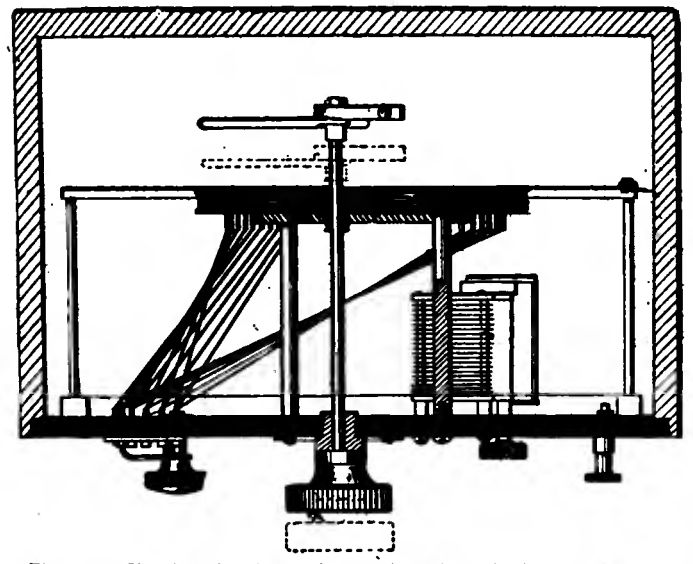

Figure 2—Showing the ring and controlling knob in full and also in phantom

With reference to the circuit diagram, figure 4, it will be seen that the receiver is the usual 3-circuit type; that is, primary, secondary, and plate circuit, and that the coupling between primary, secondary, and plate circuit, in so far as effected by the physical relationship between the coils, is uncontrollable because the coils are fixed in position. The electrical periods of the three circuits are controlled in the usual way, by variation of inductance and capacity. A movement of the metallic ring to a position concentric with any one of the coils will decrease the inductance in that coil. A movement of the metallic ring to such a position that it links any two coils as indicated in figure 3, in all probability reduces the inductance of both coils, to an extent, and slightly further inter-links their magnetic fields.

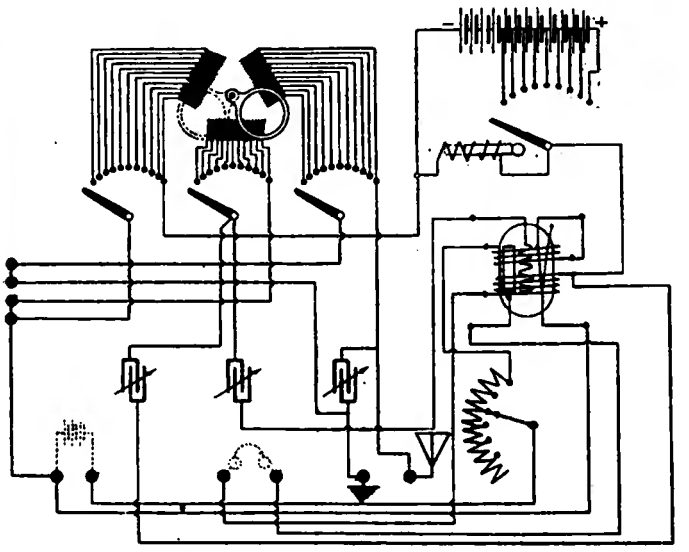

Figure 3—Showing the metallic ring linking two coils

From a strictly amateur point of view, a receiver design such as this, for use on long wave lengths, might be considered satisfactory, inasmuch as practically all the high power stations may be copied with the device; but from a commercial point of view, the scheme is decidedly impracticable, due to the fact that there exists at all times both electromagnetic and electrostatic coupling between primary, secondary and plate circuits which is uncontrollable, and furthermore it is a well-known fact that the use of a short circuited turn of inductance directly in the field of an inductance will give rise to as much as 50 per cent energy losses under certain conditions.

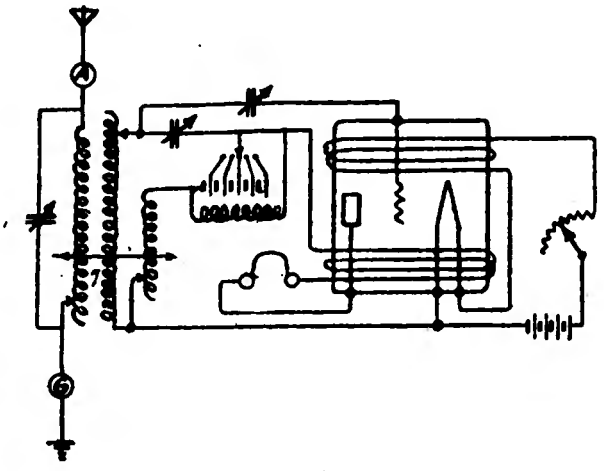

Figure 4—The circuit diagram used shows the receiver to be the usual 3-circuit type, namely: primary, secondary and plate circuit

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EXPERIMENTERS' WORLD

Views of readers on subjects and specific problems they would like to have discussed in this department will be appreciated by the Editor

A Low Power Tuned Transmitter for Local Use

By E. T. Jones

THIS is undoubtedly the question of the hour, since it deals with a method which will make amateur operation safer and place it on a sound basis. Amateurs have already caused some little trouble, all of which could have been avoided were it not for the fact that they make use of transmitting sets with power greatly exceeding their needs.

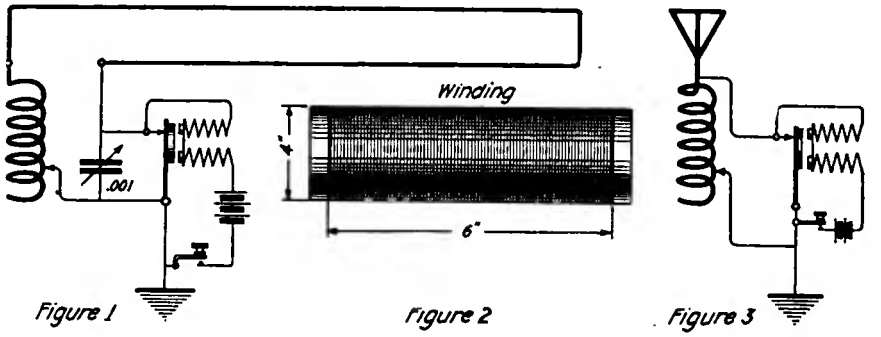
Through accident, I discovered that if inductance of certain value was shunted across the contacts of the buzzer while the antenna and ground connections remained in their usual place, greater distances were covered with the same buzzer and the note of the buzzer was entirely controllable by varying the inductance. Screwing on the contact point and altering the tension of the spring common to the adjustment of buzzers, was thus made unnecessary. All that is required is to have the note of the buzzer (high frequency) adjusted to a pure note and one of very high pitch. It is then connected in the circuit as shown in figure 3.

Here an inductance of the dimensions shown in figure 2 is shunted across the contact points. This was wound with one layer No. 24 SCC magnet wire. A slider is connected as shown. The slider is employed in this case because, with it, greater selectivity can be had. Of course, the units and tens arrangement common to primary windings of receiving transformers can be resorted to.

With this in mind, I decided to try the arrangement shown in figure 1. A loop antenna measuring 50 ft. long with two No. 18 wires spaced 4 ft. apart, was constructed. This antenna was 35 ft. high at one end and 15 ft. high at the other. I found that it was also possible to effect tuning with a condenser of the commercial type measuring maximum .001 mfd., shunted as shown (across the antenna and inductance). Here it is seen that the antenna is used as part of the shunt, which actually increased the signal strength at the receiving station some 5 miles distant. The series inductance used is the one constructed to shunt the buzzer when it is employed on an ordinary flat top antenna.

This forms a circuit similar to the wavemeter (driver circuit and is undoubtedly *the thing* for amateur local transmission. I am using it exclusively and with vacuum tube receiving apparatus, I am of the opinion that this will transmit 10 or more miles. The greatest distance to date is five miles during mid-day.

With suitable keys, music can be played on this set.



