THE WIRELESS AGE

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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.

DECEMBER, 1915

War Incidents

The Sinking of the Ancona. Directing British Gun Fire from an Aeroplane. Rescuing the Anglia's People

IT is the exception to the rule when an event of the European war occurs in which wireless and wireless men do not figure. Sometimes they are used to defeat the plans of the enemy; on other occasions they are employed to save human lives. And the art is invariably called into play to good purpose. This was the case when the Italian liner Ancona was sunk in the Mediterranean on November 7 by an Austrian submarine. Reports on the loss of the ship say that the Marconi operator on the former vessel sent out a distress signal when the attack was made and consequently a rescue ship arrived on the scene in time to save the lives of a large number of persons, among whom is said to have been one American. The loss of life is estimated at more than 200.

The Ancona left Messina at eight o'clock in the morning on November 6, according to a newspaper report. About half past ten o'clock on the morning of November 7 she picked up a wireless distress signal from the steamship France, reading: "S O S. We are being shelled."

The message ended abruptly without the position of the France being given, so that it was impossible for the Ancona to go to her aid. The Ancona continued on her route an hour afterwards, the sea being calm and the weather misty.

Without any sort of a warning the report of a gun was heard and shells simultaneously struck the Ancona forward, causing considerable damage. The wireless operator immediately sent out a distress signal with the name of the ship and her position.

The submarine approached nearer the Ancona, keeping up a continuous fire. First the wireless telegraph apparatus was demolished and then the lifeboats were shot to pieces. Fifty shots at least were fired until the Ancona stopped.

The commander of the submarine announced that he would allow ten minutes for all to quit the ship. The unsmashed boats at once were lowered, and after the wounded had been placed in them the passengers and crew followed. This was going on for half an hour when the submarine fired a torpedo which struck the Ancona on the bow. The ship sank gradually and finally disappeared beneath the waves.

Toward six o'clock in the evening the mine layer Pluton, which had picked up the Ancona's distress message, arrived on the scene. Most of the survivors thus were rescued close to the place where the steamer sank.

Additional details regarding the attempts to rescue those on the Ancona were obtained when the new Italian steamship Giuseppe Verdi reached New York on November 20 on her first voyage.

The Verdi heard the Ancona's wireless appeal for aid, flashed it on to shore stations, and then rushed at full speed to the Ancona's assistance. The Verdi steamed close to the spot where the Ancona went down, but her lookouts saw nothing.

Luigi Moroni, Marconi operator on the Verdi, said, according to a newspaper report:

"We were about 200 miles out from Palermo, watching for submarines which we had been told were nearby. At 9.20 I got a signal."

"'S O S France submarine,' was the message. Then 'Help.' This was followed by the France's position, and there was nothing more.

"We exchanged several messages with the relay ships concerning the France and submarines and while we were talking the Ancona's wireless broke in. It was 10.30.

"'S O S, S O S, Ancona,' we got. The Ancona gave her position. I sent this message to the shore stations as soon as I got it and within a few moments they sent back the answer: 'Go to the Ancona.'

"Captain Zannoni swung his ship right about and gave orders for full speed. The stewards quickly loaded the lifeboats with emergency supplies and swung them out on their davits.

"The passengers, told of the danger, were assigned to the boats, every man, woman and child being given a number. It was ninety-four miles to the Ancona and we made it at top speed.

"We tried to find some trace of the Ancona or her boats with glasses, but failed. Then we steamed away."

The officers of the Italian liner Duca Degli Abruzzi, which arrived in New York on November 17 from Genoa, said they left Naples two days ahead of the Ancona, and did not see any submarines. On the afternoon of November 5 the operator heard the S O S call for help, but could not get the name of the vessel nor her position. Next morning the liner passed a quantity of wreckage and a smashed lifeboat on which were letters indicating that it had belonged to a British freighter.

On November 7 the wireless operator picked up a message telling of the sinking of the Ancona.

When the German ship Konigsberg was attacked and destroyed by the British forces wireless in aeroplanes was used to direct the fire of the English. Chief Paymaster Charles Spedding of the Laconia, has written as follows regarding the manner in which the occupants of the British aeroplanes conducted themselves:

"During the second day of action an incident occurred which calls forth one's admiration of the pluck and presence of mind of Flight-Commander Cull and Wireless Expert Arnold, who were in the aeroplane that the Germans brought down. When it was seen that there was something wrong with the plane, the spotting corrections still continued, and the last message read as follows: 'Carry on, you are hitting her every time forward. We have been hit. Coming down on water. Send a boat.'

"A few seconds later the aeroplane (a land machine) crashed into the water, throwing Arnold out. Cull extricated himself with great difficulty under water a minute and a half after she struck. He had a very narrow escape indeed. Had these two officers not put the guns on to the Konigsberg in time a different ending of the whole action might have resulted."

The British hospital ship Anglia struck a mine in the English Channel on November 17 and sank. Before she went to the bottom, however, wireless calls for aid were sent and a patrol vessel arrived in time to save about 300 persons.

BEARS ATTACK POLAR EXPEDITION

A thrilling story of a fight with polar bears on drifting ice at the mouth of the Hudson Bay has been brought to Ottawa by a government expedition which has been erecting wireless stations in the far North, says an Ottawa, Ont., dispatch.

A. T. Fleming, a wireless expert, who headed the expedition, reports that while the party of six were endeavoring to locate a site for a wireless station at the entrance of Hudson Bay, they found themselves adrift on a huge floe of ice in a blinding snowstorm.

The following day they were without food and on the approach of night discovered that they were being surrounded by two dozen polar bears. The men took refuge on the top of a giant berg, while the bears gathered and laid seige. During the night the bears made an effort to reach the men, when one of them was killed by a well-directed shot.

In the morning the unwelcome visitors beat a retreat, and the men, half-starved and badly frostbitten, succeeded in reaching camp.

FIRST NAVAL ORDER BY WIRELESS TELEPHONE

Secretary of the Navy Daniels demonstrated to the naval forces of the nation the value of the wireless telephone on November 6 when he issued what has been described as the first navy order ever given by wireless telephone.

The Secretary's order was as follows: "Report as soon as practicable after arrival of the New York how soon the repairs can be completed." Admiral Usher received the message by wireless, replying by wire.

Secretary Daniels was sitting at his desk in the Navy Department in Washington, and personally dictated the order into the mouthpiece of a telephone transmitter. The message traveled over a land telephone wire to the main telephone office in Washington, whence it passed over a telephone wire to the naval radio station at Arlington.

Automatically the message was transferred from the telephone wire at Arlington to the antenna of the radio station and sent through the air to New York City. The message was picked up by the antenna of a wireless station in New York, where it was automatically picked up by land telephone wires, and transmitted by land wires to the office of Rear Admiral Usher in the Brooklyn Navy Yard.

Admiral Usher had his ear at the other end of the receiver and personally received the order. Admiral Usher's office was connected with Secretary Daniels's office by a long-distance telephone wire. By means of this direct land wire connection the commandant, talking to Secretary Daniels, acknowledged the receipt of the order.

"Later I expect to have the pleasure of talking with officers of the fleet at sea by wireless telephone," said Secretary Daniels. "Captain Bullard informs me that the special receiving apparatus will be installed for experimental use on some of the battleships, and that within two months I will actually be able to talk by wireless telephone to Admiral Fletcher, Commander-in-Chief of the Atlantic Fleet, while he is out in the Atlantic Ocean."

The experiment was begun at four o'clock and continued until five o'clock. During that period the Arlington station was temporarily placed out of commission for naval business and was used only in transmitting the radio telephonic message. More than fifty persons witnessed and took part in the experiment, all of the Naval Bureau chiefs being present. Mrs. Daniels, wife of the Secretary of the Navy, was an interested spectator.

The following is part of the conversation between Secretary Daniels and Admiral Usher:

Daniels—Hello.

Usher—How do you do, Mr. Secretary?

D.—Very well, admiral; how are you?

U.—Very well, thank you.

D.—You are looking well. Can you hear me distinctly?

U.—Yes, very plainly.

D.—Your voice sounds very distinct. I want to give you an order over this wire; will you have a stenographer take it down? It is an official message. (Then followed the message.)

U.—Yes, sir. Is there anything more you wish to say?

D.—How long will it take before we can get the California off the ways?

U.—We hope to get that monster off in about thirteen or fourteen months.

D.—Well, you will want another ship in a year, won't you?

U.—Yes, we will be glad to have one in about a year; we would like it a little earlier. We could prepare it much ahead.

D.—Admiral, you have my word, I will try to do that. By the way, admiral, here's a man who has an invention so that you can see over the 'phone. I can almost see you now, I hear you so plainly.

U.—I can hear you so distinctly I almost imagine I see you.

WAR PREPAREDNESS AMONG MARCONI OPERATORS

Being a firm believer in the axiom, "Preparedness in time of peace is insurance against war," the Marconi Wireless Telegraph Company of America has welcomed the suggestion made by Captain William H. G. Bullard, superintendent of the Naval Radio Service of the United States Government, as set forth in recent correspondence between the Navy Department and Edward J. Nally, vice-president and general manager of the Marconi Company.

In his letter Captain Bullard first called attention to the provisions of the Radio Act of 1912 giving the President the power in time of war or public peril to close any wireless station for radio communication, reciting that in such circumstances the United States Navy would require a number of competent operators to man the radio apparatus of ships now in reserve and of merchant vessels which would be taken over by the Navy for auxiliaries. He also called attention to the fact that an increased force of operators on board ships in commission and at shore stations, would be required.

With this emergency in view, Captain Bullard asked the co-operation of the Marconi Company in laying before the operators employed by that company a letter from which the following is an excerpt:

"The necessity of having a list of experienced men who would be available for the above purposes is very evident, and it is desired to obtain the names of such men in times of peace, and to revise the list from time to time as required, so that the Navy would not suffer from lack of operators or delay in training them, when the necessity arises.

"A form is enclosed herewith which, after making the entries as shown, should be mailed to the Superintendent of Radio Service, if you will signify your intention to serve in the Navy as a radio operator.

"This will in no way interfere with your occupation in time of peace, and can be withdrawn at any time, should you so desire.

"The Navy will offer an opportunity to operators to continue in their chosen profession and at the same time give them an opportunity of serving their country in its hour of need. This latter, it is believed, should be a determining factor in assisting you to decide to enter the Naval service at that time.

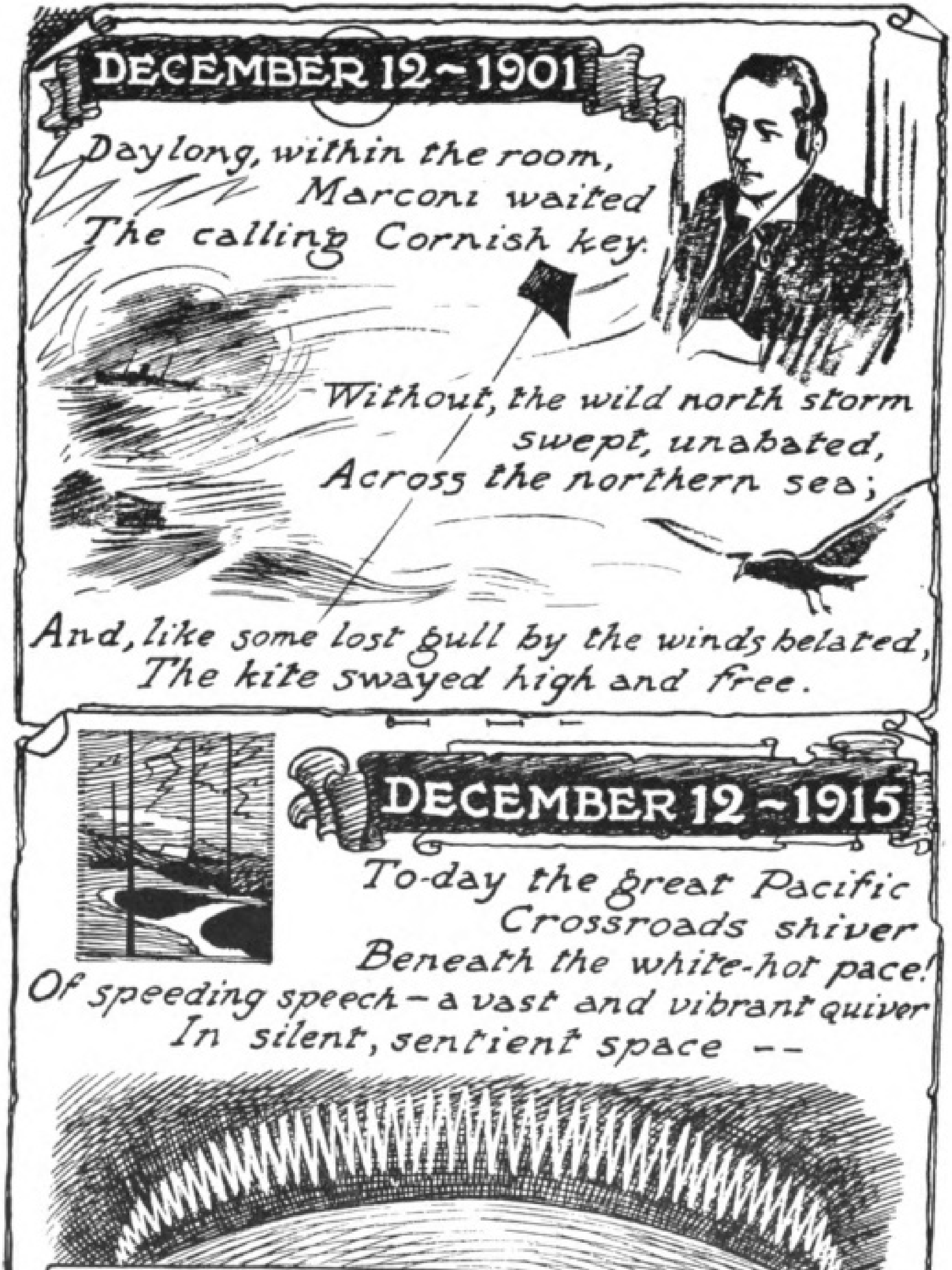
"The enrollment of your name among those who signify their intention to serve the country when required for the national defense, will be of great assistance in the efforts the Navy is making to carry out its policy. 'In time of peace, prepare for war,' and in this policy, you, as well as every American citizen, should be deeply interested. In the particularly important branch, the Naval radio service, you will not only show your interest, but will aid in making it effective, by a declaration of your intentions to offer your services."

The Marconi Company accepted this excellent suggestion and in his reply to Captain Bullard Mr. Nally, on behalf of the Marconi Company said:

"We shall be very glad, indeed, whenever you are ready, to do what we can to co-operate in the matter of the employment by the Government of radio operators of our company at such times as public exigencies might demand.'

A copy of Captain Bullard's letter requesting the return of the completed form referred to. was immediately placed in the hands of every operator in the Marconi service. The form covered the following points: Preference for ship or shore duty; number, date and class of license held; experience in wireless and wire telegraphy, and qualifications for sending and receiving.

Thus the Marconi Wireless Telegraph Company of America forges another link in the chain of national defense, the importance of which has been demonstrated in the European cataclysm and the many uses to which wireless has been put in time of public peril.


DECEMBER 12 ~ 1901
Daylong, within the room,
Marconi waited
The calling Cornish key.
Without, the wild north storm
swept, unabated,
Across the northern sea;
And, like some lost gull by the winds belated,
The kite swayed high and free.
DECEMBER 12 ~ 1915
To-day the great Pacific
Crossroads shiver
Beneath the white-hot pace!
Of speeding speech – a vast and vibrant quiver
In silent, sentient space --
And, sea to sea, there leaps the lightning sliver!
He leashed to time and place.
K·D·M· SIMONS Jr.
BISHELL.