Circuit diagrams showing hook-up of the high-frequency buzzer and the inductance used in the low power transmitter

The Submerged Receiving Aerial

By Victor R. Fisher

IN the January 1920 issue of the WIRELESS AGE I noticed an article on "Loop Antennae for Submarines," by Ralph R. Batcher. I have read this article carefully and I think it is somewhat misleading, although I have the greatest respect for the position and occupation of its author. For, relative to this submerged receiving aerial, I have evidence enough to squash the idea.

It was in either August, September, or October, 1916, I believe, that the Navy Department first conceived the idea of putting to actual test the possibility of receiving signals in a submerged vessel. At that time and date I was the radio electrician aboard the DSS K2. The submerging aerial was handed to me while we were still in the Brooklyn Navy Yard, with instructions that I should rig it up when we arrived at New London, Conn. This was in June.

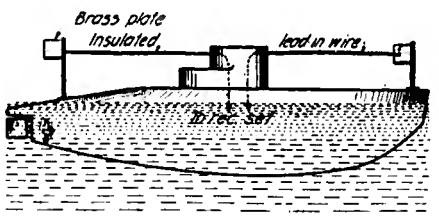


Figure 1—Showing brass plates connected fore and aft and the lead-in wire to receiving set

Later, I rigged up this "antenna" which consisted of one brass plate on the after mast (which carried the main two wire aerial), and one brass plate on the foremast. Insulated wires stretched from these plates to amidships, where they entered through a supposedly watertight stuffing box on the conning tower down to the set. The two departmental representatives were Radio Expert Clark, and an aide. On questioning Mr. Clark as to how and why they decided to experiment with this idea, I was told that he had thrown into the Potomac a couple of old wash boilers and pails, and copied NAA, which seemed entirely possible, acknowledging the close proximity of his receiving gear to NAA, which acted on his set via forced oscillations.

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He never would have heard NAA had he been 50 miles further away, as experiments proved.

But as to the submarine. After hooking up several thousand dollars worth of audions, amplifiers, and receiving sets (not mentioning the superfluous amount of meters, variable condensers, etc.) the K2 submerged to a depth of 9 feet. The antenna was at the time 3 feet below surface, the submarine trailing behind the USS Tallahassee at a distance of one mile and making a speed of 6 knots. All this time the Tallahassee was sending "dope" out of an American history and caused considerable bewilderment to operators of other ships in the vicinity. We heard . . . nothing.

But just as soon as one plate emerged and the other remained submerged, we could copy NFF, NAH, WDC, and NDC (Tallahassee). We would dive once more and not a sound, and all this wonderful outlay of apparatus. It all proved a fizzle.

During the thirty months of foreign

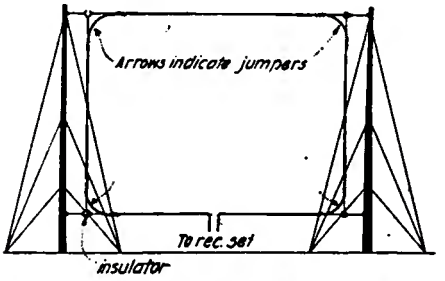


Figure 2—A single-loop antenna without ground used for receiving

service, I had the good fortune to spend one year at the French trans-Atlantic station YN (Lyons). I had considerable experience there with aerials. We used no ground for receiving, simply one immense loop, 110 feet high, 300 feet long (figure 2). We had three receiving antennae of this same style, and although one of these was situated on a farm a few blocks away, all the receiving sets were in the same room, the lead-ins coming into the room via underground insulated cables.

The most remarkable feat ever accomplished on one aerial, I believe, was accomplished there. We had three receiving stations, one for NSS, one for NFF, and the other for NDD, and the USS George Washington. It so happened that we had a bad ground on one of these out of the way antennae which compelled us to double up on one aerial. In other words, we had to copy NSS and NFF on the same aerial, and without grounds. We kept to this plan, for it was working beautifully, until YN installed his new transmitter. Up to then we had been able to copy NSS and NFF on the same aerial, while YN was transmitting with his alcohol burning arc. But when he received his Alexanderson machine we had to abandon the idea, for he transmitted on very near the same wave as NFF and when one man copied NFF he most likely had decreased the signals from NSS enough to allow YN to break him up altogether. Lyons has a 150-kw machine and radiates 180 when it's working right.

A Successful Undamped Wave Circuit

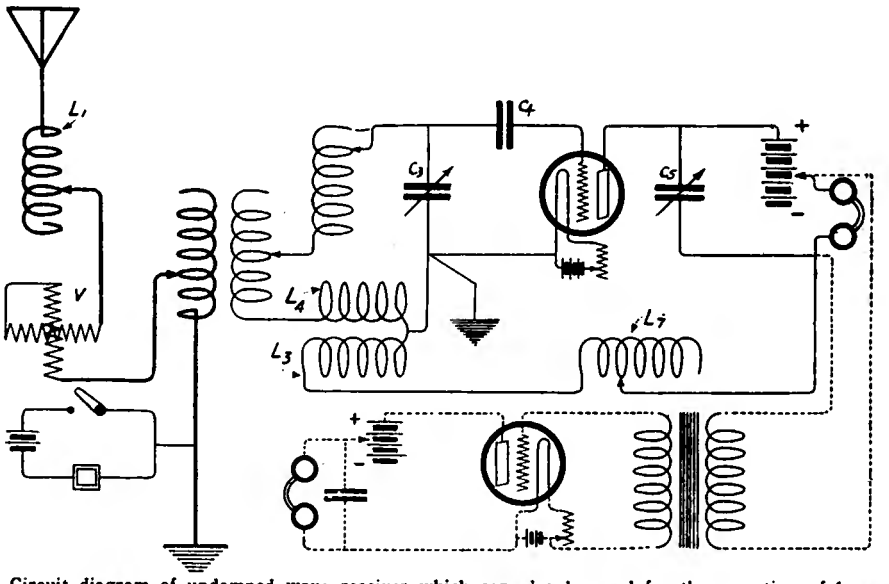
By J. C. Morris, Jr.

AN undamped wave circuit with dimensions of the units is supplied by the writer, with the belief that the set outlined possesses many advantages which will be apparent to the amateur. Very long distance records have been obtained with a set of this type, using a small aerial, therefore, it should be suitable for use with the usual amateur. The results obtained will amply repay the trouble and expense of construction.

The following dimensions do not need to be followed precisely, but have been chosen to give a suitable range of wavelength.

The primary and secondary tubes of the coupler are wound with 15 inches of wire. The former is 5½ inches in diameter while the latter is 5 inches in diameter. The primary is wound with No. 24 S.S.C. wire or with bare wire suitably spaced. The secondary is wound with No. 28 S. S. C. wire, taps to the secondary switch being taken off at suitable intervals. The primary is varied with a slider. The writer advocates the use of a slider because of the ease of adjustment. However, to avoid capacitative effects from the body of the operator, the slider should be moved by a handle of at least six inches in length, made of hard rubber or other equally good insulation.

The aerial loading coil L_1 should be five or six inches in diameter and thirty inches long, wound closely with No. 25 S.S.C., taps to the multi-point switch being taken every 3 inches or so. Precision adjustment is made by the variometer V. This variometer consists of two cardboard tubes one inch long and 5 and 6 inches in diameter respectively, wound with No. 25 S.S.C., care being taken to keep the same amount of wire on the two coils. The inductance is varied in the usual manner by revolving the inner coil within the outer.



Circuit diagram of undamped wave receiver which can also be used for the reception of long damped waves

The plate and grid loading inductances have identical values, consisting of tubes 5 inches in diameter and thirty inches long, wound closely with No. 28 S.S.C. The inductance may be varied by a suitable slider or by a multi-point switch, taps being taken from the 5, 10, 14, 16, 18, 19, 20, 22, 24, 26, 28, and 30th inch of winding.

The regenerative couplings L_3 L_4 have fixed values of inductance, but should be constructed so as to have fairly variable couplings. Good results are obtained with both coils 7 inches long, L_3 being 5½ inches in diameter, while L_4 is 5 inches in diameter. Both coils are wound with No. 28 S.S.C.

Often amateurs can make old couplers function in this position by rewinding same, or suitable variometers are sometimes substituted.

C_3 is a variable capacity of maximum value of .0005 mf. C_4 is a fixed capacity of .0005 mf. C_5 is a variable condenser of .002 mf. (Two .001 mf.

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condensers in parallel may be used if desired.)

In use, the primary of the loose coupler covers about ½ of the secondary. L_3 is about ½ way in. L_7 is almost completely used. The other values depend on the wavelength of the received wave. C_3 and C_5 are varied simultaneously.

Attention is called to the filament ground connection.

Filament control is accomplished by means of the battery rheostat. B battery current may be varied either by the potentiometer or by the step by step method. Caution is advised to see that the A battery does not tend to oppose the B battery.

The writer advises bringing the bulb to a sensitive condition by the use of a test buzzer in inductive relation to the ground circuit.

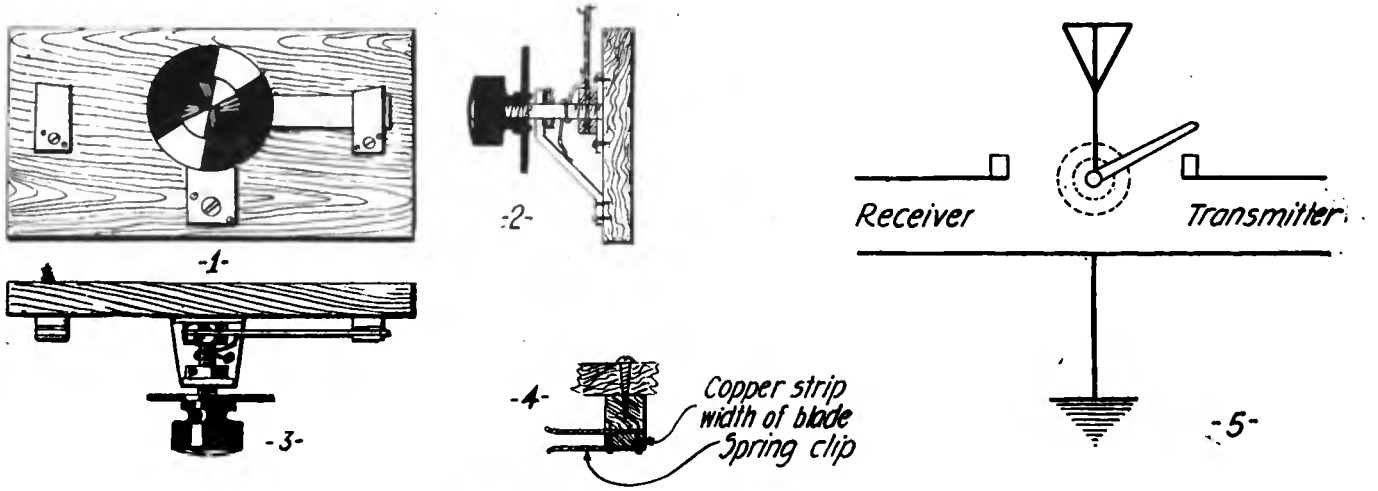
This circuit may be used for the reception of long damped waves.

In order to hear the more distant stations at times, it is advisable to employ a one or two step valve amplifier. The connections of the one step amplifier are shown by the dotted lines. When the amplifier is employed, the phones are removed from the circuit and the primary of the audio frequency iron core transformer is connected in.

An Efficient Aerial Switch

By R. C. Hitchcock

EVERY radio station needs an efficient aerial switch. If its action is quick, snappy, and dependable, it is a great help to good radio communication. The switch here presented has all of these desirable features.



Various views of the improved aerial switch

No provision for the shutting off of low voltage power is provided, as with a careful operator it was found to be unnecessary. The construction is further simplified by eliminating the ground lever. The ground wire is permanently connected to the receiver and transmitter, the aerial being switched from one to the other (see figure 5).

The main lever is about 6" x 1" x ⅛" of heavy copper. A hard rubber shield, and navy knob are mounted on the axle (see figures 2 and 3). The shield prevents the possibility of touching the switch arm, and the use of the large knob makes the throwing of the switch very easy. This navy knob is provided with a brass insert, which is screwed onto the main axle, which is threaded and fitted with nuts, as shown in figure 2. A flexible copper cable is soldered to the switch lever, coiled loosely around the axle, and then led to the copper plate and soldered, thus making positive connection at all times. The clips used may be taken from a large knife-switch, or may be built up, as in figure 4, at the discretion of the constructor. The base may be of hard rubber or of seasoned wood.

Details are clearly shown in the diagrams. Dimensions are omitted, as they vary with the materials on hand. The design should prove satisfactory.

Spark Coil Transmitters

By Albert T. Lynch

USERS of spark coils have in the past overlooked several important factors in designing the installation. A panel spark coil set is more or less difficult to construct, whereas an efficient transmitter requires no panel.

Almost without exception, amateur stations are located some distance from the ground, yet the transmitter, to be truly efficient, should be located close to the ground. This will be apparent on considering the voltage and current nodes and loops in an antenna and closed oscillating circuit. It is a well known fact that in a freely oscillating aerial the voltage loop is at the free end of the aerial, the current loop at the base; in other words, the voltage is low at the ground while the current is at the greatest value.

In the primary closed oscillating circuit the voltage loops are located at the condenser plates, the current loop being at the center of the inductance in the circuit. Hence it is a circuit transference rather than that of voltage which takes place in the oscillation transformer. For maximum results, therefore, the secondary of the oscillation transformer should be connected in that portion of the aerial circuit where the current loop is located, i.e., the ground. Sets so connected have by actual test proven their advantage.

We then can forego the panel set located in the operating room and place the transmitting apparatus in the basement with great advantage. By one stroke we make unnecessary a panel, eliminate the noise and gain efficiency.

With such an arrangement it is hardly necessary to burden the technical press with another design for assembling the apparatus. Mount the instruments compactly in a box fastened to the ceiling of the basement,

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using an oscillation transformer for coupling the aerial and closed oscillating circuit. A pair of No. 14 rubber covered wires can be run up through the partitions to enable a key to be located, at the operating table for transmitting.

The ground lead should run straight to the water pipe or buried wires if pipes are not available. By remembering that the voltage is low and the current high at the ground connection the importance of this part of the installation will be fully realized.

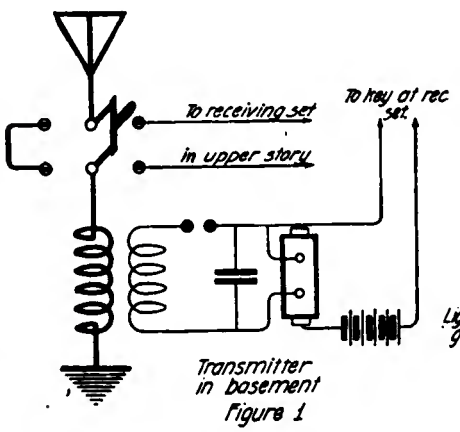

Figure 1

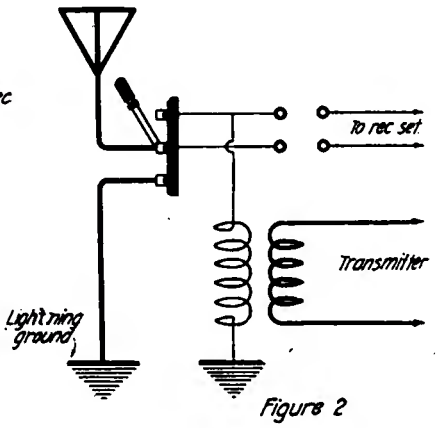

Figure 2

Two circuit diagrams showing the secondary of the oscillation transformer coupled to the ground section of the aerial circuit

A difficulty is apparently introduced in the matter of switching in the receiving instruments. This can be readily overcome by the insertion of a switch as shown in the accompanying diagram. By mounting the lightning switch so it can be operated by a rod extending through the wall it can also serve as an aerial switch, open for receiving, closed for transmitting.

The transmitter should be carefully adjusted by using a wavemeter and a decremeter. A hot wire ammeter is sometimes very deceptive. The best way is to tune to 200 meters and then get another station to listen in and determine the sharpness of the tuning, loosening the coupling till the wave emitted is clear and sharp. It is well to remember that if the strength of the signal drops to half value by detuning 6 meters on the wavemeter the wave has a decrement of .02 or less. It will be found that a closer coupling can be used with a set located in the basement than one in the upper room of a house with an increase in range.