Aboard the Seguranca in War Times

A Chronicle of the Second Cruise of the Vessel Through the Danger Zone

By J. K. Noble

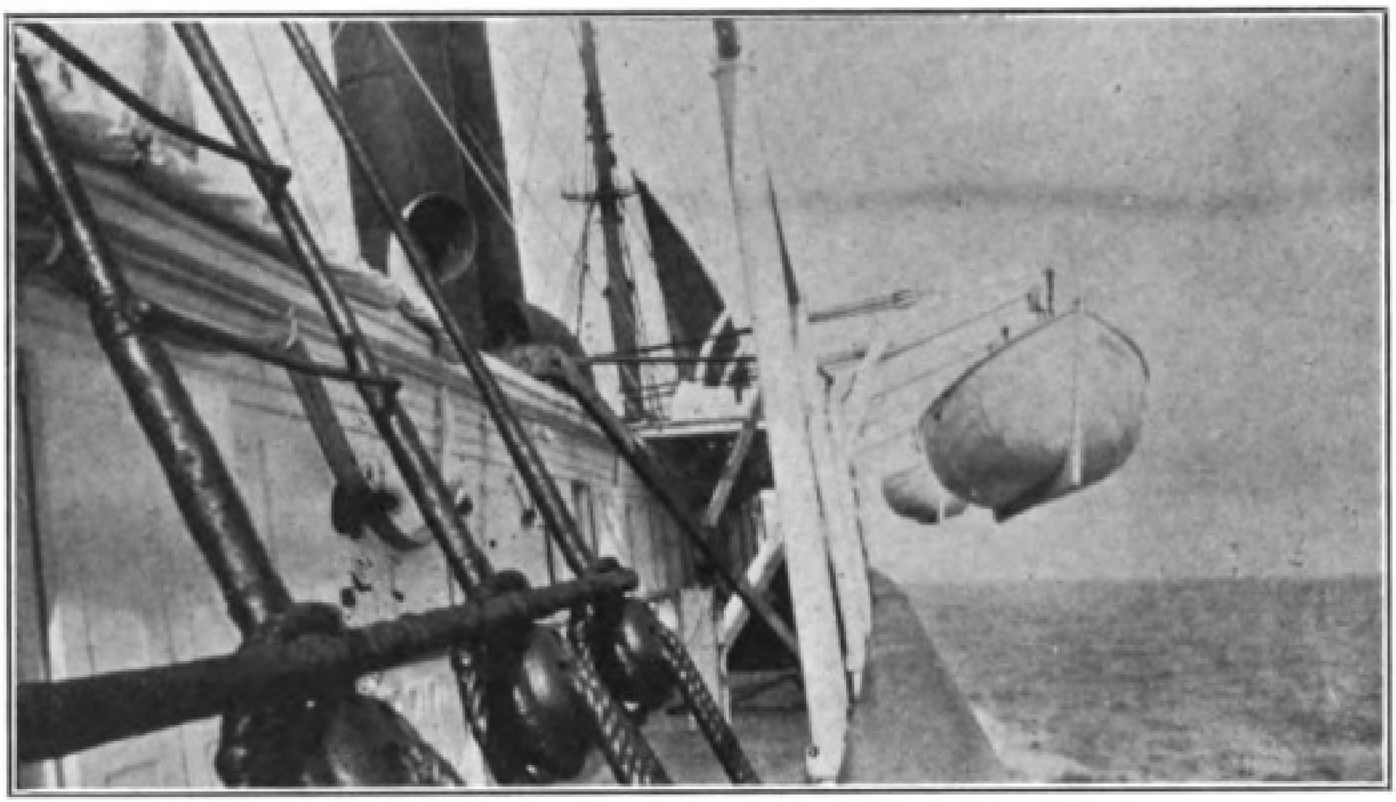
THE steamship Seguranca was introduced to the readers of THE WIRELESS AGE in the July issue of the magazine by S. Hopkins, who told of his observations made while he was wireless operator on the vessel during a voyage from New York to Rotterdam, the cruise including the war zone and mine fields. It was my fortune to be wireless operator on the Seguranca on another voyage to Europe. What happened and what I saw on the cruise I have set down in the following narrative.

Two "huskies" steering the Seguranca with emergency gear when the cable of the mechanism usually employed parted

We left New York on May 30 for Pensacola, Fla., planning to ship naval stores and lumber from the latter port to London. The first unusual incident of the voyage occurred a short time after he had passed Sandy Hook and were well on our way down the coast. A large hawk circled around the Seguranca and, finally becoming exhausted, perched on top of our forward mast. Apparently he was hungry and searching for some choice morsel for dinner. Booze, our pet kitten and mascot, being directly in the hawk's line of vision, the bird swooped down on the little creature. Then, with the unfortunate kitten gripped in his talons, the hawk ascended into the air. But Booze was resolved not to succumb without a struggle and he resisted so vigorously that the hawk relinquished his grip and the kitten fell to the deck and scampered away to safety. Some of the ship's officers then tried to kill the hawk, but the bullet fired at him went wild and the bird flew away.

The Seguranca steamed past Sand Key at dusk on June 3d, the three tall masts of NAR (the Key West naval station) standing out in the distance. Soon afterwards the lighthouse signaled us with a Morse light and the captain asked me to go on the bridge and find out what was wanted. The lighthouse asked the ship's name and then said GN (good night). We steamed in under the big guns of Fort Barrancas, guarding the entrance to Pensacola Bay and the naval station on the morning of June 5th. As soon as we were sighted on shore, the Naval Aviation School sent up several flying boats, which hovered over us like huge eagles.

Pensacola is a most interesting place and the Seguranca, being the first two-funnel steamship ever seen in the harbor, attracted considerable attention.



This photograph pictures the vessel when she was in the heart of the war zone. The life-boats swung over the side of the ship have just been inspected and provisioned

The Pensacola News said: "More than usual attention was given to the arrival of the Seguranca because she has two funnels and is equipped with wireless."

A day or two after our arrival a small hurricane struck the vessel, causing her to drag her anchor. We narrowly escaped collision with three other vessels before anchoring again.

A visit I paid to the NAS (Pensacola station) deserves mention. This station has a big flat topped aerial and a standard 2 k. w. quench gap set. For receiving, galena with an audion amplifier is used. Continuous service is maintained with the Key West naval station and NAT (the New Orleans station). For long distance work a big 10 k. w. low frequency set, with a non-syncronous rotary gap set, is employed. Ninety-three standard copper plated jars are used as the condenser for this set. The Aviation Training School, the only one conducted by the government, is located on the bay near the wireless station and is one of the prominent points of interest in Pensacola. It consists of nearly a dozen large tents, each housing a hydro-aeroplane. A big repair shop and storeroom for aeroplanes stand nearby.

Our stay at Pensacola came to an end only too soon and at length we steamed away for Europe. When only a few days out of port we ran into a heavy squall. The seas, lashed by the heavy winds, mounted skyward and formed waterspouts all around us; luckily, none came near enough to cause any serious damage. Several flying fish, probably attracted by our lights, were blown aboard during the storm and the sailors had them cooked for their breakfast.

The wireless gave us the latest news from Cape Cod and Poldhu, England, every night during the voyage. I was able to copy the French war news from F. L. (the Eiffel tower) up to 1,600 miles. We also used the Eiffel Tower's time signals to test the accuracy of the ship's chronometer. As we neared England I was surprised at the various calls I heard. Some had four station letter calls, such as ZAAW and ABMV; others used two letter calls, such as CX; some had number calls, such as A27 and 51M; and some used unassigned calls, such as XXJ and YCF. Nearly all communication was carried on in different codes.

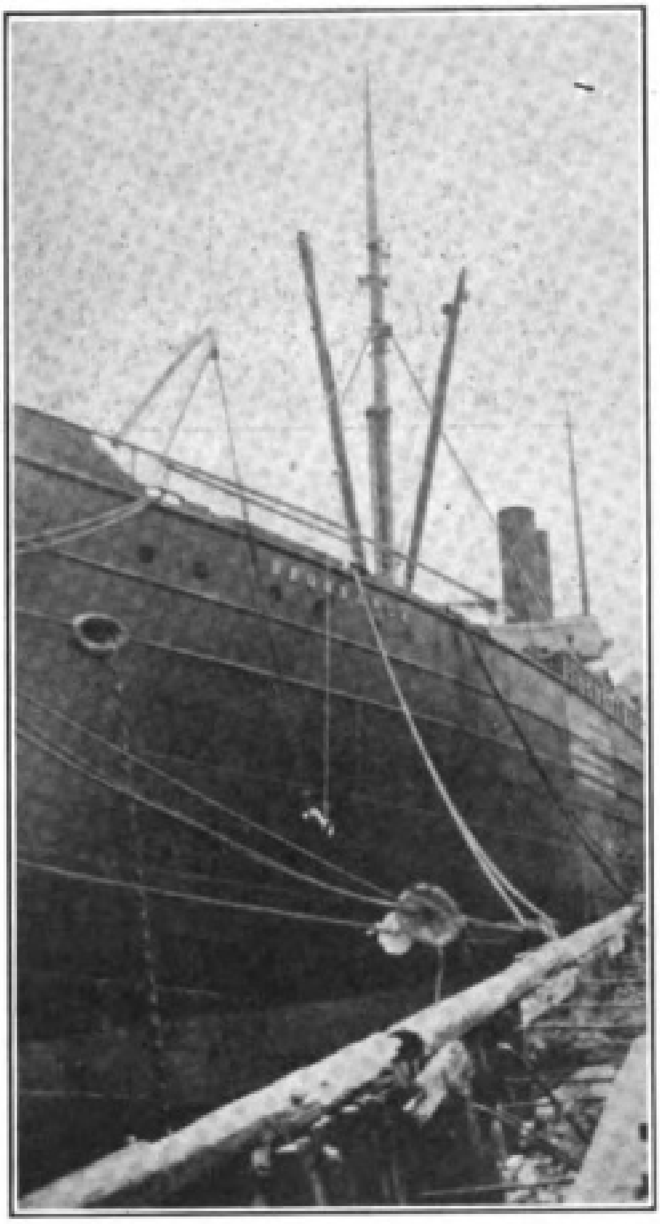
I copied on July 7 a message sent by Poldhu to the steamship Saxonia, conveying a warning regarding a bomb which it was feared had been placed on the vessel by a fanatic who had attacked J. P. Morgan.

We entered the war zone on July 8. At night, as a precautionary measure, the American flag at the Seguranca's stern, the name of the vessel and the letters "U. S. A.," which were painted on both sides of the ship, were illuminated. The lifeboats were slung out over the sides, too. Steaming up the English Channel, we sighted two submarines running awash, but as they flew no flag we could not tell their nationality nor did we care as long as they remained at a considerable distance from us. Many armed trawlers were cruising about. The majority of these vessels carry wireless, with a limited range, due to short aerials. The latter usually consists of four wires arranged as a long oblong and not the flat topped type commonly employed in America. The sets on these trawlers are invaluable. GLD (the Land's End Admiralty station) frequently sends out reports regarding the enemy's submarines and the trawlers immediately go in search of the enemy's under sea craft. Two German submarines, it was reported to me by wireless one night, were within fifty miles of us. Most of our crew had all their belongings packed and slept fully dressed till morning, but nothing happened.

With the exception of torpedo boats and armed trawlers we saw no war vessels until we reached Dover, where there were several big battle ships behind the breakwater. While steaming through the Strait of Dover it is necessary for vessels to pass between two lightships anchored near together. The remainder of the Channel, some twenty odd miles across, is mined or set with huge nets to entrap the German submarines.

At Deal the Seguranca was stopped by a patrol boat, the officers on which examined our papers. Many vessels of various neutral nations were being held for examination. After a few hours' detention we shipped a pilot and proceeded to London under a torpedo boat escort.

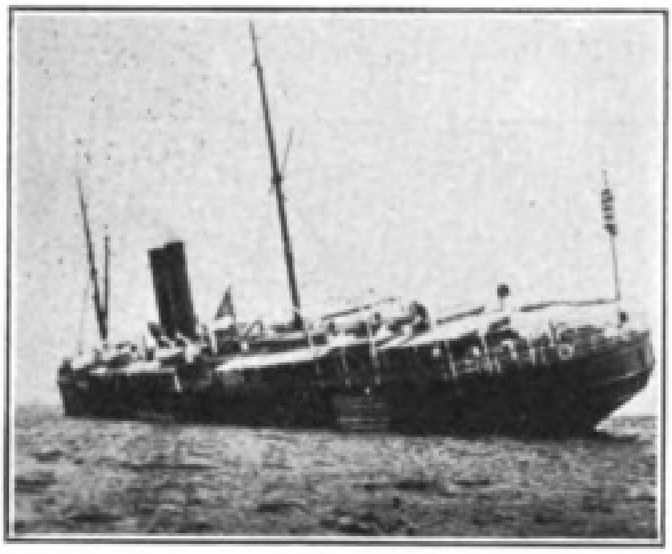
While off Margate we heard the heavy firing of the big guns in France. As we passed up the Thames the firing gradually ceased. At one point in the river a pontoon bridge has been built by the army for quick transportation of troops and supplies in case of necessity. A little farther on was an encampment of soldiers, their tents being dyed green to harmonize with the grass and make them invisible to the occupants of scouting aeroplanes. There was also a long shed, probably filled with explosives, that was covered over with a netting as a protection against aeroplane bombs.



The Seguranca at Pensacola. The American flag was painted on her side in order to identify her as a vessel of a neutral country

All of the Seguranca's lights had to be covered at night and even the ship's generator was ordered shut off at ten o'clock.

Our trip up the Thames was full of interest, due to the conditions resulting from the war. The progress of the Seguranca was not hindered, however, and finally I found myself in London. I do not intend to write at length regarding my stay in that city. I was impressed, however, by the precautions taken to guard against attacks by aeroplanes. Huge searchlights swept the sky at night, but in spite of this precaution there were two raids on the outskirts of London while we were there. High angle



A short time before the ship steamed away from Pensacola she was struck by a heavy hurricane. When the photographer snapped her she was listing considerably to port

anti-aeroplane guns are mounted on some of the buildings.

Because of the war, the stevedores were shorthanded so we remained five and a half weeks in London. This gave me a chance to see the city. Marconi House, of course, was especially interesting to me. I was stopped many times by officers who tried to persuade me to join the British forces and heard recruiting speeches and concerts in practically all parts of the city. The parks are used to drill the raw recruits.

When we steamed away from London we were enveloped in a typical English fog all the day down the river. As we neared the mouth of the Thames the fog lifted, disclosing to our view a small flotilla of war craft. There were five torpedo boats, four battle cruisers and a couple of big dreadnaughts. An aeroplane put out from the Chatham Navy Yard and, after inspecting us, flew back. At Deal we were stopped a short time. Near Dover we saw a big balloon search for floating mines and enemy submarines. There was also an attendant boat nearby with a specially constructed landing platform for the balloon. After we passed Dover I put the aerial up again.

August 19th lives in my memory as the busiest day of the voyage for me. In the morning the MHF (the Baron Erskine) reported being chased by a submarine and one of the patrol boats said she was coming to her assistance. A little later the MFC (the Arabic) reported a sinking steamer, believed to be the steamship Ugansley. About an hour later the Land's End station sent me a warning of a floating mine in our vicinity. At fifteen minutes to three o'clock in the afternoon I heard somebody calling SOS. I took a pencil and copied:

Taking down the aerial in the Strait of Dover by order of British officers. One of the sailors lost his balance and just saved himself from falling by grasping a stay

"Torpedoed by two enemy submarines. Crew ready to take to the boats. Can't read any one's signs because of the steam whistle blowing."

The operator who sent this message then gave his position, but did not sign. He was, however, either on the steamship Arabic or the steamship Nicosion. We were 200 miles away so we did not go to the aid of the distressed vessel.

Next come an S O S from the steamship Bovic (GDO). This was at half past five o'clock in the afternoon. The message gave the Bovic's position and said that she was being chased by a submarine. A patrol boat said that she was coming to the Bovic's aid. At half past seven o'clock the Bovic reported that she was sinking. The Vice Admiral at Queenstown sent the vessel a message through ZAAW (patrol boat) saying that he was expecting to pick up the Bovic at nine o'clock that night. After that the air was comparatively quiet.

The steamship Georgia (GDT) asked me two days later if we had a doctor aboard. It seems that the chief engineer had just met with an accident, having seriously wounded himself with a rifle, and the captain wanted a doctor's services immediately. We had no doctor so he called CQ and asked for one. A reply came from the Minnehaha (MMA) saying that there was a doctor aboard that vessel. GDT asked for the doctor's services, but MMA insisted that he must have a message to that effect. Then, to make sure that the message wasn't "faked" by some German war craft, the Minnehaha asked the Georgic to repeat the message or to confirm it in the MV code. After this code message had been sent the captain of the Minnehaha told the Georgic to proceed to rendezvous XJNPJ, where a boat containing a surgeon would be lowered. An hour or two later the captain of the Minnehaha sent a message to the effect that the wounded man had arrived on board that vessel.

This occurrence constituted the last noteworthy incident of our voyage. To be sure, we sighted a small iceberg a few days later, and a short time afterward the steering gear cable parted, necessitating the use of the emergency wheel at the stern. But iceberg and accident were overshadowed by the realization that the cruise of the Seguranca was nearing an end. And so with thoughts of the war far behind us the Seguranca steamed past the lights of Coney Island and headed up the bay while on the lips of those on board was framed a word full of meaning—home.

THE STRANDING OF THE SANTA CLARA

The steamship Santa Clara ran aground on Coos Bay Bar, Oregon, early in the morning of November 2. C. E. Goodwin, Marconi operator, immediately called the station at Marshfield, Oregon, saying that the vessel was aground and asking the aid of the life saving corps. By this time there were indications that the ship was in danger of breaking in two and Goodwin sent the S O S. The Adeline Smith, which answered, was only a short distance from the Santa Clara, and Goodwin asked her to stand by. The Willamette also answered, but she was twenty miles north of Coos Bay and could not give immediate aid. Boats were launched to transport those on the Santa Clara to the shore, the wireless being operated almost up to the minute the last one left the vessel.

WIRELESS TELLS OF FIRE AT SEA

A marconigram received in New York City on November 8 tells of a fire which started on the French Liner Rochambeau while she was on her way from New York to Bordeaux carrying a cargo which included cartridges and cotton. The message, which was sent by the commander of the vessel, Captain Juham, follows:

We are fighting fire in reserve coal bunker. If we do not succeed, will put into Halifax. Everything all right and no danger. Juham.

That the flames were extinguished was told in the following marconigram which was received in New York on October 9:

Have succceeded in extinguishing the fire and am proceeding to Bordeaux. All well on board. Juham.

Reminiscences

The Story of an Operator Regarding Incidents at Sea and Ashore

By Irving Vermilya

ALTHOUGH the ranks of the United Wireless operators are gradually thinning out there are still a number of them in the Marconi service and, like myself, I suppose they take pleasure in recalling the old days when there were no regulations at all and the fellow with the most power in kilowatts had the best show. Most of my old United days were spent on board the North Star of the Maine Steamship Company, or the same owners' Northland. Indeed even my Marconi days, up until about a little more than a year ago, were spent on the Northland, with the exception of one trip on a private yacht. If anybody in those days mentioned wireless on the North Star or Northland, their thoughts involuntarily turned to either old Hiram Hilkins or myself; it seemed as if there was a permanent arrangement under which we swapped ships every once in a while, so as to break the monotony of the same crowd and scenery.

The North Star, back in the United days, when only one operator was aboard, was surely some job. My chief duty was to call up 42 Broadway and let him know we had left without slamming off the posts of the dock. Then I would listen to the talk of a few amateurs up the East River, and send in our O. S. report at every old rock we passed all the way to Stratford. Along about 10 p. m. I would call old WN (Wilson's Point, Conn.) or BG (Bridgeport) and say ND—nothing doing—and give them a good night. There was nothing to do then but go to bed. I laugh when I think of that bed. It was a box hung on the wall inside the wireless coop and supported by two chains. Every time the boat pitched the chains doubled up and I would have to hang on to the helix to keep from going out on the floor. The wireless house was only about eight feet by six, and about seven feet high; in consequence the box which served for a bed was less than five and one-half feet long and three and one-half feet wide. I am six feet tall. You can imagine how I fitted in. But despite the uncomfortable conditions I stuck to the old ship for a number of years; and after the Marconi Company took over the United, conditions were bettered and I willingly stayed on that line.

I became a wireless operator in rather an unusual way, I think. Long before there was any United Company and when the Marconi was quite young, I put up an amateur station at my home in Mt. Vernon and tried to get in touch with a fellow in New York. I failed because I did not know how much power was necessary to go fifteen miles overland. I was trying to do it with a two-inch coil, and as detectors were crude at that date, there was nothing doing. I heard my friend, however, for he had a sixteen-inch coil and plenty of power. With the assistance of a liberal father I gradually saved up enough money to secure a one-quarter k.w. transformer. This made quite a disturbance, but not enough; so I kept getting larger transformers until I eventually obtained one of the 5 k.w. closed core type. This made considerable rumpus, and my efforts to equip other amateurs so as to have some one to talk to, became so energetic that one day I received a letter from the United company offering me a job, providing I would shut up my station while away. This looked good to me, but the job was to be on an old oil tanker and I immediately side-tracked it. Not long afterward the Caracas, a Red D Line passenger ship, was offered, and I set out on my first trip to South America.

I thought afterwards that I had plenty of nerve to go to South America first trip, for I had never been out of sight of land before. I was seasick for eleven days. When I finally overcame the malady, however, I enjoyed myself very much. We landed at Caracao, a Dutch island, and there I had my first experience in a foreign land. I can well recall coming to a bridge which I wanted to cross, but I was held up at the entrance and the gateman said something to me I did not understand. I told him to talk United States, whereupon he gave me a card printed in English which stated that to cross the bridge it cost one cent if you took your shoes off, and two cents if you wore your shoes. I burst out laughing. I was tempted to take 'em off, but on second thought I paid my two cents. I did not have any pennies, it so happened, so I gave him a nickle. He refused to take anything but silver, and as a quarter was the smallest change I had in silver, I gave him this. You should have seen the change he gave me! There was so much of it, it looked to be about forty-eight dollars in copper, brass, iron, zinc, tin, bronze and (in one small coin) what appeared to be wood.

It filled both my coat pockets and when I had crossed the bridge I was glad to come upon a small car pulled by a mule. I got aboard and had a very nice ride; everything went well, in fact, until I tried to pay my fare. He who discharged the dual functions of conductor and driver stopped the car and came around when the proper time arrived. I was the only passenger, and he evidently knew I was an American, for he asked me for a ten-cent coin. I wanted to give him some of the junk the bridge man had given me, but he did not seem to want it. I gave another quarter finally and the junk money he returned filled another pocket. I was given a little receipt for my fare, and also a blue ticket with something written on it. Afterward, when I met a man who spoke English, he told me it was a sort of a receipt to show I was a perfect gentleman.

I had a chance to demonstrate whether his surmise was correct when I was sent aboard the yacht Emeline as operator for Robert Graves and had one of the finest trips imaginable. We started for the Panama Canal and all enjoyed every moment of the voyage. The yacht was furnished luxuriously. We carried a cabaret along, consisting of Hawaiian singers and dancers and a moving picture apparatus which I operated in the evenings, and for which the owner paid me a special salary. There was also an automatic piano, a $1,500 organ, electric chimes and an electric fountain which sent

The life of a wireless operator is not made up entirely of dull routine, as this photograph shows

forth streams of perfumed water. We were headed for Kingston, Jamaica, but one of the ladies' dogs got seasick and we to turn back and land at Norfolk, Va. While we were in Norfolk a funny incident arose. Mr. Graves had forgotten the combination on the safe, and as he wanted to purchase some supplies he did not know what to do. We finally found a safe opener by trade and after a few moments of tinkering he opened it. I came on the scene about the middle of the operation and was given an awful scare—I thought it was a robbery in full swing! I did not send an S O S, but I did something about as bad: He was a tough looking individual and I asked him what he did at night. This got his temper up and he told me a few things.

When the job was finished and Mr. Graves asked him how much it would be, he said: "Fifteen dollars; ten for opening the safe and five for the operator getting fresh."

We did a fine wireless business; at every port we entered the owner sent ashore by wireless a batch of invitations to attend dinner or a banquet on board, and we received all our answers by the same means. When we reached Colon Mr. Graves took me with his first day party across the canal by rail to Panama. He then appointed me guide and each day I took ten men from the crew across the canal from one end to the other. I was paid ten dollars a day for this and expenses for all, including dinners and cigars. As a climax Mr. Graves bought me a twenty-dollar panama hat. I was rather sorry when those yachting days were over.

When the summer season ended I went back on the Northland. I stayed there until I was detailed to fill a vacancy which occurred at Sagaponack. We communicated with my old ship, the Northland, from the land station, and I often wondered if the operators on the vessel derived as much pleasure out of their jobs as I used to.

In my day, my second man, Dugan, and myself rigged up in the wireless room what we called a "jouncer." It consisted of an uninsulated wire connected to the lounge where visitors usually seated themselves. One end of the wire was laid gently under the thin covering of the lounge and the other end was hooked up to the business end of the ten-inch coil. There was usually something pretty brisk doing when the key was pressed on that set, let there be no mistake about that. The only trouble was that Dugan or myself would forget ourselves and sit there while thinking some sweet thoughts, and of a sudden the other fellow would press the jouncer and the one on the couch would go floating out the door with a six-inch spark following close on the point of contact. I say "floated" because he never had time to stop and jump.

We tried a new arc light one day, and some of the colored waiters got interested. We had one old fellow who had a known record for being about as slow as an Erie freight and who always chewed tobacco, despite the fact that he had false teeth.

We were explaining the wonderful light to him and he had about one-half of the couch covered with his person when Dugan pressed the key. I ducked the tobacco! The false teeth broke one of the windows. The old colored man never stopped until he got safely in his cabin down aft and locked the door.

We always had plenty of callers while in Portland. I dare say many amateurs can remember my "jouncer" without any trouble.

COMMUNICATION WITH GUATEMALA CITY

A step toward increased efficiency of communication between the countries of the Western Hemisphere was taken recently, when messages were exchanged between the naval wireless station at Arlington, Va., and the new radio station erected by the government of Guatemala at Guatemala City.

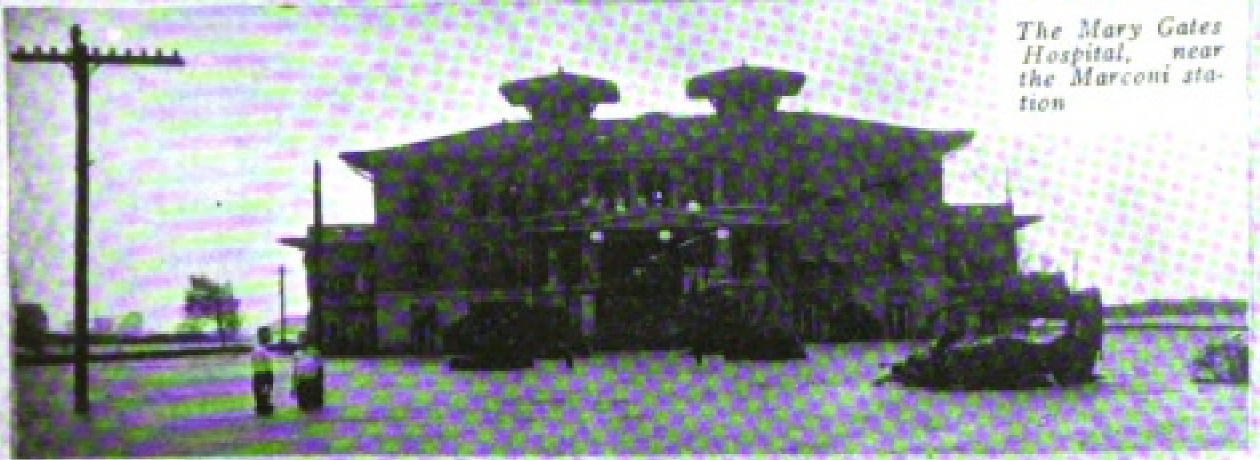
To commemorate its opening, Secretary Daniels announced, messages of felicitation were exchanged between the President of Guatemala and the President of the United States. The messages were exchanged by radio telegraphy between the Arlington station and the government radio station at Guatemala via the naval radio station at Key West.

MEDICAL AID BY WIRELESS

A wireless call was sent out from the steamship Radiant on Sunday, October 11, for the treatment of an engineer who had for three days remained unresponsive to the medicines administered by the captain.

Marconi operator W. C. Thompson communicated with the station at Tampa, Fla., and then with the Southern Pacific steamship Comus, from which vessel doctor's advice was obtained and the sick man greatly relieved.

Port Arthur, Tex., seen from atop a wireless tower after the recent tornado



The Mary Gates Hospital, near the Marconi station

Operator Foley on the roof of the Marconi station

The Marconi station after the storm

The wrecked mast of the Marconi station

National Amateur Wireless Association

A Few Comments of the Press Following the Announcement of its Organization Given in Brief

ARTICLES comprising more than 2,000 words announced the organization of the National Amateur Wireless Association in the New York newspapers of October 31. It is impossible to reprint here the many columns of favorable newspaper comment made all over the country, but the few extracts which follow give some idea of how the press of the country viewed the undertaking.

On its editorial page, the New York Sun said, in part:

"The National Amateur Wireless Association—a comprehensive organization formed for the development and training of amateur wireless workers throughout the country—comes into existence tomorrow.

"Its founders, headed by Guglielmo Marconi, of the Marconi Wireless Telegraph Company, hope to interest the 200,000 amateurs in a greater development of their experiments by co-operative or group working, so that in case of emergency the nation may have a reserve body of operators.

"It is the view of the organizers that the amateur wireless operator, whose efforts are generaly frowned upon by Government officials as well as other individuals, should be encouraged; that the merest tinker may develop into an enthusiast and by proper study become a great radio engineer. The association plans to help young men in this field. Cooperation,, coupled with direction of experimental work, is the means by which this service is to be performed. Existing wireless clubs and organizations will be recognized and properly accredited officers may have a share in the councils of the national association.

"Every amateur who is properly indorsed may join as an individual. According to his abilities and geographical location he will be entered for eligibility in an existing club or association, published recognition of anything noteworthy he accomplishes will be given, and in due course admittance to an engineering body will be arranged. Progressive courses of study will be placed in each member's hands, experiments far removed from text-book humdrum will be added, and a monthly bulletin of new calls and other items included.

"One arrangement that is being planned is this: Small clubs in their entirety or larger organizations divided into groups will be permitted to affiliate with some military organization as accredited members and officers of signal corps. Next summer these corps will enter military training camps similar to those recently held in the East. Thus a third line of defence will be available. The importance of this is emphasized by the fact that 1,100 men employed by the Marconi Company were requisitioned by Great Britain for wireless service at the outbreak of the war.

"It is pointed out that the United

States in time of war would need hundreds of operators and these would be available. Among the distinguished men in the advisory board of the National Amateur Wireless Association is Major William H. Elliott, a signal officer of wide experience and Adjutant-General of the Junior American Guard, who will serve as military adviser.

"Mr. Marconi will be president and J. Andrew White, of the Marconi Company, administrative officer. Mr. White is editor of THE WIRELESS AGE. Clayton E. Clayton, associated with Mr. White, will be managing secretary; Prof. Alfred N. Goldsmith, of the College of the City of New York, an instructor in radio engineering; Prof. A. E. Kennelly, of Harvard, another radio expert, and Profs. Samuel Sheldon, of Polytechnic Institute, Brooklyn, and Charles R. Cross of Massachusetts Institute of Technology, and E. E. Bucher, instructing engineer of the Marconi Company, also will act on the advisory board. To assist them will be a national council made up from existing clubs, State and interstate organizations.

"The headquarters of the new organization will be at 450 Fourth avenue. It is to be strictly a co-operative body. Personal contact with national officers will be possible through conventions to be arranged."

Promotion of Existing Organizations

The New York World included in its 200-line article, the following:

"A new organization for preparedness will become a reality to-morrow when the National Amateur Wireless Association enters upon its official existence.

"According to Mr. White, the association has been formed in order to develop and help young men interested in the subject, so that, in case of war, there will be a large body of trained wireless operators upon which the United States Government can rely. There are fully 200,000 amateurs in this country who need and are anxious to receive the instruction the association purposes to give.

"Close relations will be established with a large army of lieutenants, in the persons of those active in the direction of the many community clubs, State and interstate associations. Existing organizations will be aided to further growth, and, where a community lacks a club, every effort will be made to establish one. Officers of existing clubs will be admitted to the national council and conventions will be held at regular intervals.

Importance of Signal Corps

"Membership in the National Association will be open to every amateur who is properly indorsed. According to his abilities and geographical location he will be entered in some existing club or association and published recognition of his accomplishments will be given and eventually he will be admitted to some engineering body. He will be supplied with progressive courses of study, including experiments, and everything that a body of national officers of wide experience finds essential to the welfare of the amateur will be provided for.

" 'Within a short time,' said Mr. White yesterday, 'it will be possible for small clubs in their entirety, or larger organizations through division into groups, to affiliate with military organizations as accredited members and officers of signal corps. Next summer these signal corps will enter military training camps similar to the one recently held at Plattsburg. Those who wish may become full members of a third line of defense for the safeguarding of the Nation in event of war.