These paragraphs may cause a state of confusion in the minds of those about to construct a panel set, but it is merely a question of whether the improved appearance of your station is more to be desired than efficiency. Let the amateur decide. Of course he can build a panel set and place it in the basement; or better still, locate his station there with improvement in all respects.

The Vacuum Tube as a Frequency Multiplier

By Clyde J. Fitch

BESIDES being a detector, generator, and amplifier of radio frequency currents, the vacuum tube can also be used as a frequency multiplier. Figure 2 shows a method of tripling the frequency. This method has never been tried by the writer, and is offered only as a suggestion for the experimenter. A sinusoidal alternating current connected to terminals A and B, figure 2, will cause an alternating current of three times the frequency in the circuit L_2C_1, if the tubes are properly adjusted, and the coils L_1 and L_3 are of opposite polarity.

An explanation can be found from the characteristic curve of the tube,

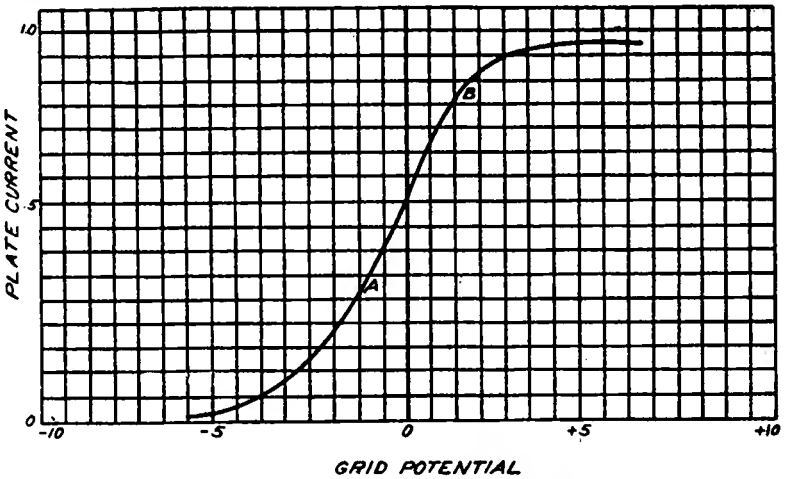

Figure 1—Characteristic curve of the vacuum tube

figure 1. The horizontal axis indicates the potential of the grid in respect to the filament, and the vertical axis, the plate current in milliamperes. As the grid potential increases, the plate current at first increases rather slowly, then very rapidly, then less rapidly, and finally becomes constant at the saturation point. By carefully adjusting the filament current and plate potential of tube V_1, we can operate it at the lower bend of the characteristic curve, at A, figure 1, and the plate current through L_3 will be peaked, as in B, figure 3. By adjusting the filament current and plate potential of tube V_2 to operate at the upper bend of the curve at B, figure 1,

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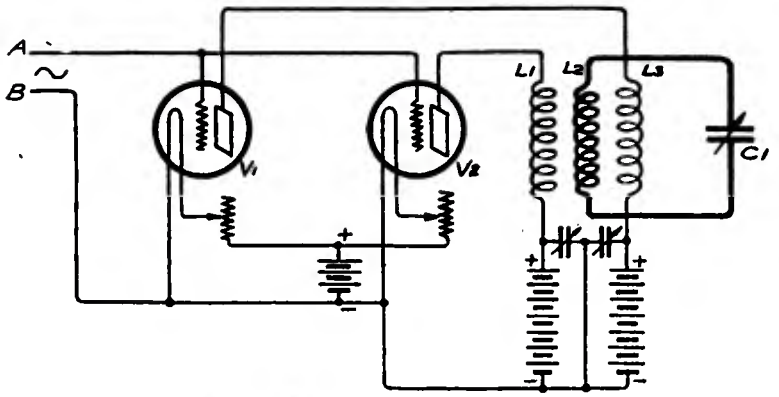


Figure 2—Method of tripling the frequency

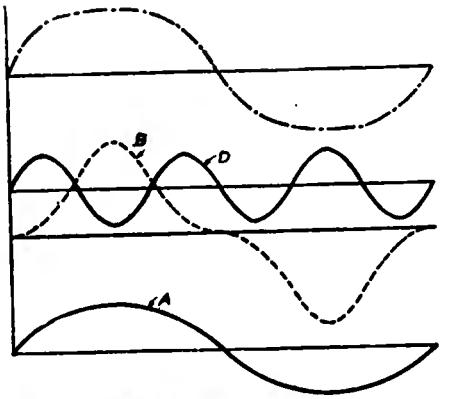


Figure 3—Graphs showing plate current resulting from various adjustments

the plate current through L_1 will be flat topped as indicated by upper curve in figure 3.

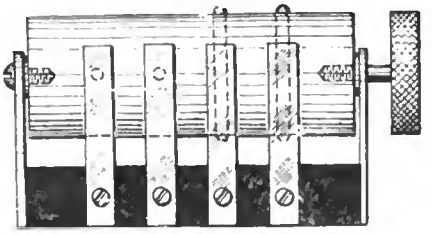
Curves B and C each indicate the presence of a strong harmonic oscillation of three times the fundamental frequency. By connecting coils L_1 and L_3 so they are 180° out of phase, and hence neutralize each other, the fundamental oscillation will disappear, and the harmonic of triple frequency will exist alone. This is shown in curve D, which is obtained by subtracting the ordinates of curve B from those of curve C. Curve D, therefore, represents the resultant current through coils L_1 and L_3 and will induce a similar current in the tuned circuit L_2C_1. Curve A represents the alternating current connected to terminals A and B, figure 2.

Circuit-Changing Switch for Receiving Sets

By Arno A. Kluge

FOR changing various connections in the receiving set when different circuits are being tried, it is often desirable to have a switch that will accomplish this in one operation, instead of using a number of separate switches. Telephone cam switches are commonly employed for this purpose, but these sometimes introduce capacity effects that are unwelcome, and are rather expensive for the amateur of limited means.

The switch here described is not open to these objections, as it has very small capacity effect and may be constructed of the simplest materials at slight cost. It consists of a rod of bakelite or well-seasoned hardwood, about one inch in diameter, mounted



Complete switch with four pairs of springs

to turn just above a rectangular block of the same material. The bearings for the rod are provided with machine screws threaded into each end, holes ¼ inch deep being drilled for the screws. The bearing supports are made of 1/16 inch brass strips screwed to the ends of the base block.

A series of contact springs touching the sides of the rod are mounted on each side of the base block, and the connections between different sets of these springs are established by means of conductors running through the rod. These conductors are made of ⅛ inch copper or brass rod, forced into holes drilled for that purpose, and projecting 1/16 inch on each side. It will be noted that one pair is at right angles to the other pair, so that the connections are changed by turning the rod through 90°. The contact springs are made of No. 28 phosphor bronze or brass, ¼ inch wide. The accompanying drawing shows a complete switch with four pairs of springs, but any number required may be used.

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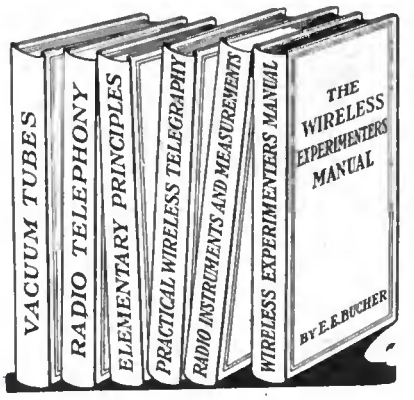

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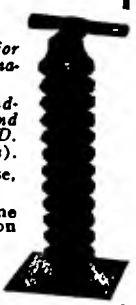

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A Simple and Ready-Made Aerial

By C. L. Allen

THE cartoon showing the city fisherman with all his fancy tackle but with no fish, and the typical country lad with almost no tackle, but with plenty of fish, is familiar to everyone. Perhaps the average wireless novice is like the country lad in that he has rather meager tackle with which to conduct his wireless experiments. The resemblance ends there, however, for the art of operating wireless apparatus involves a few qualifications not generally encountered in the art of catching fish. No problem is likely to cause as much hesitation, next to the financial one, as that of the aerial. The novice no sooner reads that the "longer and higher the aerial the better" than he longs for a couple of skyscrapers to stretch his wires between. However, he turns over a page only to learn that someone has actually buried the aerial in the ground—it's no longer an aerial. The novice may accept these statements, but he doesn't understand them. Such extremes are too much for a beginner, and it is as much of a mystery to him as the latest fashions showing women wearing furs in summer and socks instead of stockings in winter.