" 'Should this country be invaded the work of the wireless signaling corps would be of the utmost importance. Wireless is a most important adjunct to the modern war machine. A reserve corps made up of amateurs would be of inestimable value to the Nation.

" 'We would have difficulty at the present moment in mustering sufficient wireless men of experience to provide for the defense of even a small strip of our coast. The solution of the problem lies evidently with the amateurs. Official figures give 3,836 licensed amateurs. I can say conservatively that double that number could pass the examination. Under the guidance of the National Amateur Wireless Association a reserve force of competent wireless operators adequate

National Amateur Wireless Association

This is to certify that

Ray Dio Enthusiast

having furnished satisfactory credentials and having shown that he is a student of Radio Communication is hereby accepted in fellowship and full membership in THE NATIONAL AMATEUR WIRELESS ASSOCIATION of America. He agrees hereby as shown by his signature, to promote the interests of experimental radio work and at all times to observe the laws of Radio Communication of the United States.

Signed by: Member

Approved: President

Executed by Acting President Managing Secretary

Membership expires

The steel engraved membership issued to each member. It is printed in green, gray and black, with halftone shadow background, and carries the signatures and official seal of the Association for all our needs can be developed within a year.'"

Interesting and Valuable Experiments

The New York Press devoted a full column to the announcement, saying in part:

"The formation by the leading radio experts of the East of a country-wide organization to be known as the National Amateur Wireless Association, by which amateur wireless enthusiasts can be aided toward maximum efficiency and grouped into national defense units, was announced yesterday. Guglielmo Marconi will head the movement.

"By means of the proposed association, which becomes officially existant to-morrow, November 1, the country's radio engineers hope to direct the activities of the many thousand amateur wireless enthusiasts along standardized scientfic lines.

"Marconi will act only in an advisory capacity. In fact, his position at the head of the new league is the first official post he ever has accepted. The active work of the association will be carried on by J. Andrew White, editor of The Wireless Age. Clayton E. Clayton is to be secretary.

"Major William H. Elliott, a signal officer of considerable experience and one of the leaders in a juvenile patriotic organization known as the Junior American Guards, is to be vice-president of the association. Upon his shoulders will rest the highly important work of developing, from the countless wireless enthusiasts of the country, efficient military signalers ready to fill up the gaps in the Nation's wireless reserve in time of war.

"The first act of the experts heading the new movement will be the recognition of various community wireless clubs, State and interstate associations.

"The most important work of the association will be in finding the true radio enthusiast, finding equally as active coworkers for him, and directing their experiments along the most productive lines.

"There are almost 200,000 amateur wireless enthusiasts in this country, ranging from the youngster with a back yard communication set to the wealthy radiographer with an expensive and highly efficient set of instruments. A large percentage of the 200,000 belongs to wireless clubs or associations, but, with few exceptions, such organizations fall far short of their purpose.

"The radio experts backing the movement say they have devised many interesting and valuable experiments and wireless stunts that the average enthusiast never heard of. It is by supplying such channels of instruction and development to the growing crop of wireless operators the association will organize a large corps of radio engineers and experts. The association will institute a bulletin service, keeping its members constantly posted on wireless affairs.

"Perhaps the most important phase of the national wireless plans is that which deals with training military wireless operators. It is planned to have those of the youngsters interested in such branches of the work form signal corps detachments of the Junior American guard. The older wireless enthusiasts will be used as instructors.

"From a statement made by Marconi to directors of his company recently, it was learned that Great Britain, despite the thousands of radio operators on board her warships, in her army and aboard the many vessels in her merchant marine, had to call time and time again for recruits with a knowledge of wireless telegraphy. It is understood that even the schoolboy wireless clubs in England have rendered valuable service to their country. The new association hopes to fit many thousands of the country's amateur experimenters to pass the Government tests and be ready for any emergency.

"By reason of its organization the many operators and their home stations throughout the country are to be grouped for military usage. Each member of the association will receive information concerning all radio stations, and will be placed in a position where, with average application, he can make himself a military necessity."

Prediction of Celerity in Organizing

The Christian Science Monitor, of Boston, had this to say editorially:

"Marconi is co-operating heartily with the National Amateur Wireless Association in which it is planned to enroll the 200,000 persons in the United States, who, for the love of it, have taken up with the new mode of communication and have acquired apparatus and mastered use of it. He foresees much aid, both theoretical and practical, from the co-ordinated and directed service of this large group. Evidence of their capacity to serve the Government has been shown since the war opened in more than one strategic way. The celerity with which schemes of this kind are worked out in the United States, once the plan is given a definite shape by a man like Marconi, well-nigh insures the ultimate achievement."

Large Membership Expected

An editorial in the Rochester, N. Y., Chronicle stated:

"The extent to which wireless telegraphy has interested American students of electricity is shown by the formation of a National Amateur Wireless Association, with the intention of systematizing instruction to wireless enthusiasts, their clubs and state and interstate organizations. The membership roll of the association is to be wide open and every amateur in the absence of a local club or organization, can join the parent body as an individual by giving local references and receiving indorsement. It is almost needless to say that the membership of the National Association will be large."

A lengthy editorial in the Syracuse, N. Y., Post-Standard, said in part:

"Not long ago the average amateur wireless operator came into disrepute up and down the country for his habit of meddling in commercial and governmental business. Youths with sufficient ability to construct simple wireless systems continually eavesdropped, interfered with legitimate radio work and generally made themselves nuisances.

"It now develops that the amateur wireless man has his use in the world.

"Older radio experts have decided to turn the activities of every amateur in the country into work that will be valuable instead of destructive. A country-wide organization, to be known as the National Amateur Wireless Association will be formed, and its members will be aided toward maximum efficiency and then grouped into national defense units.

"The first problem is to organize the 200,000 amateur radio workers into clubs and other divisions. When this is done, the leading men of the country in wireless knowledge will lend their services for instruction.

"The amateur has come into his own and his hitherto frowned upon labors will shortly be recognized as of value when directed into proper channels."

Scores of other press clippings from all quarters of the country have been coming in daily to headquarters. Space does not permit printing even a small fraction of the newspaper comment. The unanimous support of the press, however, is appreciated by the officials of the National Amateur Wireless Association and this opportunity is taken to thank the leading papers of the North, East, South and West for their unsolicited efforts in the Association's behalf.

WIRELESS INVENTIONS AND THE PRESS

So seldom does this magazine find a true expression of its principles in the periodicals that occupy the field of semi-technical reporting, it is particularly pleasing to find our good neighbor the Scientific American once again in full accord with our policies on 'freak" news. On the editorial page of a current number is an observation we consider worthy of reprinting in full. It remarks:

"It has been a matter of considerable surprise to many that the columns of the Scientific American have failed to contain descriptions and illustrations of several of the portable wireless receiving sets recently heralded as marvelous and revolutionizing inventions by both the daily press and a small portion of the semi-technical press. Accordingly, an explanation is due.

"It is simply lack of knowledge regarding the possibilities of radio communication that causes the laity to marvel at the portable instruments that appear periodically. If the present stage of the art were fully understood—or even partially familiar to the layman—

these *soi-distant* inventions would seem commonplace indeed. In most cases it would be immediately evident that they were in actually nothing but more or less worthy replicas and modifications of instruments that have been in regular use for several years. But to appreciate fully the merits of these portable sets and the work of their designers, it is necessary to review briefly the possibilities of wireless communication.

"There is nothing complicated nor truly mysterious in the reception of wireless signals. The electro-magnetic waves emitted by a radio transmitter travel in all directions at a speed of 186,300 miles per second, and have the power of creating certain effects at distant points if properly gathered and sent through appertinent apparatus. So powerful are the present-day transmitters that, given the proper apparatus, it is possible to intercept radiograms with small antennæ, such as an ordinary steel clothesline, a metal bedstead, an ordinary umbrella, any large metal object that is more or less insulated from the ground—even no antennæ at all if the station sending the messages is in the immediate vicinity. As for the apparatus, it may be reduced down to a chip of mineral possessing the desirable rectifying property, on which presses a piece of copper or brass wire, forming the "detector," which is shunted by an ordinary telephone receiver. The ground connection, which is not essential but if available will permit of the use of a smaller antenna for a given strength of signal, may comprise a metal rod driven a few inches into the ground, a wire wrapped a few times around a water or gas pipe, or any object which makes good electrical contact with the earth. Could anything be simpler—or more compact?

"For transmitting wireless signals over a short distance, a small induction coil and a battery will suffice. Even a common buzzer may be substituted for the induction coil, if so desired. Compactness is as readily obtained as in the receiving set.

"Yet marvelous wireless 'inventions' in the form of portable apparatus that may be carried in one's vest pocket and used in receiving messages sent from stations hundreds of miles distant, employing an umbrella as the antenna and a metal rod driven a few inches into the ground, continually find their way into the press. In some instances it is a beginner in the field of wireless experimentation who discovers for himself that almost any combination of odds and ends will comprise a receiving set for powerful signals, and in all good faith assumes that he has suddenly become a benefactor to mankind. But more often there is evinced a deliberate attempt by a well-versed person to secure gratuitous publicity and short-lived fame by preying upon the public's and the press's lack of technical knowledge."

That is exactly the way THE WIRELESS AGE feels about it.

WIRELESS REGULATIONS

At the outbreak of the present war immediate steps were taken by the governments of the belligerent countries to bring the use of wireless telegraphy under direct official control, and all stations not operated under government supervision were ordered by the respective governments to be dismantled. This action, as might well have been expected, did not stop at the belligerent countries, but extended to neutral governments all over the world. It was necessary that steps should be taken by non-belligerent powers to ensure that their neutrality obligations were not violated by the utilization of wireless stations in their territory for the transmission of communications of a non-neutral character. Consequently, almost all countries throughout the world issued special regulations relating to the use of wireless telegraphy; but as these regulations were all made with the same object in view they naturally differ but slightly from one another. . . .

The International Bureau at Berne has become an organization of supreme importance, thanks to the zealous, economical and efficient manner in which it is conducted. To this organization is entrusted the work of preparing and circulating, in accordance with article 13 of the Convention, particulars regarding every station located in countries adhering to the Convention. . . .—From "The Year Book of Wireless Telegraphy and Telephony," for 1915.

Chapter XVI

Type 107-A Receiving Tuner

INSTRUCTIONS have been issued to the marine service of the various divisions of the Marconi Wireless Telegraph Company of America for the reconstruction of the former type 103 and valve tuners to allow the reception of wave-lengths up to 2,800 meters. After either type is altered in accordance with the following directions, it is to be known as type 107-A.

The original design of these tuners affords a maximum wave-length adjustment of 600 meters in all circuits. By a slight rearrangement of apparatus and wiring the maximum value may be doubled. In consequence the 107-A tuner is suitable for the reception of time signals at a wave-length of 2,500 meters.

A brief review of the prominent features of the type 103 and valve tuners may assist in clearing up the manner in which the necessary changes are to be made.

(1) In the original design the aerial tuning inductance comprises two coils connected in parallel.

(2) The intermediate circuit is shunted by a variable condenser of .01 microfarad capacity.

(3) The inductance coil of the detector circuit is shunted by a small variable condenser of .0001 microfarad capacity.

(4) The elements of a circuit are of such value as to allow conditions of resonance throughout.

(5) A double pole double throw switch allows the detector circuit to be "tightly" or "loosely" coupled to the aerial circuit as desired. The switch has two markings, one known as "stand-by" and the other as "tune."

Directions for Obtaining Increased Range of Wave-Lengths

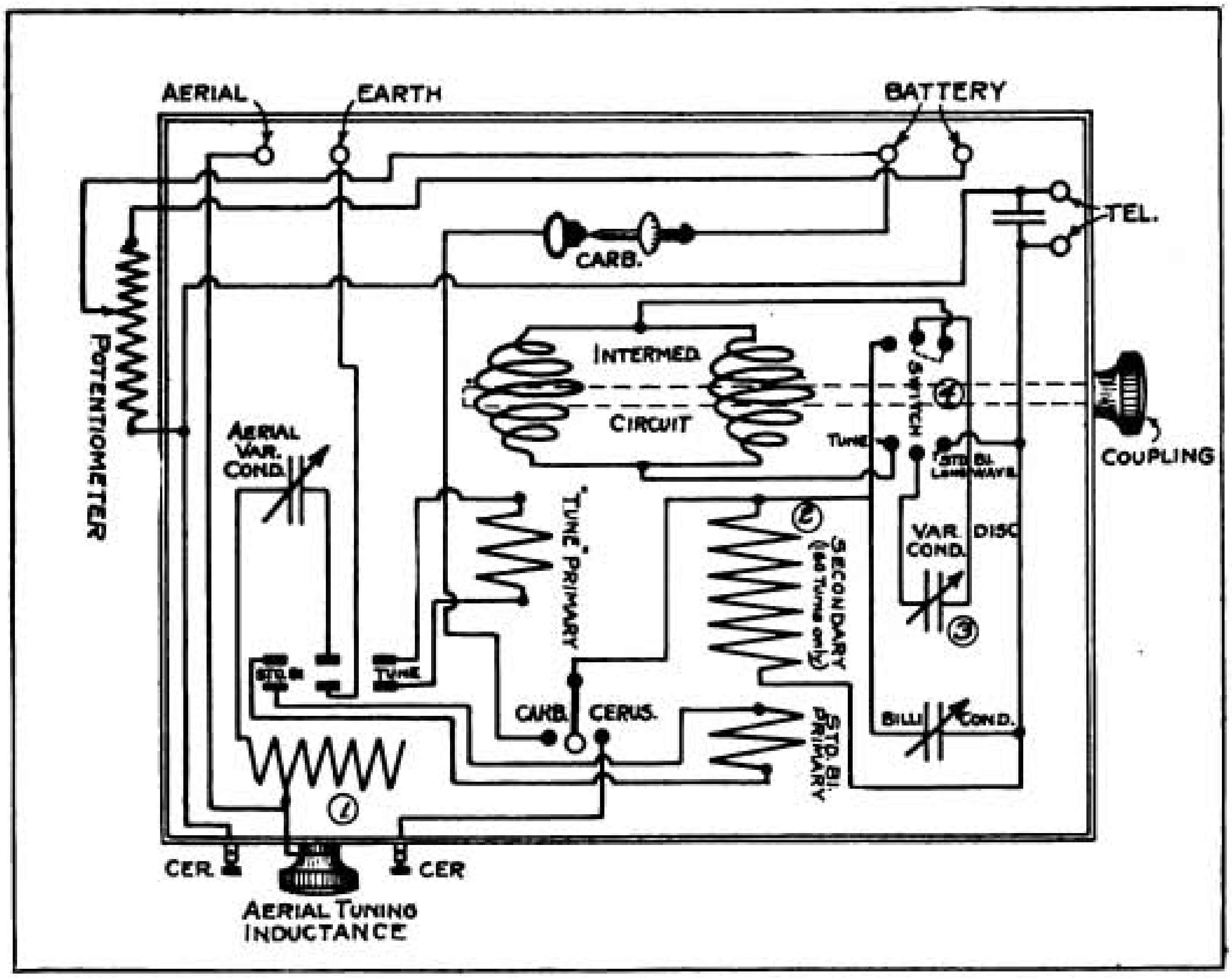
In order that adjustment to wave-lengths of increased value may be obtained, the following instructions should be carefully observed and corresponding alterations made at the repair shops of the various divisions.

(1) A special six-point double throw switch to be known as the "intermediate condenser switch" will be supplied and is to be mounted on the tuner between the two Marconi disc condensers. The switch has two markings, "stdbi" and "tune" respectively.

(2) This switch is connected, as per Fig. 2. When shifted to the "tune" position the intermediate condenser is connected in parallel to the intermediate circuit and in the "stdbi" position it is disconnected from the intermedate circuit and reconnected in parallel to the billi-condenser of the detector circuit.

(3) The two coils comprising the aerial tuning inductance are to be connected in series in lieu of the present parallel connection. Corresponding tap-offs are brought out to the aerial tuning inductance multiple-point switch.