In selecting the proper type of aerial, therefore, the beginner will perhaps do well to compromise on a happy medium, especially if his purse is inversely proportional to his ambition.

The writer, being affected with the usual beginner's troubles and in addition being, paradoxically, lazy as well as ambitious, began by looking about for a "ready made" aerial. After debating several schemes and trying others he found a possible solution of the problem in the common down-spout and tin gutter of his house. The spout was of copper and the gutter of tin, both of good size, and the latter not over thirty feet from the ground, but extending completely about the house. A wire was soldered to the spout near the bottom and led into the house, with a jack knife switch placed

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presents six different surfaces of the Crystal to the action of the needle, without changing its position. It keeps you on the LIVE SPOT at all times and thereby gives you the loudest and clearest signals.

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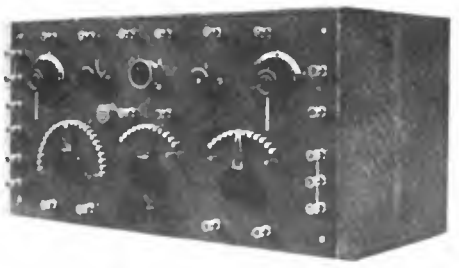

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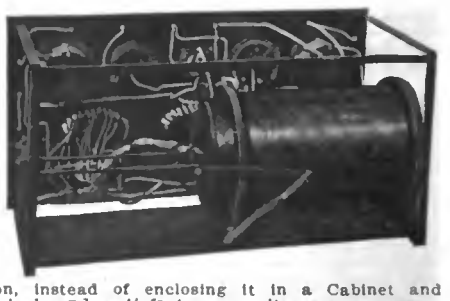

We reproduce the set in its entirety that you may see and understand its construction, instead of enclosing it in a Cabinet and allowing you to guess. It is now used in Schools of Radio Instruction where Technical and satisfactory results are necessary.

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in the circuit between the spout and the instruments.

Two grounds were available at pleasure by means of a two-point switch, one on the water pipe and the other on the gas main, the latter at the point where it entered the house from the street.

This "ready made" aerial—found on practically every dwelling, however humble or elaborate—actually offers the novice something for nothing and, aside from the moment consumed in soldering the connecting wire, involves no expenditure of time or labor. If in a given case it does not give desired results, it might be kept in mind that height is really of consequence, and a "three decker" dwelling is preferable to the bungalow type.

The arrangement offers no added danger from lightning, does not need any ground switch, is not liable to be blown down by storms and is not conspicuous before the general public.

With a tuning coil, a simple detector-condenser and a pair of four dollar 2000-ohm receivers, the writer began the job of "listening in." No fisherman ever waited for a bite with greater eagerness or with less results. However, after much trying of this and that, until patience had ceased to be a virtue, one evening, "while I nodded, nearly napping, suddenly there came a tapping, as of someone gently rapping"—and, behold! NAF (Newport, R. I.) made its first recognized entry.

There is something about hearing one's first wireless signal that is a reward for all the work and time that has gone before; like the boy's first rifle it may be a pretty slim affair but it's real, and it's his. What further joys the reading and grasping of a complete message might bring, the writer could then only surmise, for his knowledge of the code was very limited.

One of the biggest fish in the wireless pond is the time signal sent out by high-power stations, and since it calls

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for no knowledge of the code it is not so very difficult to angle for. However, the wireless sets usually described as suitable for time signal reception are somewhat more elaborate than the simple outfit already mentioned, and the aerials are "longer and higher." It was only by chance, therefore, that the writer was listening in late one evening, and it was only a childish desire to see the wheels go 'round that made him push the slider much further along the coil than usual, which accidentally put the receiver in tune with NAA (Arlington, or Radio, Va.) Signals came in on his tin gutter aerial, located in New England. The signals did not come in like the boom of a cannon, nor even like those of the "buzzer," but they were audible.

Subsequent trials were disappointing, especially in the daytime, and so a loose coupler was substituted for the coil and several crystal detectors were also tried. Crystal detectors remind one of the old adage "when she will she will, and when she won't she won't, and there's an end on 't." Doubtless other detectors are equally guilty. Fortunately there is nothing bigamous about having more than one detector; in fact, there seems to be safety in numbers, although two will answer nicely and also reduce the expense. The detector is the very heart of the apparatus, the *sine qua non* of the whole, yet the most satisfactory detector the writer has used to date cost about two dollars and was of a simple vertical type with a ball and socket adjustment, the galena crystal enclosed in glass, and the whole looking more like a tiny lantern than anything else. With this equipment the reception of signals at night could be depended upon fairly well, although some nights were better than others. With the approaching summer they grew weaker. The aerial apparently worked equally well during rain or sunshine.

Having tried a much-advertised amplifying device without getting the desired results, I experimented with a pair of high-priced receivers of novel design, acquired from a fellow "bug." After repeated trials no appreciable improvement was noticed and added respect was acquired for the cheaper telephones which were apparently giving results out of all proportion to their cost.

With a pair of ordinary wireless receivers bridged across a fixed condenser and with a good detector and loose coupler many of the long winter evenings will not seem so long, even in these dry times, and the total cost need not exceed ten or fifteen dollars.

By getting a book on first principles of wireless, any Tom, Dick or Harry can learn to manipulate a set and secure results. Experience is the best instructor. Moreover, the wireless telephone is already knocking at the door and will in all probability be in regular use ere long. The novice can then entertain the whole family whether they know any code or not.

Prize Contest

The next Prize Contest Subject is:

"The Design and Construction of a Simple Wavemeter, Range 150 to 300 Meters."

Those designs which are built around any one of the standard type of condensers obtainable on the market will be given preference. The data should include a calibration curve for the instrument.

The prize-winning articles will be published in the June issue.
Closing date, April 17th.

Contestants for the prizes are requested to submit articles at the earliest practicable date.

To one who pays frequent visits to the stations of his amateur friends, it is surprising to note the absence in the majority of these, of any form of wavemeter. A wavemeter is a very simple thing. It is also an extremely useful device and the simplicity of its construction, together with its usefulness, should be sufficient incentive for every amateur to construct one.

PRIZE CONTEST CONDITIONS—Manuscripts on the subject announced above are judged by the Editors of The Wireless Age from the viewpoint of the ingeniousness of the idea presented, its practicability and general utility, originality, and clearness in the description. Literary ability is not needed, but neatness in manuscript and drawing is taken into account. Finished drawings are not required, sketches will do. The contest is open to everybody. The closing date is given in the above announcement. The Wireless Age will award the following prizes: First Prize, $10.00; Second Prize, $5.00; Third Prize, $3.00; *in addition to the regular space rates paid for technical articles.*

All manuscripts should be addressed to the Contest Editor of The Wireless Age.

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5AP in Texas

STATION 5AP, illustrated in the accompanying photograph, is the property of Raymond L. White, of Ennis, Texas, and is located three miles from the city of Ennis, at the Lake Side Country Club.

The station is a one-room boxed building, and is something similar to the radio cabin found on boat deck of the average ocean going liner. It is situated at the end of one of the 60-foot masts, and a six-wire inverted L antenna is employed. There are no buildings or obstructions near, and when the station is fully completed some very efficient work is expected. In location it is something similar to that of 9ZN.

The transmitter consists of a 1 k.w. Thordarson transformer having a secondary voltage of 24,000, twelve Murdock moulded condensers with a capacity of .0017 mfd. each, connected in series parallel (seven condensers and one rack missing), Murdock non-synchronous rotary gap. The oscillatory transformer is made of 1" x 1/16" brass ribbon and mounted as shown, the hot-wire ammeter is just to the left of the oscillatory transformer mounted on the marble slab; the necessary connections for the transmitter are of copper braid 1 1/16" in width.

Station 5AP, owned and operated by Raymond L. White, Ennis, Texas

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The receiver consists of a navy type loose-coupler (short wave regenerative receiver coming). The arc receiver has a wave length of 300 to 18,000 meters.