(4) The detector circuit or secondary winding which normally contains 240 turns of wire is reduced to 160. These turns are removed from the end



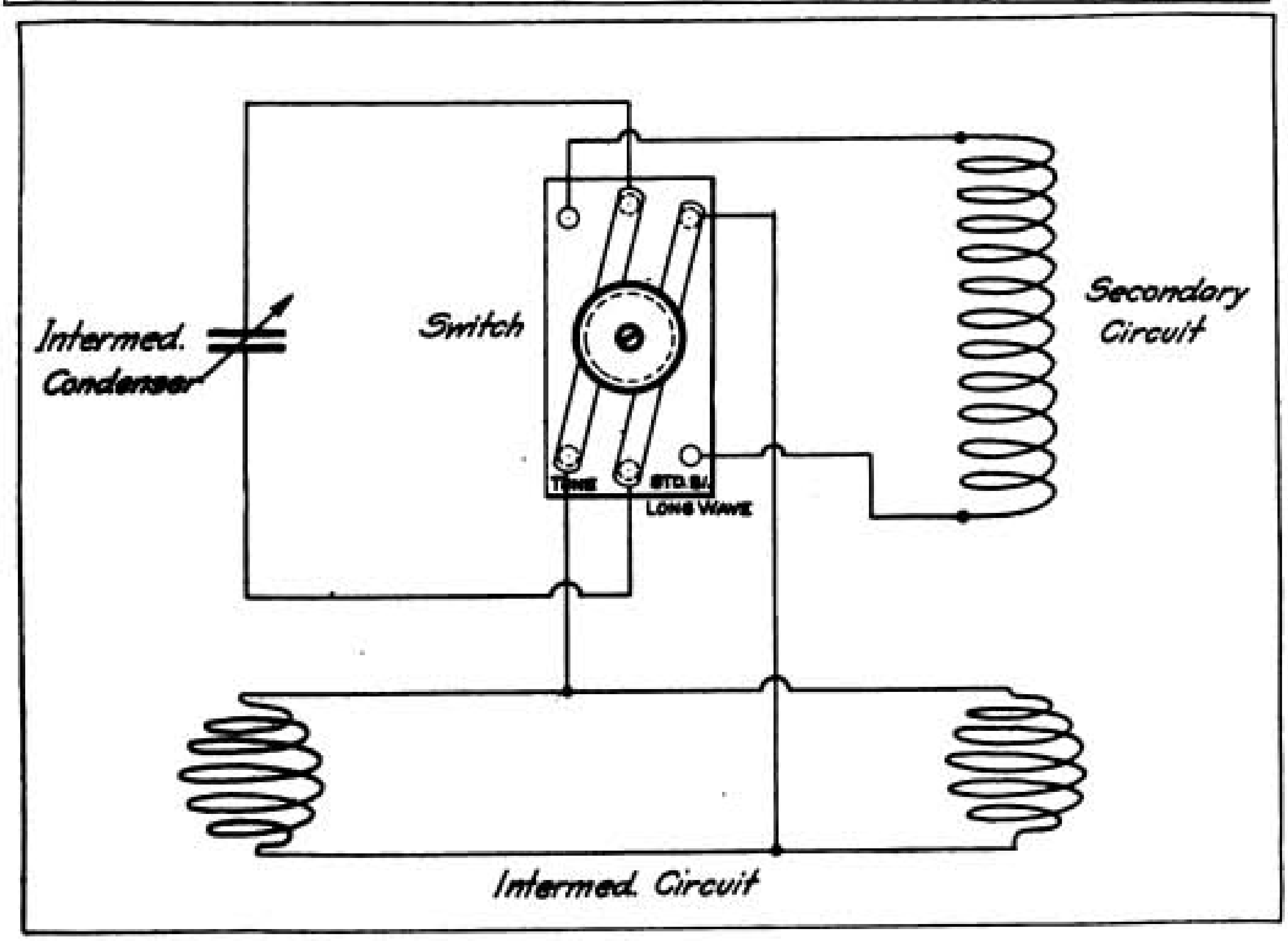


Fig. 1 (above) *Fig. 2 (below)*

opposite that of the ball winding of the intermediate circuit.

The foregoing instructions having been accurately complied with, the aerial and detector circuits may now be placed in exact resonance at adjustments of increased wave-lengths.

Instructions for Practical Operation

(1) Wave-lengths above 800 meters can only be obtained when the D.P.D.T. switch and the intermediate condenser switch are in the "stdbi" position.

(2) With the connections given in (1) the intermediate circuit is not in use. The coupling knob should therefore be turned to zero to prevent needless energy absorption.

(3) At wave-length adjustments up to 800 meters, for purposes of sharp tuning, the D.P.D.T. switch may be shifted to the "tune" position, thus bringing the intermediate condenser into use. The intermediate condenser switch must likewise be shifted to the "tune" position and the coupling knob set at the angle desired.

(4) For tight coupling (stand by adjustments) at wave-lengths up to 800 meters the D.P.D.T. switch is shifted to the "stdbi" position. The coupling knob is now placed at zero. The intermediate condenser may, if desired, be shifted to the detector circuit or left to remain in shunt to the intermediate circuit.

(5) When the disc condenser is shifted to the detector circuit, careful adjustment must be made owing to the large value of capacity in this condenser as compared to that of the billi-condenser.

A complete wiring diagram for the converted tuner is shown in Fig. 1. The connections to the type F aerial change-over switch and the Cerusite detectors are shown in detail.

Applications of Wireless

Apart from the shipping industry, says A. H. Morse, A. M., I. E. E., in "The Year Book of Wireless Telegraphy and Telephony" for 1915, commerce has held itself strangely aloof from radio-telegraphy. Countless islands in the Southern seas await its advent to aid the full development of their rich natural resources, and an era of unprecedented prosperity would dawn for many a remote mine, plantation or other enterprise, could it have radio-telegraphic communication with its markets and bases of supply. The difficulties in the way are largely unreal. From the growing army of skilled operators many could be drawn who would be capable of performing other useful duties besides operating a wireless station. Running expenses, therefore, need not be high, especially as an adequate electrical power supply is generally available or could be installed to supply many needs in addition to furnishing the power for communication. Also, the maintenance expenses in connection with modern wireless apparatus are very nearly at the vanishing point. In respect of these cases just mentioned it is safe to say that radio-telegraphy is well ahead of its applications.

Now, as to the best way of furthering the development of the life-saving and other beneficent applications of radio-telegraphy. Undoubtedly nothing could be better than that shipowners, railway managers and others should take the wireless experts into their confidence, tell them their requirements, and what business could be relied upon if they were met. It is to such a keen and co-operative spirit that the world today owes the wireless fog signal which is now only entering on its career of usefulness.

These references to a few existing and suggested applications of the principles of radio-telegraphy are, perhaps, quite obvious, but collectively they illustrate the newly dawning fact that those principles are destined to serve us in many fields of endeavor. Thus will be enhanced an already glorious record, the crowning feature of which is the endowment of vessels with such powers that, though 500 miles may part them, they are but as—

"Ships that pass in the night and speak each other in passing."

The Physics of the Expanding Hot Wire Ammeter

By William H. Dettman

IN forcing a current against the resistance of a wire, a certain amount of electrical energy must be expended which manifests itself as heat. Let (R) be the resistance of the wire in ohms and (I) the current in amperes made to flow through it under the potential difference of (E) volts applied to its ends. Then the power expended in the wire is given by the equation:

$P = E\ I \text{ or } I^2\ R$ ....(1)

Since $E = I\ R$, which appears as heat; the total energy (W) transformed into heat in (t_1) seconds

$W = I^2R\ t_1 \text{ or } E\ I\ t_1$ Joules......(2)

The unit of heat in the C. G. S. of units is the gram calory, which is the amount of heat required to raise one gram of water through one degree centigrade. One Joule equals .24 calory.

$W' = .24\ I^2R\ t_1$ calory.

This heat raises the temperature of the wire above the temperature of its surroundings, with the consequent increased rate of heat loss by radiation, convection and conduction. A body is said to give off heat by radiation when the heat is conveyed away from the body by ether waves, these waves being similar to light waves but much longer. A body loses heat by convection when it is immersed in a fluid such as air or water as a result of the molecules of the fluid coming into contact with the hot body and robbing it of some of its heat, thereby raising their own temperature. These molecules are then carried away from the heated object by the motion of the fluid. A body loses heat by conduction when it is in contact with solid objects, the molecules in contact with the heated body taking some of the heat from it and handing it on to other molecules further away from the body.

If the wire lost no heat by any of the methods referred to, all the heat would go to raise the temperature of the wire. If (W) is the weight of the wire and (S) the specific heat of the material of the wire, which may be defined as the ratio of the quantity of heat required to raise the temperature of the material through one degree centigrade, to that required to raise the same mass of water through one degree centigrade, then the temperature (T) acquired by the body after (t_1) seconds, assuming (R) and (S) remain constant, is given by the equation:

$$T = \frac{.24\ E\ I\ t_1}{WS} \quad \text{.................(3)}$$

The temperature of the conductor would continue to rise until it would melt, and thereby break the circuit. But the above state of affairs is never realized since every body, when at a temperature above its surroundings, always loses heat by radiation, convection and conduction, except when placed in a vacuum, as the filament in the incandescent lamp, when it loses heat by radiation mostly, and a small amount by conduction along the lead-in wires which may be neglected.

If (A) is the surface area of the wire, and T_1 (= 273 t) its temperature, while T_2 is the temperature of the surrounding objects, then the amount of heat radiated per second or the power radiated by the wire is according to Stephan's Law:

$P_r = KA\ (T_1^4 - T_2^4)$...........(4)

Where P_r is expressed in watts. If T_1 does not differ greatly from T_2, as in the case of the hot wire ammeter (4) can be written:

$$P_r = KA\ (T_1 - T_2)\ (T_1^3 + T_1^2T_2 + T_1\ T_2^2 + T_2^3)$$

or approximately

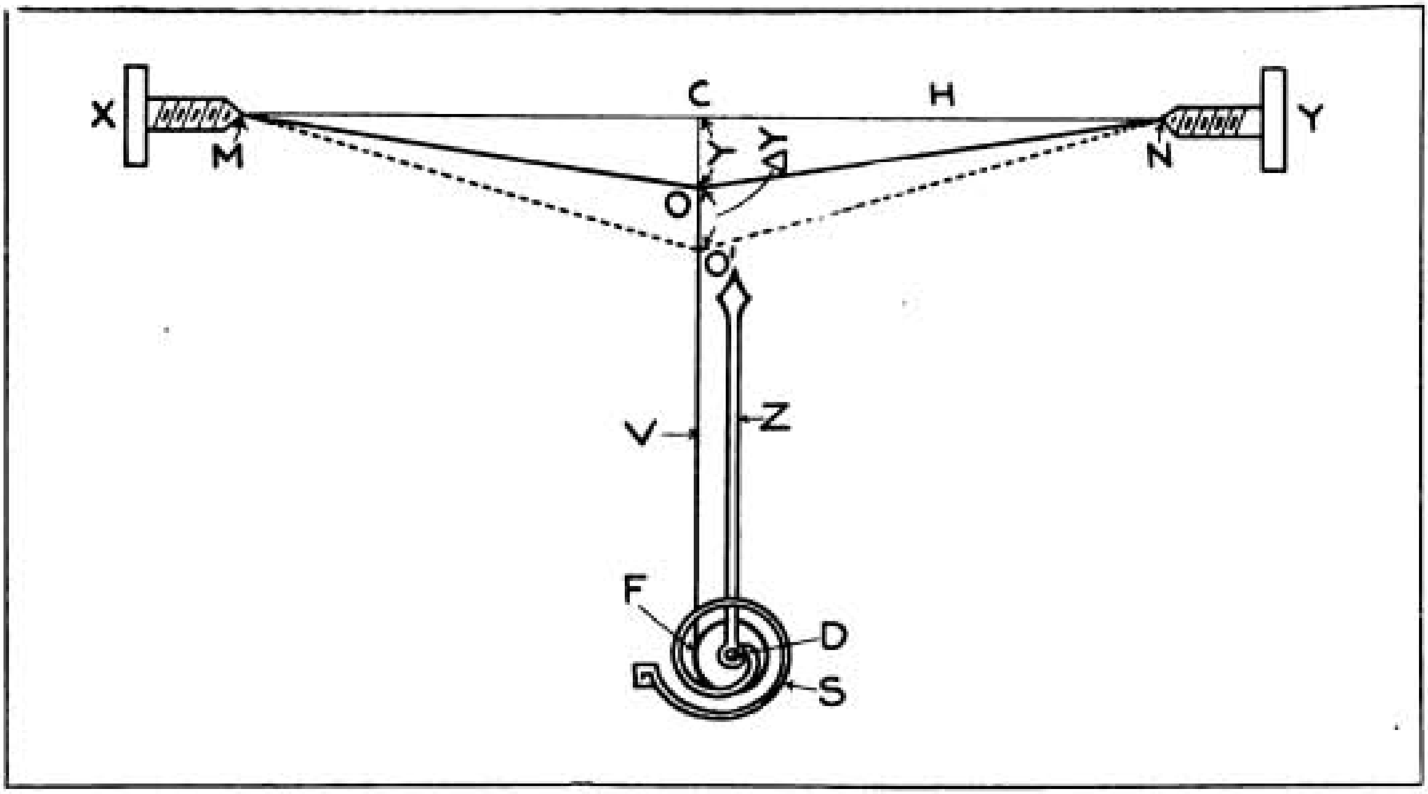


Fig. 1

$P_r = 4\ K\ A\ T^3\ (T_1 - T)$.......(5)

Where $(T_1 - T)$ is the difference of temperature between the temperature (T_1) of the wire and (T) of its surroundings. Then it will be seen that for moderate temperature difference the power radiated is proportional to the temperature rise.

In air, the heat lost by the wire will be greater than that given in equation (5) due to the loss of heat by convection. But since the heat lost by convection is also approximately proportional to the temperature difference, if this is moderate (5) can still be used if the constant (K) is increased to (K_1) which has a value for stationary air

$K_1 = 25 \times 10^{-12}$ to 50×10^{-12}

The temperature of the wire considered above will continue to increase until the power supplied is equal to the total power lost by radiation and convection, or when

$I^2R = 4\ K\ A\ T^3\ (T_1 - T)$

$= 4\ K\ A\ T^3 t$.................(6)

where $t = (T_1 - T)$ = rise of temperature of the wire above its surroundings.

When the temperature of a wire is raised, its length is increased and this linear expansion or elongation is proportional to the rise of temperature (t), in fact:

$\triangle L = B\ t\ L$....................(7)

where (L) is the length of the wire and (B) the coefficient of linear expansion of the wire, which is defined as the elongation produced per unit length for a rise in temperature from 0° to 1° centigrade. For platinum, B = .0000088 which means that a platinum wire 1 centimeter long has its length increased by .000088 cm. for 10° cent. rise in temperature.

Transposing equation (6), we have

$$t = \frac{I^2R}{4\ K\ A\ T^3} \quad \text{................(8)}$$

Substituting this value of t in equation (7), we have

$$\triangle L = \frac{B\ L\ I^2R}{4\ K\ A\ T^3} \quad \text{..............(9)}$$

which is an approximate formula upon which the operating principle of the expanding hot wire ammeter is based.

It will be seen from equation (9) that if other things are constant, the increase in length ($\triangle L$) of the wire is proportional to the square of the current, and therefore this property of the wire may be used to indicate the root mean square value of the oscillatory currents used in radio communication, if this wire be so mounted as to show by means of a pointer its elongation when the currents flow through it. Since the coefficient of linear expansion for most wires is very small, the elongation will also be small for moderate currents and therefore moderate rises in temperature of the wire.

It is, of course, evident from equation (9) that by increasing the length (L) of the wire ($\triangle$ L) will be larger for a given current, but this would require an instrument of large size, which is not desirable.

By using a very fine wire, we not only increase the resistance (R) but also at the same time decrease its surface (A), thereby making ($\triangle$ L) large. The resistance (R) can furthermore be increased by employing a wire having a high specific resistance. This specific resistance should not only be large, but it must be practically constant for such changes in temperature as are encountered in the use of the wire as a current indicator; otherwise, the accuracy of the instrument will be impaired. A wire made of a pure metal is rarely used on account of its large temperature coefficient of resistance; this is nearly .004 per degree centigrade. That is, the resistance of the wire increases by this amount when subject to one degree rise of temperature. But there are alloys, such as German silver, constantan, and manganin, which have a much smaller temperature coefficient.

An excellent material for hot wire ammeters is "Therlo," which is an alloy of copper, manganese and aluminum. Its temperature coefficient is very small and practically constant, while its expansion coefficient, as proven by experiment, is quite constant.

Platinum-silver has been used in the Cardew hot wire voltmeter.

Even after taking all the measures mentioned to make ($\triangle$ L) as large as possible, it is still so small as to necessitate some arrangement for magnifying this elongation. The method generally adopted for effecting this magnification in the hot wire ammeter used for measuring high frequency currents is outlined in Fig. 1.

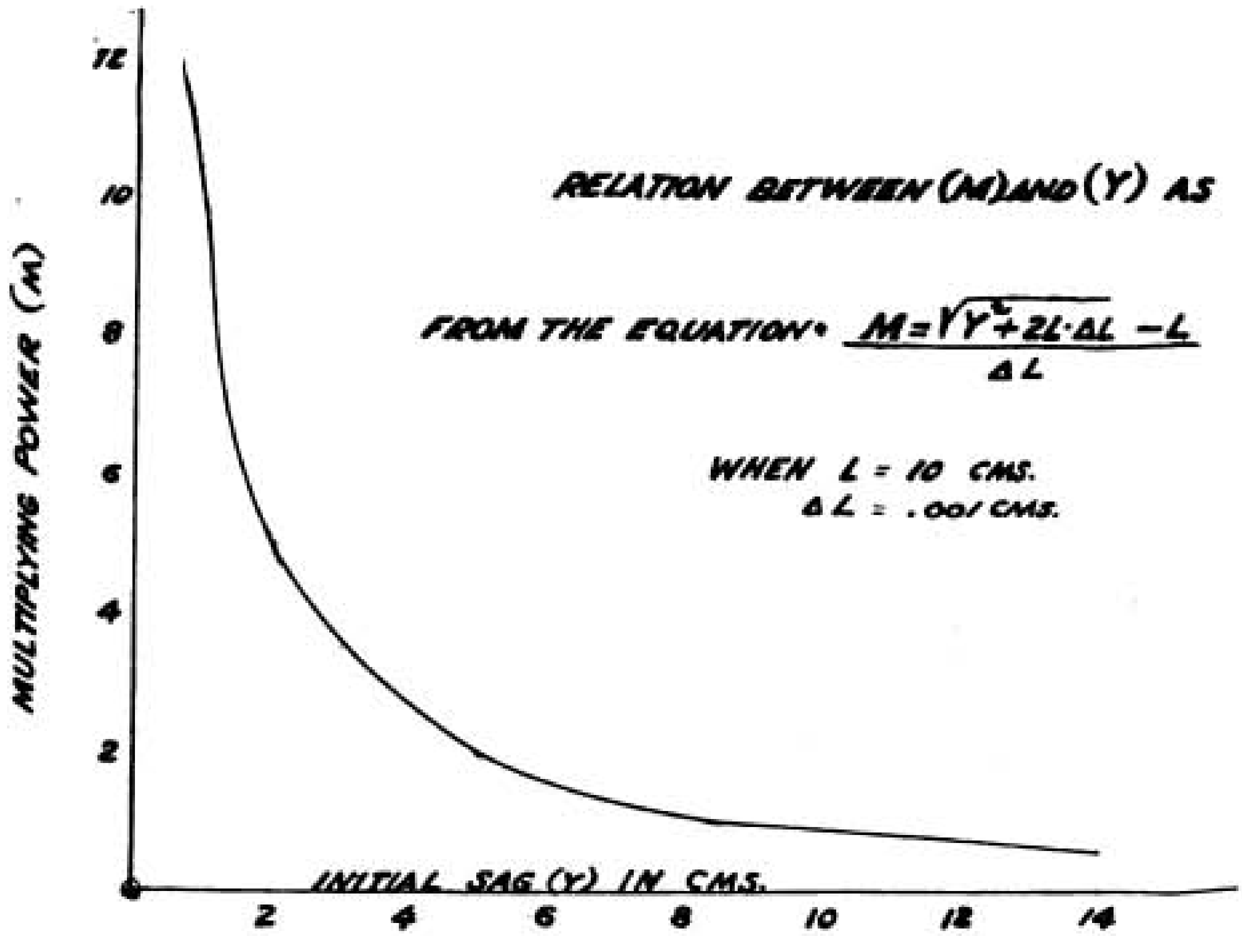


Fig. 2

The extremities of the wire (MON), through which the currents to be measured pass, are fastened to the screws (X) and (Y) which are mounted on insulating supports. To the center of the wire, one end of a silk thread is fastened while the other end passes around the drum (F). The drum and the pointer (Z) are fixed to a spindle (D) which turns in jeweled bearings to diminish friction. The spiral spring (S) serves to keep the silk thread (V) and wire (MON) taut, by tending to wind the thread upon the drum (F). If now a current passes through the wire, its temperature will be raised, and therefore it will expand. The center (O) will sag, thereby allowing the spring (S) to turn the drum and move the pointer over the scale.

A small expansion ($\triangle$ L) of the wire will produce a much larger displacement ($\triangle$ Y) of the cente rof the wire. But let us see what the actual multiplying power of this arrangement is, and what should be the initial sag (Y) to obtain the best results.

Let the semi-length (ON) of the wire be represented by (L), and the initial sag of the wire by (Y). Let (H) represent the distance (CN). If now a current be sent through the wire, (L) will increase to (L + $\triangle$ L), and (Y) to (Y + $\triangle$ Y), or the whole wire (2L) will increase in length by (2 $\triangle$ L). Since (C O N) and (C O' N) are right triangles, we have

$$H^2 = \overline{ON}^2 - OC^2 = L^2 - Y^2$$

$$\text{And } H^2 = O^1N^2 - \overline{O^1C}^2$$

$$= (L + \triangle L)^2 - (Y + \triangle Y)^2$$

$$\text{or } L^2 - Y^2 = (L + \triangle L)^2 - (Y + \triangle Y)^2$$

transporting $(Y + \triangle Y)^2 = (L + \triangle L)^2 - L^2 + Y^2$

Solving for ($\triangle$ Y), we have

$$\triangle Y = \sqrt{Y^2 + 2L \triangle L + \triangle L^2} - Y$$

and

$$\frac{\triangle Y}{\triangle L} = M = \frac{\sqrt{Y^2 + 2L \triangle L + \overline{\triangle L}^2} - Y}{\triangle L}$$

Where (M) is the multiplying power of the sagging wire arrangement. ($\triangle$ L) is usually so small that its square may be neglected in comparison with (2L $\triangle$ L). We therefore have

$$M = \frac{\sqrt{Y^2 + 2L \triangle L} - Y}{\triangle L}$$

Now it can be shown that the larger (Y) is, the smaller (M) will be, for a given expansion ($\triangle$ L) of the wire, and conversely the smaller (Y) is, the greater (M) will be. This means that the straighter the wire (MON), the more sensitive the instrument.

The relation between (M) and (Y) is shown graphically in Fig. 2.

In the limit when (Y) is zero, we have

$$M = \frac{\sqrt{2L \triangle L}}{\triangle L} = \sqrt{\frac{2L}{\triangle L}}$$

from which it is evident that (M) would be extremely great for very small expansions of the wire, that is for small currents.

From the foregoing considerations it is seen that this arrangement has different multiplying powers for currents of different strengths. Equation (9) shows that the increase in length of the wire is proportional to the square of the current, that is, the length increases more rapidly than the current, while the multiplying power diminishes with an increase of current, and thus tends to some extent to make the deflection of the needle, a linear function of the current.

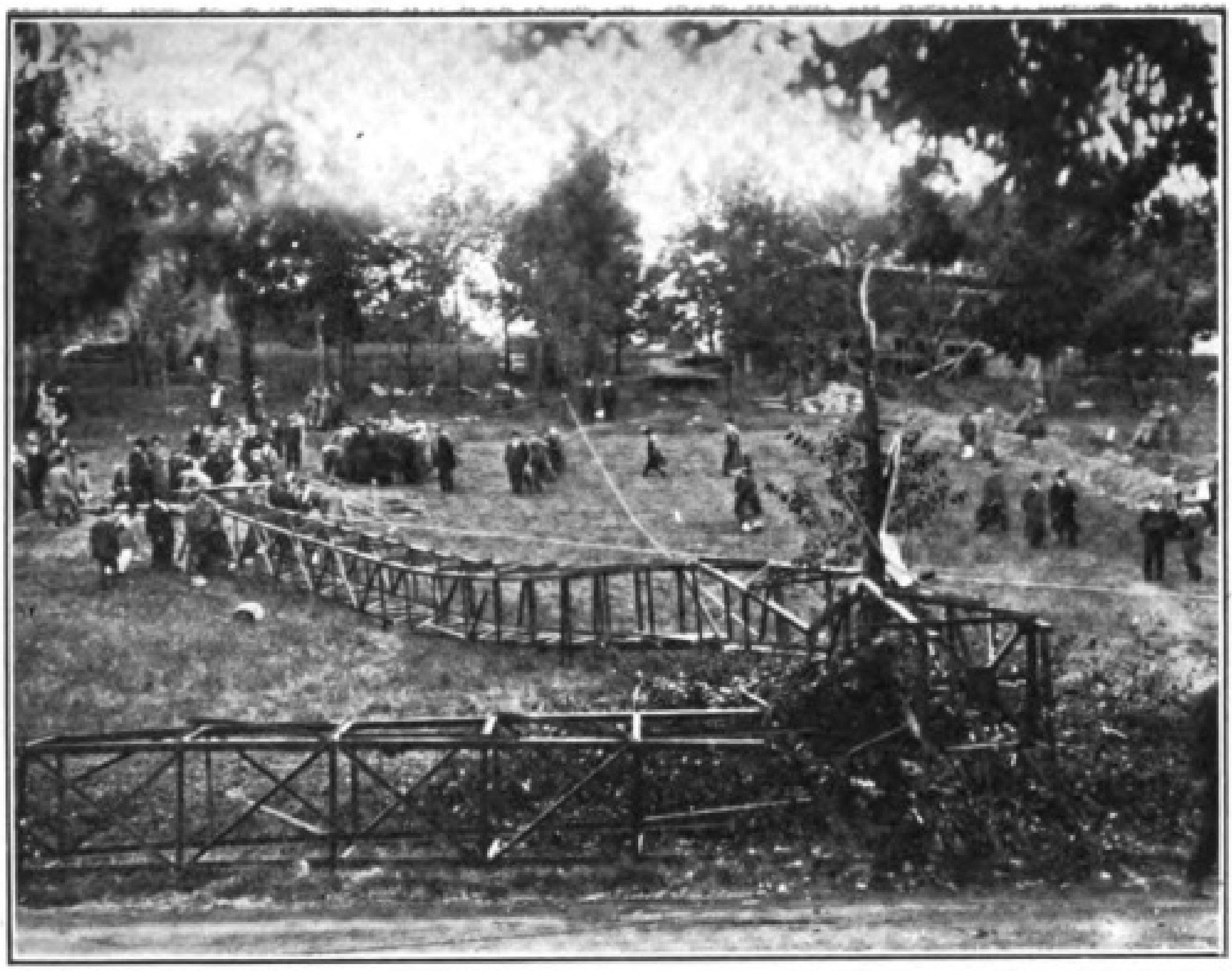
The multiplying power of the instrument can be still further increased if the lower end of the thread (V) be fixed to a rigid support, while one end of a second thread is fastened to the center of (V), the other end passing around the drum (F), which now occupies a position to the right or left of (V). A small sag in the wire (MON) produces a much larger sag in (V), thereby giving a much larger deflection of the needle.

By making the drum (F) quite small and the needle fairly long, the multiplying power is still further increased in the ratio of the length of the needle to the radius of the drum.

Supposing the average multiplying power obtained by utilizing the sag produced in the wire by an expansion is 10, while the multiplying power of the thread (V) is 5, and the ratio of the length of the needle to the radius of the drum is 40, then the total multiplying power is

$$10 \times 5 \times 40 = 2{,}000.$$

That is, if the wire expands by .001 in. due to a certain current, the total displacement of the end of the pointer will be .001 $\times$ 2000 or 2 inches.



Wreck of the 304-foot wireless tower at Tufts College

TUFTS' TOWER ALMOST WRECKED TRAIN

As reported in the October issue, on Sunday September 26, during a terrific gale the new 304-foot wireless tower at Tufts College, Mass., was blown over, a section landing in front of an express train speeding 40 miles an hour.

The quick wit of the engineer in throwing on the brakes prevented a serious accident; as it was, the cow catcher was tangled up with a mess of steel girders and it took hours to clear the track.

The new tower was nearly completed and it was hoped through it communication would be established with Europe.

A new tower will replace the old one in a short time.

Locomotive stopped just in time to avoid an accident

WIRELESS INSTEAD OF CABLE

A Washington correspondent says that because of numerous complaints made by American exporters and importers against censorship delays of commercial cable messages in London and the inability of the United States government to effect relief, the State Department is about to advise these firms to use the wireless instead of cable. The principal protests have concerned the detention of commercial messages of American firms to and from Norway, Sweden, Denmark and Holland.

M. E. Packman presented a paper on "The Training of the Radio Operator," at a recent meeting of The Institute of Radio Engineers.

How to Conduct a Radio Club

Specially Prepared for the National Amateur Wireless Association

By Elmer E. Bucher

Article XVIII

THE resonance curve of a radio transmitter is a graphic equation showing the relation between current amplitude and frequency or wavelength at points on and off the fundamental frequency. The value of the plotting lies in the fact that it enables the experimenter to obtain, in a general way, the over-all distribution of energy in the emitted wave, the decrement of damping and the relative current amplitude in the two wave-lengths, if present.

To plot the resonance curve of a radio transmitter, a wave-meter is required in series with which is connected either a hot wire milliammeter or a hot wire milliwattmeter. The milliammeter should have a range of, say, forty to 240 milliamperes, while the wattmeter may have a scale reading of .01 to .1 watt. The latter instrument is preferably connected to the secondary winding of a step-down transformer, the primary winding of which is connected in series with the circuit to the wave-meter. This transformer, as a rule, is made up of Litzendraht wire, the primary consisting of ten turns wound on a wooden spool, about 1½ inches in length by 1 inch in diameter. The secondary winding consists of five turns of the same wire wound directly over it with a single layer of empire cloth between.

The wattmeter having been connected accordingly, a few preliminary determinations are made in order that the proper inductive relation between the coil of the wave-meter and the antenna circuit may be found. Care must be taken that the wattmeter is not burned out at the point of resonance. The proper inductive relation having been obtained by trial, the coil of the wave-meter is placed in such position as to give a near maximum scale deflection of the wattmeter at the peak of resonance for the longer wave. If the maximum deflection of the wattmeter is obtained at resonance, it is evident that there will be a decrease of current at wave-lengths off resonance, the reduction being dependent upon the decrement of the circuit.

Readings of the indicating instrument having been observed at resonance, corresponding readings are begun off resonance at a point where the indicating instrument shows a small scale deflection, say, .01 watt. Similar observations are made at other wave-lengths approaching resonance and beyond resonance until a full set of values is observed; that is to say, the readings are continued to a point beyond resonance where a nearly zero deflection of the wattmeter is obtained.