The installation of a short wave regenerative receiver has since been effected. Stations on 425 meters (special amateurs) and 600 meters come in exceedingly well.

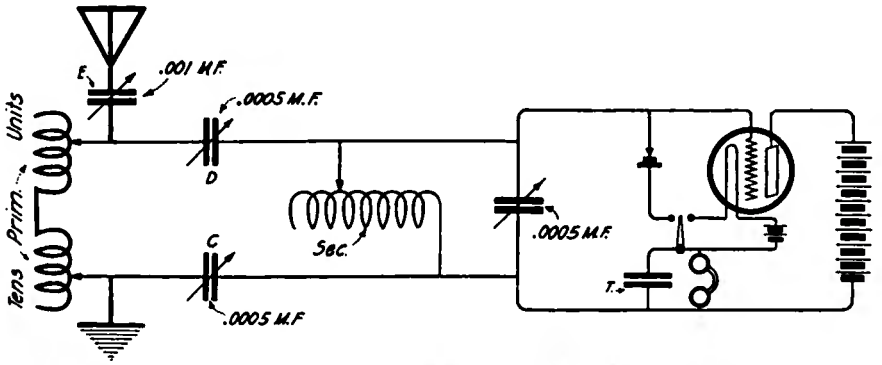
Electrostatic Coupling

R. Newell Turner

IN the majority of cases, descriptions of radio receiving sets which are published in THE WIRELESS AGE and other magazines, refer to electromagnetic coupling.

It appears just a little odd that so few have turned their attention to the electrostatic or capacitive coupling, and I am sure experimenters would be more than repaid if they would investigate it.

The set is more compact and more rigid because the "loose coupler" is replaced by multi-layer coils which are permanently fixed. The coupling is not only easier and quicker to adjust but more complete and it affects the wave length less than the inductive couplings.



Secondary coil should be perpendicular to primary. Condenser "E" may be placed either in series or multiple. It may be omitted entirely, but better to have it as in diagram. Condenser "C," the coupling condenser connected to the ground, may be omitted, but if so, the set will be slightly less selective

I have used the "loose coupler" for some time, but I have now discarded it and have made a receiver with a capacitive coupling which is more satisfactory than I have ever found the inductive coupling to be.

The capacitive coupling is very selective and, in comparative tests, signals came in louder than with the "loose coupler."

The experimenter will find that the condenser bridged across the 'phones may be of much greater capacity than is ordinarily used.

The condenser in the primary circuit could be omitted, but it is valu-

Up - Down - or Sideways

A
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able for "stiffening the circuit," as Marconi calls it.

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Some Recent Amateur Apparatus

By W. H. Kirwan

BEFORE the war I tried to perfect three tuners, one of the 200 meter regenerative type, the other an Arlington tuner efficient on wave lengths from 600 to 3,000 meters, and the other a small 20,000 meter tuner. Success was achieved in designing the coils, but trouble came immediately thereafter because a certain European nation had the idea that it could lick the world and all the amateurs therein. Some will remember that amateur work then stopped for a while. But the original scheme about the three units did not die and all three tuners are perfected. They weigh 2 lbs. each and are about 4" x 4" x 3" in size. The highbrows claimed the tuners were no good, could not possibly work, and said lots of other things that did not in the least discourage this hard-boiled amateur.

This type of tuner is wound with 800 turns of No. 28 enameled, silk covered, or cotton covered wire, all of which were found equally efficient for the primary winding. Taps were not used; instead, a loop of the wire was brought out at 5 equal points, 160 turns apart. It was found that taps caused trouble in shorting adjacent layers. I have wound the primary coil with this wire, using a lathe for the purpose, and getting what has been called the involute winding, but fair results may be obtained by winding the coils any old way you want to. I have wound the coils so that the wire

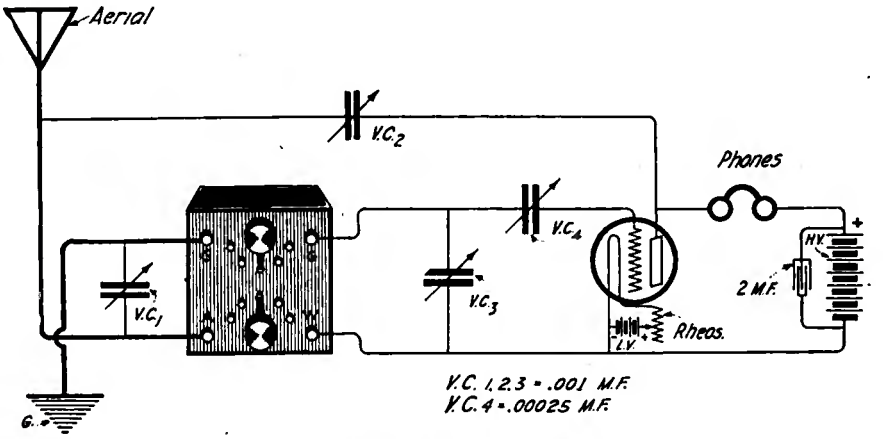

Diagram of the vacuum tube circuit used with the three tuners of 200, 600-3,000, 4,000-20,000 meters range respectively

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makes 1½ turns and advances across the coil ¾". This makes the pitch of the winding ½". At this point the winding returns to the width of the wire from where it started, crossing the first wire or layer twice. The winding is advanced the thickness of the wire after each 1½ turns, by properly gearing the lathe; it starts back that much quicker from the other end. This makes a coil that is self-contained and needs no outside wrapper to hold it together. Eight hundred turns are wound on a wooden form ¾" wide and 2" inside diameter. This gives an outside diameter of about 3", depending on what kind of wire you use.

The secondary is wound the same way, only the form is ½" larger in diameter; No. 32 wire, enameled, silk or cotton covered; all work equally well. The secondary should have at least 1,200 turns of wire, tapped at 5 equi-distant points and use the loop tap, not the soldered tap. These two coils will then have 6 taps or wires coming from them, the beginning, the end, and 4 taps.

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B-1-2-3-4-5, use one on both primary and secondary, by running the wires through the holes, and see that the taps are as marked. These coils then may be put in a small box or tube just big enough to hold them and a good grade of paraffin poured into the box.

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XDA, the station in Mexico, comes in on his natural tone with the aerial wire connected to the ground terminal and without any ground wire to it at all, merely using the capacity of the body as a ground. I have tried the tuners with the underground aerial, and with the Jones underwater open end coils, and they function equally well, using different hookups, however. Loop aerials also work.

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Advantage can be taken of this fact to employ a wavemeter without any changes to determine whether the decrement exceeds the limit set by the government. It will be found that at 200 meters, detuning 6 meters will not weaken the signal to less than half its intensity if the decrement is .2 or less.

Thus, when a detector and phones are employed, the decrement of a transmitter can be found roughly by placing the wavemeter quite a distance from the transmitter so the note in the receivers at its maximum intensity is comfortable, that is, not annoyingly loud. Then detune the wavemeter till the tone has dropped to half its former value. Now determine the wave length at the last setting of the condenser. If the difference between the actual wave length of the transmitter and the wave length giving half-signal intensity is greater than six meters, the decrement is too great. Should it be six meters or less, the decrement is within legal limit. This is a very handy method of checking the sharpness of the emitted wave.

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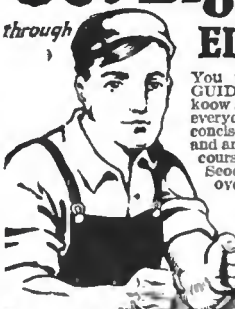

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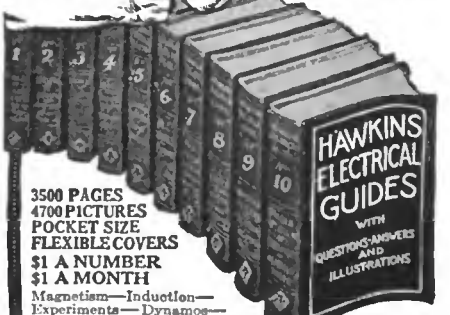

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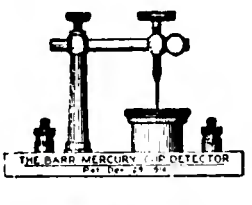

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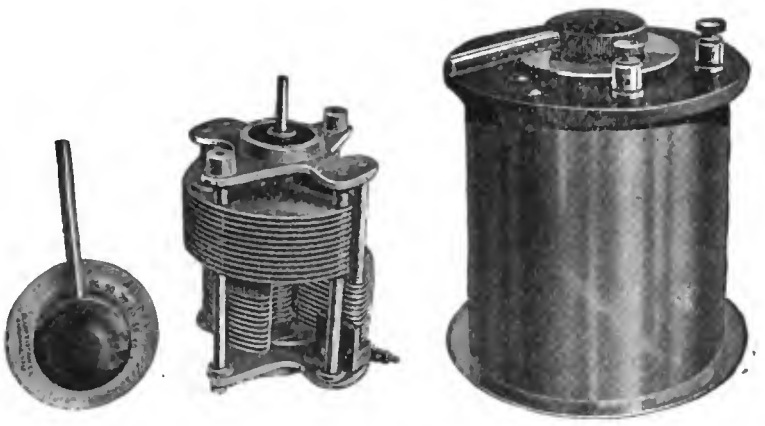

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loosening the coupling between the primary and secondary of the oscillation transformer, thus getting the aerial circuit to oscillate freely at its natural period.

The tuning of a set is often done by means of a hot-wire ammeter but there are certain characteristics of this instrument that lead to short range and poor tuning. An ammeter may often give a high reading while the range of the station and sharpness of the wave is anything but good.

Consider a set emitting a highly damped wave with two humps, as is usually the case. This results from too close coupling between the primary and secondary of the oscillation transformer, permitting the aerial circuit to react on the primary oscillation circuit.

At the receiving station only one of the humps can be tuned to at a time, and only the energy represented in that particular hump will affect the receiver, the energy in the other hump being wasted. But the ammeter at the transmitter will record the current in both humps, which would indicate plenty of power in the aerial circuit, whereas but a portion of it can be utilized at the receiver.

Loosening the coupling and making the wave sharper may reduce the ammeter reading, but the range will be increased. This is due to the fact that the energy is lumped into one hump and has a greater effect on the receiving set. Though the actual current in the antenna is reduced, it is so distributed that it is more effective than the larger current value divided into two, and sometimes more, humps.

Therefore, when the range is out of proportion to the ammeter reading it is not always the fault of the meter nor of the receiving set. Under these conditions, check up the decrement as previously described and it will usually be found to exceed the amount permissible in an efficient set. A broad wave is not only a nuisance in the ether, but it is a waste of power, has a bad effect on the range of transmission and the sure sign of a "Ham."

Apartment House Antenna

THE apartment house has always been a draw-back to the Radio Bug. It is hard to obtain a permit to put up an antenna, and if a permit is obtained, there is always some old woman who is afraid of lightning and will complain to the owner. After which, much to your sorrow, the antenna you put up to stay has to come down. But fear not, there is still a chance, a good chance, of coming into your own.

You have no doubt heard of people using such things as beds, fire escapes, gas fixtures, etc., but when you tried

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to use them they did not work. Well, here is one that will, and you can sit down and listen-in to your heart's content.

You know when you have visitors and the bell rings, and you or mother run out in the kitchen to press the button so that the ticker on the door will work. Well, that's the secret. All you have to do is to unscrew the button cover and inside you will find two connections. Attach a piece of wire to one of these and connect to the antenna binding post of your set; connect another piece of wire from the water pipe to the ground post of your set, dust off the head set, connect them in—and you can sit back and listen to the music that touches your heart.

A New Club in Brooklyn

AT the first meeting of the Bedford Wireless Association, held in the radio room of the Bedford Y. M. C. A., Brooklyn, N. Y., the following officers were elected: G. Johnson, president, and J. Corcoran, secretary. Two instructors have been secured, Dr. Happe, an all-around radio man, and Mr. Bowie, formerly radio instructor in the U. S. Navy Radio School at Harvard University. They give instruction every Friday night from 8 to 10 p. m. Arrangements are being made for members to visit the big naval wireless stations and those maintained by the different local newspapers.

The club has a receiving set, 15,000 meters, and a transmitter with a motor generator, ½ k.w. transformer, 5 Murdock condensers, a rotary gap and an oscillation transformer.

All those in the Bedford district who are interested in wireless and who would like to join, see or write to Mr. James Corcoran, secretary, 420 Gates avenue, Brooklyn.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.
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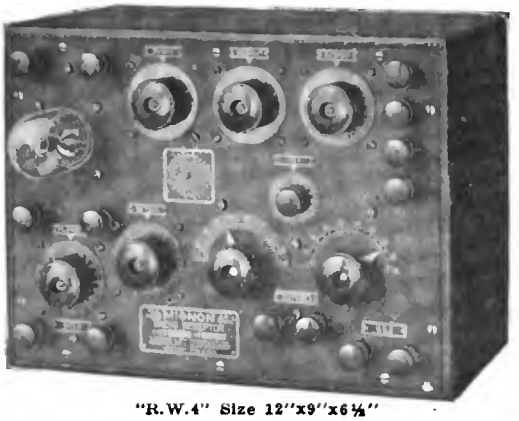

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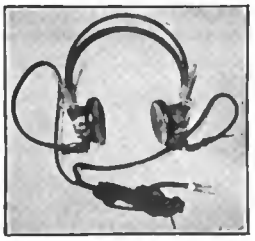

These head receivers are the exact type used by the Army and Navy wireless operators during the war. The Signal Corps U. S. A. knew them as #P-11. The U. S. Navy knew them as C-W 834.

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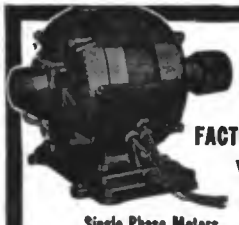

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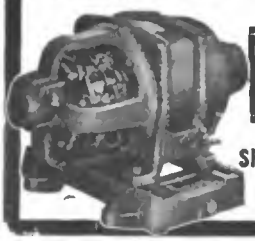

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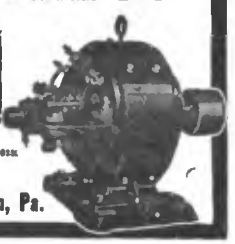

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We are at a loss to understand your inability to receive San Diego time signals at night when you are able to hear them at noon. It may be possible that the absorption at his wave length is greater under night conditions than under day conditions. This is sometimes the case; instances having been known where communication was possible at, say, 3,000 meters during daylight, and only possible at a much shorter wave length during night time.

From what you have to say about the action of your tuner, we are led to suggest that you procure a good text book on radio telegraphy. Instructions for the proper manipulation of a receiving transformer and explanations of the "reason why" will be given there.

A tin shack underneath your aerial would somewhat reduce its effectiveness.

Another condenser in shunt to your primary winding would increase your wave length, but we suggest the use of additional inductance instead.

* * *

F. B. A., Pennsylvania:

The current which flows through the receivers in a vacuum tube circuit is a pulsating direct current.

Coupling the plate circuit to the grid circuit will produce an alternating radio frequency current in both the grid and wing circuits. A vacuum tube is a repeater. If an impulse is thrown upon the grid of a vacuum tube, the rate of electron flow which is taking place between the plate and filament of this same vacuum tube is changed, due to the change of state of the grid. Now, if the plate circuit is coupled to the grid circuit, any change in the electrical states existing in the plate circuit as a result of impulses thrown upon the grid, will be communicated to the grid, which will in turn disturb the electrical state in the plate circuit a second time, and so on. Thus, if the grid circuit and plate circuit disturbances are properly timed by the tuning of the plate circuit and the grid circuit and by the use of a particular value of coupling between these two circuits, this reflex action will continue indefinitely and the tube is said to be in an oscillating state or to be a generator of oscillations. The frequency of these oscillations depends upon the electrical period of (usually) the grid circuit. The electrical period of the grid circuit in turn is determined by the value of inductance and capacity in this circuit. For ordinary radio work, these values are of such order as to produce frequencies above the range of audibility of the human ear. They, therefore, cannot be heard. If you wish to hear the oscillations of a vacuum tube in your telephones, it will be necessary for you to use inductance and condensers of such size that oscillations are forced to take place at frequencies lower than about 15,000 cycles per second.