A diagram of connections and the relative positions of the apparatus for this determination are shown in Fig. 1, where the closed oscillatory circuit of an amateur radio transmitter is represented by the primary winding, L, the high potential condenser, C, and the spark gap, S. The antenna system includes the secondary winding, L-1, the aerial tuning inductance, L-2, and the earth wire, L-3, which preferably has a single turn inserted series. The coil of the wave-meter, L-4, is placed in inductive relation to L-3 and is in series with the primary winding of the step-down transformer, T, and the variable

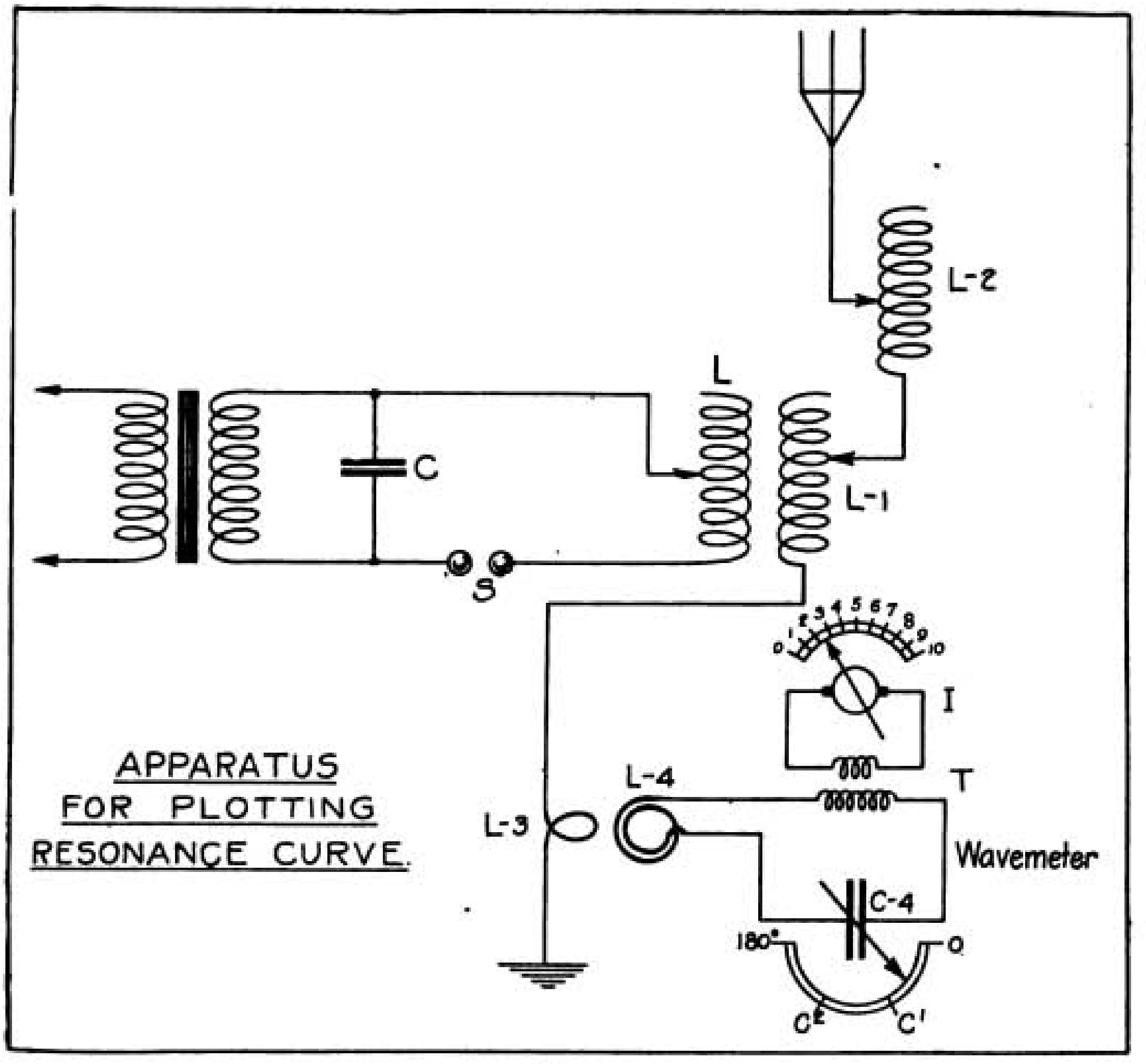


Fig. 1

condenser, C-4. The wattmeter is indicated at I.

Assume, for example, that the spark gap, S, is discharging and that the closed and open oscillatory circuits are in exact resonance; furthermore, that the points, C-1 and C-2, on the variable condenser, C-4, are the peaks of resonance in the double wave. Then, as the pointer of the variable condenser is moved from zero position toward C-1, the reading of the wattmeter increases, until the point, C-1, is passed, when a decrease takes place. An increase of current again takes place as C-2 is approached, followed by a decrease when the peak of resonance is passed. If the setting of wave-length for the wave-meter is noted and the corresponding deflection of the hot wire wattmeter observed, the data thus obtained may be plotted in the form of a resonance curve in the following manner (see Fig. 2):

Placing in one column the value of wave-lengths corresponding to the condenser scale of the wave-meter, and in the second column the corresponding deflection of the hot wire wattmeter, co-ordinate points are laid off on cross-section paper through which a common line or curve is drawn. A typical set of readings follows:

Wave-length of the wave-meter	Corresponding deflection of the hot wire wattmeter
250	.02
255	.034
260	.038
265	.037
270	.034
275	.032
280	.033

285	.035
290	.05
295	.09
300	.1
305	.08
310	.05
315	.03
320	.02
325	.013

With the cross section paper before us, the wave-length readings are laid off horizontally as indicated in Fig. 2 and are known as the abscissas of the points on the curve, while the hot wire wattmeter readings are laid out vertically and are known as the ordinates of the points in the curve. Take, for example, the wave-length of 290 meters; the corresponding hot wire wattmeter deflection is .05. Then follow the vertical line corresponding to 290 to that point where the horizontal line is met corresponding to .05 and place a dot or a cross, as indicated. Proceed in a similar manner throughout the entire set of readings until a complete set of points for the curve are located. Then draw a line joining them.

Now, if the coil, L-4, of the wave-meter is allowed to remain in the same position to the coil, L-3, and various degrees of coupling are employed between the primary and secondary winding of the oscillation transformer, L and L-1, the curve in Fig. 2 will become sharper or broader, accordingly, as the coupling is decreased or increased. In this manner a comparison may be made of the relative sharpness of emitted waves, allowing to some extent a predetermination of the amount of interference to be expected. If the coupling between L and L-1 is sufficiently decreased, the lower peak of resonance, which in the curve exists at about 260 meters, may completely disappear and a single sharp maximum peak result. The resonance curve shown in Fig. 2 is not that of a "pure" wave in compliance with the United States restrictions. To be considered as such the energy in the lesser wave must not exceed ten per cent. of that in the greater.

Should the wave-meter indicate no sharp or defined peak of resonance, it may be that an excessive value of coupling is in use between L and L-1, or that high resistance joints or poor connections exist in the antenna circuit. Again, this may be due to leakage of the insulators; the remedy, of course, is obvious.

From the curve given in Fig. 2 we can estimate the damping of the emitted wave using the formula:

$$\delta_1 + \delta_2 = \frac{\lambda_r - \lambda}{\lambda} 2\pi$$

where λ_r = the wave-length of the wave-meter at resonance.

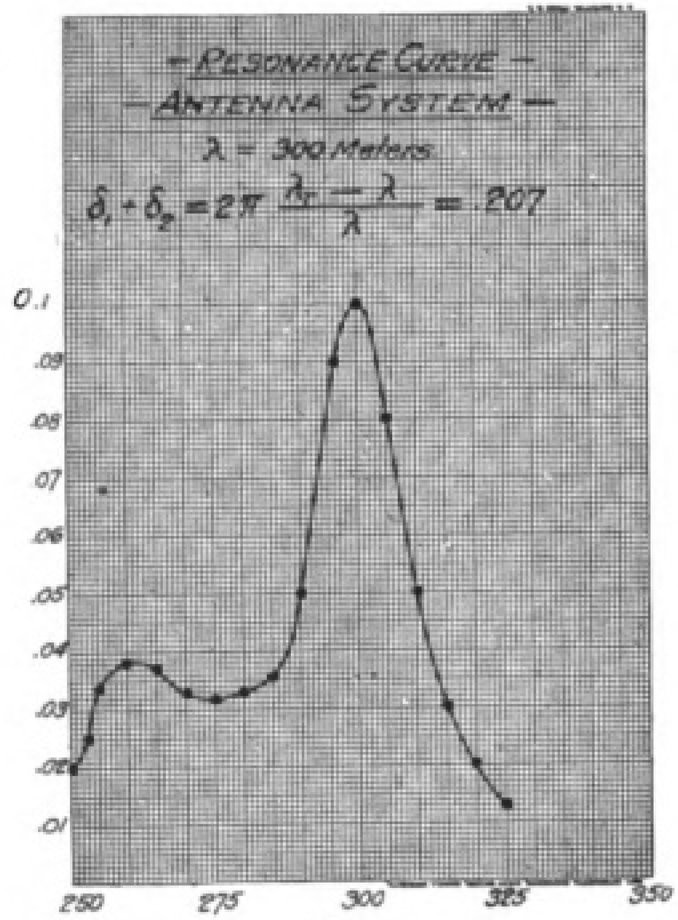


Fig. 2

λ = the wave-length of the wave-meter at a point off resonance where the current in the wattmeter is one-half of that indicated at λ_r.

δ_2 = the decrement of the wave-meter.

If δ_2 is known, we can subtract its value from the sum of $\delta_1 + \delta_2$, leaving the value of δ_1 the circuit under measurement.

If the abscissas of the points in the curve represent capacity values of the wave-meter condenser, and furthermore, the curve is not symmetrical on either side of the slope, we may then take a mean value as per the following formula:

$$\delta_1 + \delta_2 = \frac{\pi}{2} \times \frac{C_a - C_b}{C_r}$$

where C_a = the capacity of the wave-meter condenser at a point above resonance where the reading of the wattmeter equals one-half of that at resonance or C_r.

where C_b = the condenser capacity at a similar point below resonance.

and C_r = the capacity of the condenser at resonance where the maximum scale deflection of the wattmeter is obtained.

Again, the values of δ_2 being known, we may subtract it from the value of $\delta_1 + \delta_2$ to obtain the value of δ_1, the decrement of the circuit under measurement.

Using the same apparatus as that employed for plotting a resonance curve, the amateur experimenter may obtain other curves indicating the wave-length of the open and closed oscillatory circuits with various turns of inductance in use at the primary and secondary windings. For example, if it is desired to determine the increase in wave-length by the addition of turns in the closed circuit, the apparatus is set up as shown in Fig. 3. The coil of the wave-meter, L-4, is placed in close inductive relation to L, but not too close to burn out the wattmeter, I. Starting with one turn in the closed circuit, the corresponding wave-length is read on the wave-meter at the point where the maximum deflection of the wattmeter is obtained (with spark, of course, discharging). Turns are then added progressively at L throughout the series until a full set of readings is obtained. A typical case follows:

Turns	Corresponding Wave-Lengths
1	100
2	145
3	200
4	242
5	295
6	345
7	395

Plotted in curve form these data appear as at curve A in Fig. 4. Here the wave-lengths in meters are the abscissas of the points on the curve and the helix turns the ordinates of the points on the curve. The corresponding wave-lengths between complete turns on the helix can be calculated readily by following the abscissas to the base line or the horizontal axis.