The coupling between the wing and grid circuits may consist of resistance, inductance, or capacity. The effect in all three cases is the same. Resistance coupling is seldom used due to the losses which take place in the resistance. Capacitive coupling is often used on account of its simplicity and, perhaps, its convenience; but inductive coupling is usually the most satisfactory, and this is particularly true when amateur wave lengths are being dealt with; capacitive coupling being suitable in every respect only at the longer wave lengths.

* * *

W. O., Indiana:

With reference to the article describing a short wave regenerative receiver in the May, 1919, issue, the loose coupler primary

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should be 3¼" in diameter and 2½" in length. The size of the secondary should correspond with this.

* * *

C. R. L., Illinois:

It will be necessary for you to secure a license for transmission of any sort, in order to be on the safe side.

* * *

J. A. B., New Hampshire:

With reference to your first hook-up, if you will shunt the telephones and high voltage battery with a condenser of about .001 mfd., oscillations will be more easily obtained. The fact that your antenna and ground are connected directly across the grid circuit inductance will increase the effective resistance of that circuit to such extent as to make the production of oscillations considerably more difficult; that is, to require abnormally close coupling between the plate and grid circuits.

With reference to your figure 2: If your inductance and capacity are of the proper value, you should have no difficulty in making this work easily at any wave length. Try a variation of your inductance.

Regarding hook-up number 3, if one of your two tubes is to be an oscillator, the efficiency of the outfit cannot be materially increased, if at all, by the use of a radio frequency amplifier tube. You might better use this tube as an audio frequency amplifier.

* * *

F. G. O'B., Nova Scotia:

If you place one of the receivers of your head set on a phonograph horn the volume of the signal received will be very greatly increased, and inasmuch as you are using a three-stage amplifier this should prove suitable for time signals, etc. The resistance of the receiver may be of the usual order, that is, 1,000 to 2,000 ohms.

With reference to the data on your transmitter: Assuming that the dielectric constant on the glass in your condenser is 3, the capacity is approximately .005 mfd. From the data which you have given, the approximate inductance of the primary of the oscillation transformer is 25,000 centimeters. Under these circumstances, your maximum wave length is probably about 445 meters. If you wish to increase your wave length to 600 meters, you may do so by doubling either the capacity or inductance in your closed circuit, and, in all probability, doubling the inductance in the antenna circuit will be sufficient for that circuit.

Your 200 ft. aerial, 80 ft. high with the 3 wires, inverted L, has a fundamental wave length of approximately 375 meters. This antenna should be used for your 600 meter work.

Book Reviews

Airplane Antenna Constants.

In this new paper which the Bureau of Standards has ready for distribution, methods are described for measuring the capacity, inductance, resistance, and natural wave length; also the directional transmitting effect of airplane antennas, when the plane is flying. Using these methods results obtained upon various forms of fixed antenna, as well as with one, two, and four trailing wires, are recorded.

Selenium Cells and How They Are Made. By Samuel Wein. The Progress Publishing Co.

This book should be welcomed by those who would like to carry out some of the extremely interesting experimental work which is possible with selenium cells. The publication gives a concise chronological review of the history and development of selenium cells, as well as some very practical data on their construction.

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Fleming Pat. No. 803,684
De Forest Pat. Nos. 841,387-879,532

A WARNING

to Manufacturers
Importers
Dealers
Jobbers
Agents
Amateurs
Purchasers
Users of

Vacuum Tubes

The Marconi V.T. Patent is Basic

United States Letters Patent to Fleming, No. 803,684, November 7, 1905, has been held to be valid by Judge Mayer of the United States District Court for the Southern District of New York, and by the United States Circuit Court of Appeals for the Second Circuit.

It is a basic patent and controls broadly all vacuum tubes used as detectors, amplifiers or oscillions in radio work.

No one is authorized to make, sell, import or use such tubes for radio purposes, other than the owners of the patent and licensees thereunder. Any others making, selling, importing or using them alone or in combination with other devices, infringe upon the Fleming patent and are liable to a suit for injunction, damages and profits. And they will be prosecuted.

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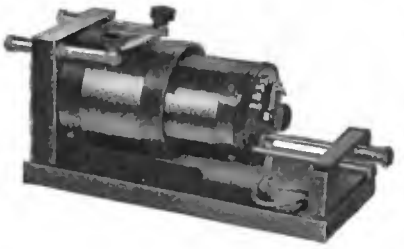

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L-150	660-2200	1.80	LL150	2.16
L-200	860-2850	1.90	LL200	2.28
L-250	1120-4000	2.00	LL250	2.50
L-300	1340-4800	$2.10	LL300	$2.66
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L-500	2340-8500	2.40	LL500	3.35
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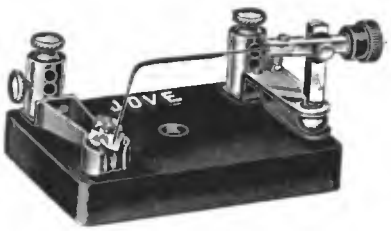

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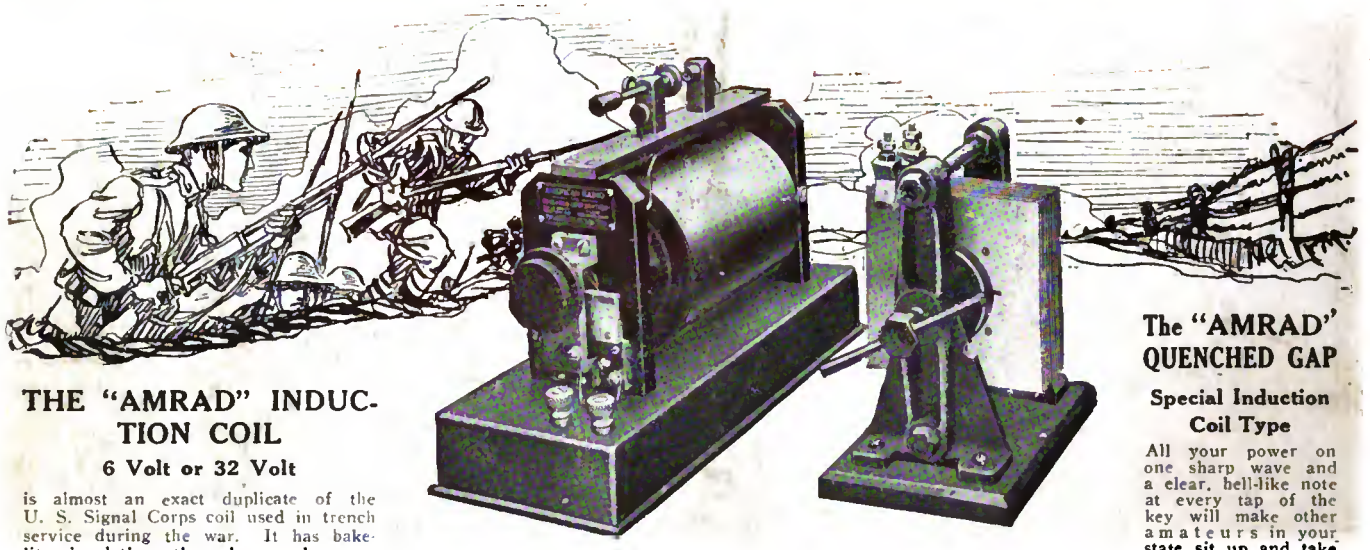

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"Amrad" Quenched Gap, " " - - -	**12.50**
	$41.00

Special Price for the Double Buy, $33.50

Either 32-volt or 6-volt coil may be chosen

How to Order Show this advertisement to your dealer and ask him to order one of these combinations for you. If you have no radio dealer in your vicinity send us check or money order for $5 and we will ship direct to you by parcel post C. O. D., the balance plus postage. Act promptly, as the standard Signal Corps parts which we secured from the Government were only sufficient to make up a limited number of sets. If you are not ready to buy and want further information send for free Bulletin P which contains complete description and operating directions.

Dealer's Opportunity Write at once for short-term trade discount on this combination. No better opportunity to introduce apparatus of such high quality at such low prices will ever be had again. The offer is made especially to introduce our rapidly growing line of "commercial type" radio apparatus.

Address all communications to New York office

AMERICAN RADIO AND RESEARCH CORPORATION

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