We can plot the readings for the

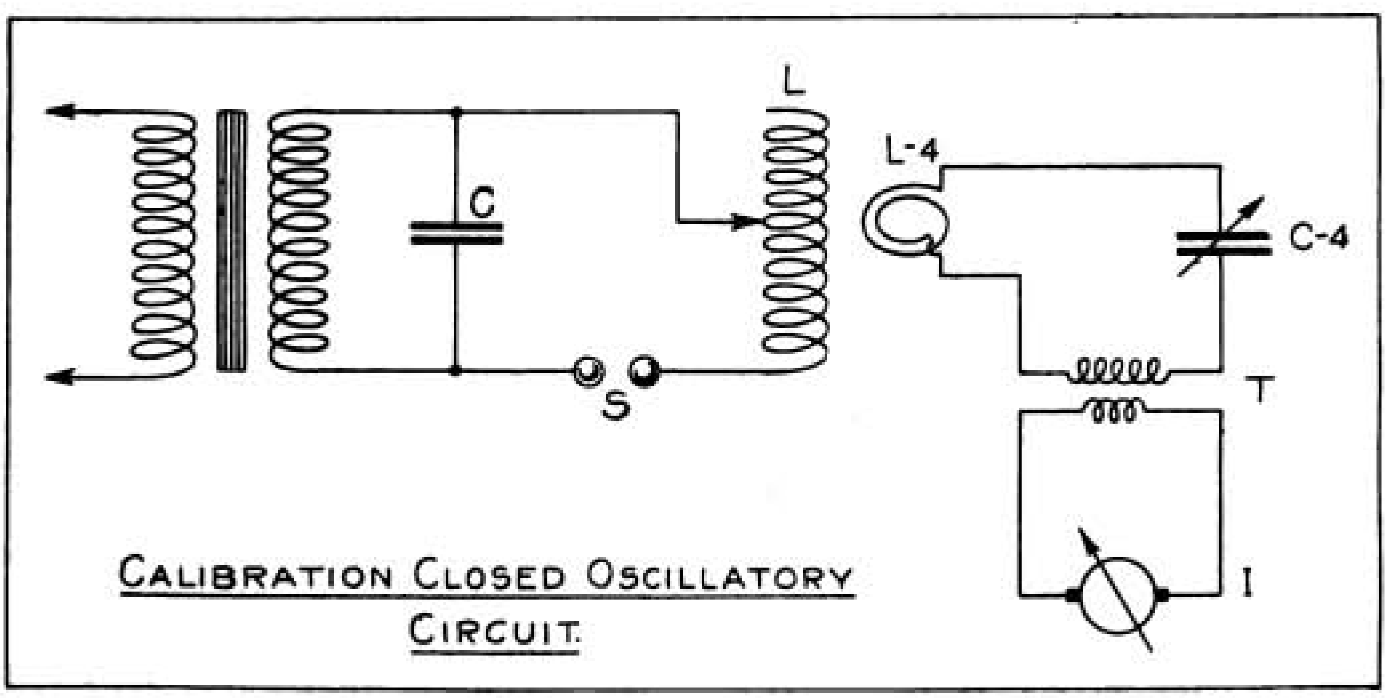


Fig. 3

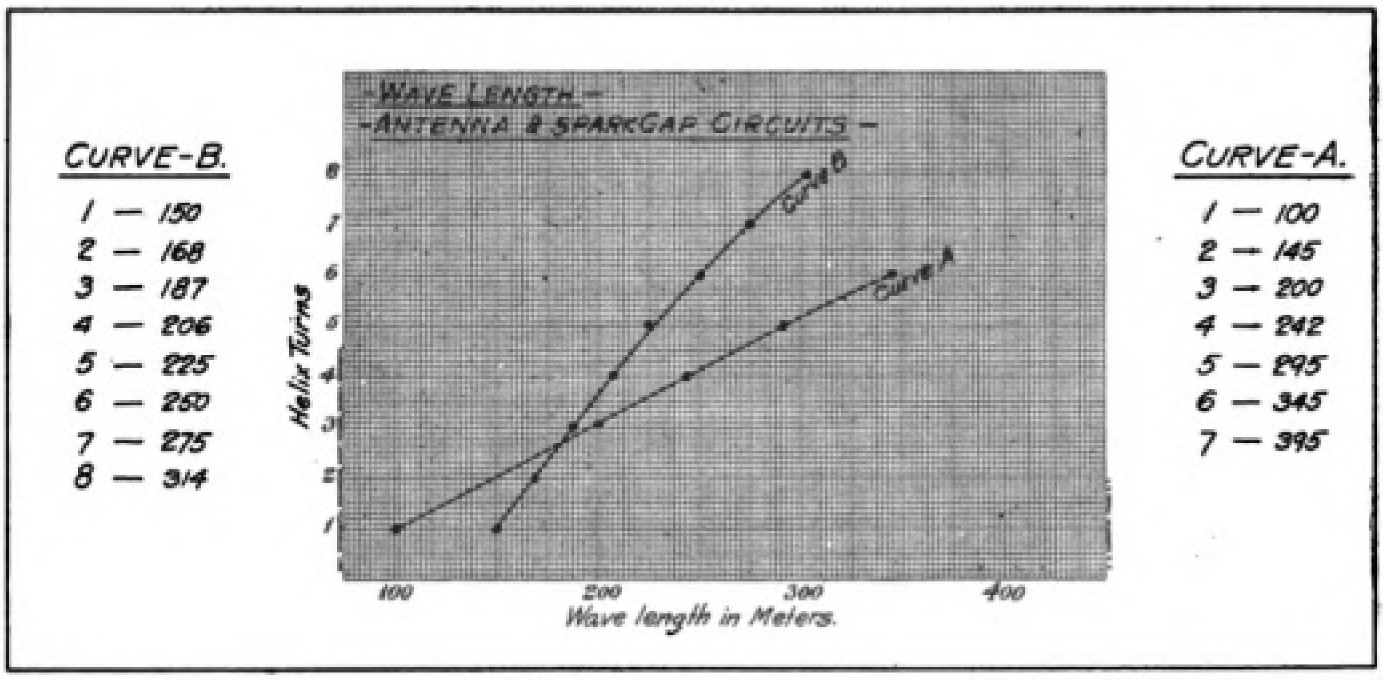


Fig. 4

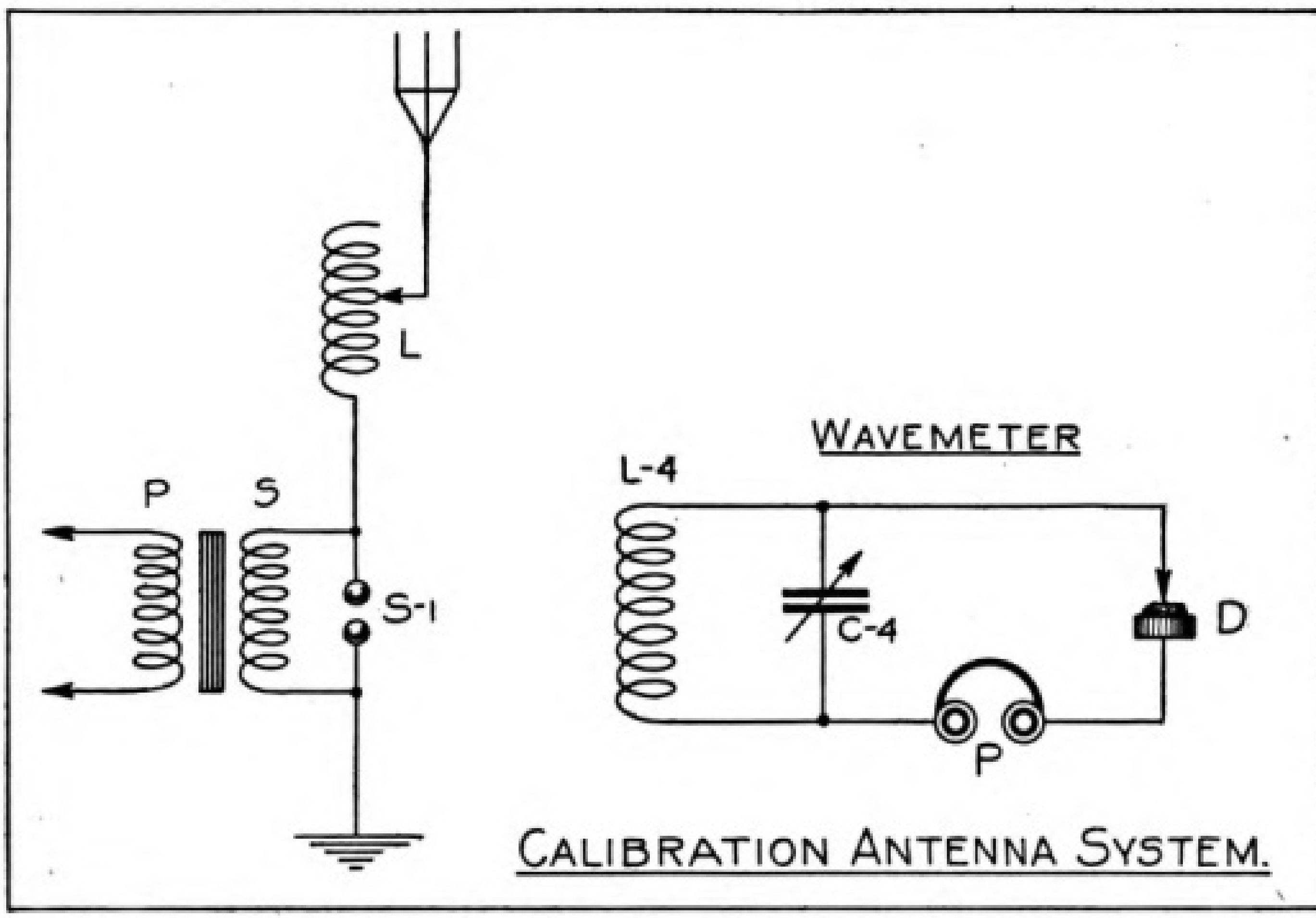


Fig. 5

open circuit of a transmitting system in a similar way, but in this case a spark gap must be connected in series with the antenna system and in turn connected to the secondary winding of an induction coil. Generally the energy flowing in the antenna circuit is insufficient with this connection to operate the wattmeter, or, in any event, the spark discharge is too irregular to permit a reading of the wattmeter to be observed. It is therefore preferable to shunt the wave-meter by a crystalline detector and head telephone, the point of resonance being located by the maximum sound in the receiver. A diagram of connections for obtainng this reading is given in Fig. 5. Here the secondary winding of the oscillation transformer is represented at L and has a variable tap-off. The spark gap in series is indicated at S-1, the primary and secondary windings of the induction coil at P and S. The wave-meter, L-4, C-4, is shunted by the crystalline detector, D, connected in series with the head telephone, P. Various turns are added in the circuit at L and corresponding wave-length readings made on the wave-meter. A typical set of readings follows:

Turns	Corresponding Wave-Lengths in Meters
1	150
2	168
3	187
4	206
5	225
6	250
7	275
8	314

These data appear in the curve, B, on Fig. 4 and intermediate values lying between the complete turns may be taken as in the previous case.

It is recommended that curves of the latter type be prepared at each amateur station and posted in the apparatus room for quick reference. In this manner the wave-length of the open and closed oscillatory circuits may be quickly changed, with the assurance that the two circuits are in exact resonance. Of course, the emitted wave is somewhat altered in length as the coupling between the primary and secondary windings is changed. Therefore at each standard wave-length various degrees of coupling should be tried out, until the one most suitable for local conditions of interference and effectiveness is determined. A wattmeter suitable for the foregoing measurements is briefly described on page 925 of the September, 1915, issue of THE WIRELESS AGE.

A method for eliminating the decrement of the wave-meter is fully described in the book "How to Conduct a Radio Club." This volume can be obtained by enrolling as a charter member of the National Amateur Wireless Association.

(To be continued)

NEW TAHITI STATION

The United States Bureau of Navigation announces that the wireless station now being built by the French government on Tahiti Island, Society Islands, will be ready to receive and transmit commercial messages before the close of 1915.

The temporary station now in course of erection will be followed by a much more powerful plant. The plans of the temporary station contemplate a 10-kilowatt installation of the type used by the French government, with a wave-length of 600 meters. The towers, two in number, will be 100 meters in height. The station will be expected to reach Awanui, New Zealand; Suva, Fiji; and the Samoan Islands.

Immediately upon the completion of the temporary station work will begin on the permanent station. This permanent 300-kilowatt station will be operated by a 500-horsepower gasoline engine, and will use a wave-length of 2,500 meters. There will be eight towers, each 100 meters high, erected in parallel rows of four towers. The space between the towers will be 250 meters, and 200 meters between parallels. There will be two antennæ, one of 600 meters wave-length, the other of 2,500 meters.

With the permanent station it is expected that communication will be established with stations in Cochin-China, South America; Honolulu, Hawaii; San Francisco, Cal.; Sydney, Australia, and even in Martinique and Guadaloupe, West Indies. All material used in the construction of these stations is supplied by the French government and is shipped from France.

Call letters have not been assigned to the station and rates are not obtained at the present time.

Dr. Filippo de Filippi, Italian explorer, in a lecture recently delivered before the Royal Geographical Society at Bombay, on his expedition to the Karakorum and Central Asia, related how he had determined longitude by means of wireless time signals transmitted from Lahore.

A Word with You

THIS is to be considered a personal talk in which I wish first to thank in person the many amateurs who have so promptly responded to the invitation to become associated with our nation-wide organization. It is certainly very gratifying to have received hundreds of applications for membership within the elapsed period of less than two weeks since our first announcement appeared. And the fact that our membership dues are reckoned in dollars, rather than cents, as all previous amateur organizations have been, speaks eloquently to me of the appreciation of our efforts to really DO something for you ambitious and energetic experimenters. I know that in a great many cases considerable sacrifices have been made to secure this money, and the fact that I am now addressing hundreds of fellow members who have had, of necessity, to very carefully weigh the merits of the project, spurs me on to renewed effort to make the *big* men of the country take an interest in your affairs which shall equal that which I already feel. It would have been a great pleasure to all concerned in the establishment of the National Amateur Wireless Association if the necessary equipment could have been supplied gratis; this, however, was out of the question and we had to resort to the next best thing: placing the equipment on an actual cost basis. From the letters which are pouring into headquarters every day I know all our members are pleased; and that is ample reward for the labor without compensation which was required of the half dozen experts who collaborated in the creation of this serviceable material. And it is a great pleasure to record that I have already seen marked indications that you, as fellow members, appreciate that nowhere outside this organization could services of equal value be secured so economically.

That the National Amateur Wireless Association will have imitators is confidently expected; that our carefully worked out plans will be copied, modified, twisted and turned to serve someone's ends or gratify another's vanities, is something we anticipated long before the organization was launched. But the emblem and membership certificate you now hold means, and will continue to mean, more than an empty symbol. Conducting an orgaziation of national service to amateurs requires—even with the unusually favorable facilities at our command—membership fees at least equal to ours. I feel that this financial discussion is required in explanation in these early days of our existence. As Americans of intelligence, you will be the first to appreciate that what is given for nothing is usually worth just that.

With so many men of high scientific position associated with us in official capacities this association should mean a great deal to those who purpose making radio communication a lifetime work; the National Amateur Wireless Association not only hopes to standardize progressive instructional steps for the amateur but assist those who qualify to enter the field professionally. Neither myself nor my associates are particularly interested in the dawdler who looks upon his wireless set as a pleasing plaything; we seek rather for better acquaintance with the many young men who are sufficiently interested in the experiments they are conducting to want to know why certain elements in combination accomplish certain results, not merely that these things happen. This does not mean that we have no interest in the beginner; on the contrary, we wish particularly to cultivate those who are just entering the amateur ranks. One of our most cherished desires is to place the newcomer in the proper environment, to have him associate with whatever club in his town or city is best qualified to instruct him along the proper lines, and to co-operate with that club in making its meetings so interesting that the beginner will apply himself diligently to the task of acquiring knowledge which will place him alongside the more advanced members. Through the delegate that each club securing recognition from the National Amateur Wireless Association elects to the National Council, we expect to learn just what are the definite problems that hinder progress and to deal with the cases in a broad way.

THE preparedness features of our program already outlined to you are ones we must not neglect in our anxiety to be of service to ourselves as individuals. A few nights ago I had the great privilege of dining with Frederick Palmer and listening to a talk on war conditions as he saw them. Mr. Palmer, as you probably know, is the war correspondent selected to represent the entire American press and the one newspaper man who spent a full year on the firing line in the great conflict raging abroad. What he said of our perilous situation is indelibly impressed on my mind. Never before have I so fully appreciated that where fighting forces are short of both equipment and training, they may be mowed down like wheat before the scythe, wiped out in battalions in the twinkling of an eye. That great personal courage is of little avail in modern warfare has never before been so graphically and horribly demonstrated; it is a war of iron machines spitting deadly fire and human machines burrowing in trenches. Brilliant charges and hand to hand conflict in the open is practically unknown—organization wins the victory, organization of heavy artillery equipment, vast quantities of supplies and ammunition brought forward with clockwork precision, and tens of thousands of men acting as one. As Mr. Palmer expressed it, it is a war of engineers.

WHAT would this country come to if we were invaded in our present state of unpreparedness! Have you ever stopped to think what war means? You know in a general way that the Navy's recent "war games" off the Atlantic coast have resulted in the defending vessels being "sunk" or put out of action and the "invaders" having things pretty much their own way. You know something of the naval appropriation bills that are now coming up before Congress. In a phrase, you know that with our present navy an attacking power would have little difficulty in landing on American soil. The army then must save us? In theory, yes; but in practice it would not have a chance.

Most of us accept the unthinking attitude which considers raising a million men over night; many of us—particularly those who can trace lineal descent from Revolutionary fighters—believe the American civilian, once aroused, the greatest natural warrior in the universe. For a long time I felt that way about it myself. The fact that as a nation we have never been whipped, that wonderfully effective armies have been created out of raw material and have repelled strong invaders, has given us a false sense of security that is dangerous beyond expression. As one good American has phrased it, our young grow up believing that each of us can lick ten men of any other country. The boy leaves school with the idea that all he has to do is to grab a rifle and march to victory, that we can lock arms with each other and just push the enemy into the sea; and in a pinch, the Lord, or Edison, will save us. Blatant pacificism has so flattered our vanity that we have not taken the small effort necessary to see what lies spread before our very eyes.

THE army we are expected to depend upon is smaller than the army of Montenegro, a toy-country. It could not possibly defend all its forts, for it has less than one hour's supply of ammunition for coast defense guns. We picture it going valiantly into battle, never considering that the entire mobile force on the United States proper is scarcely more than twice the size of the New York police force, and has ammunition supplies that would be exhausted in three or four days of fighting.

A telegraphed summary of the text of President Wilson's annual message to Congress has come to my desk just as this is written. The strongest recommendations embodied in the document have to do with comprehensive plans for strengthening the national defenses, because: "The European war has extended its threatening and sinister scope until it has swept into its flame some portion of every quarter of the globe, not excepting our own hemisphere; has altered the whole face of international affairs, and now presents a prospect of reorganization and reconstruction such as statesmen and peoples have never been called upon to attempt before."

The passion of the American people, the President declared, was for peace; that conquest and dominion was not in their reckoning nor agreeable to their principles. "But just because we demand unmolested development and the undisturbed government of our own lives upon our own principles of right and liberty," he said, "we resent, from whatever quarter it may come, the aggression we ourselves will not practice. We insist upon security in prosecuting our self-chosen lines of national development. We do more than that. We demand it also for others."

War, the President declared, was regarded by the United States merely as a means of asserting the rights of a people against aggression, and that "we are as fiercely jealous of coercive or dictatorial power within our own nation as from aggression from without." He said the nation would not maintain a standing army except for uses which are as necessary in times of peace as in times of war, but that the country did believe in a body of free citizens ready and sufficient to take care of themselves and of the Government. "But war has never been a mere matter of men and arms," he continued. "It is a thing of disciplined might. If our citizens are ever to fight effectively upon a sudden summons, they must know how modern fighting is done, and what to do when the summons comes to render themselves immediately available and immediately effective. And the Government must be their servant in this matter; must supply them with the training they need to take care of themselves and of it. The military arm of their Government, which they will not allow to direct them, they may properly use to serve them and make their independence secure—and not their own independence merely, but the rights also of those with whom they have made common cause, should they also be put in jeopardy."

The President presented the War Department plans for strengthening the army as "the essential first step" and "for the present" sufficient. The plans include the increasing of the standing army to a force of 141,843 men of all services, and the establishment of a supplementary force of 400,000 disciplined citizens, who would undergo training for short periods, throughout three years of a six years' enlistment. "It would depend upon the patriotic feeling of the younger men of the country whether they responded to such a call to service or not," said the President.

There can be little question that the response will merit the confidence the leader of the Nation has publicly expressed on many occasions when referring to the patriotism of our young men.

The new army and the proposed National Reserve will not insure victory should war be declared on us to-morrow. But it is a step in the right direction and may aid in eventually securing the 400,000 *trained regulars* we need to back up our volunteer forces.

NOW a word or two as to what the National Amateur Wireless Association expects from you. In the land warfare which history records the cavalry has always been considered the eye of the army. Nowadays an army is more concerned in determining the exact range for its artillery than in ascertaining the details of possible infantry charges on its flanks. Trench warfare means ceaseless firing of rifles and machine guns from covered positions, constant shelling from concealed batteries. Positions are usually taken only after the enemy entrenchments have been battered to pieces; consequently it is of the greatest importance for a commander to learn the location of enemy guns and the layout scheme of the opposing redoubts. In former days one of the most important missions of the cavalry was to conduct the reconnaissance, it was sent out to bring back word of the number of men opposing and their distribution. The new method of fighting has changed all this. As I have had it described to me by men who have actually walked along occupied trenches, there is absolutely no telling the number of the occupants—or even that they are occupied—until you are right upon them. Cavalry sent forth on this particlular mission would be wiped out in an instant on the present battlefields in France.

Reporting the advance of enemy reinforcements brought up from the rear is also no longer the simple task it used to be. Thousands of men are now brought forward to the firing line in underground passages extending back as much as five miles from the actual scene of hostilities; they do not march along smooth highways with fifes screaming and banners flying.

The cavalry still has its uses and they are many, but the change just mentioned is indicative of the increasing importance of the branches of military service that are of such special concern to the members of the National Amateur Wireless Association.

IT is difficult almost to the degree of impossibility to learn exactly how wireless is being employed in the present fighting. But a few scattered bits of information given publicly and pieced together throw a little light on our needs in this connection.

The famous inventor, Marconi, president of your Association, said in a recent interview given to the Giornal d'Italia that while the war continued he could not enumerate the advantages obtained with wireless, but it was not a secret that with a small wireless apparatus aeroplanes could now communicate with headquarters without landing—indeed, could remain in the enemy's zone and continue their scouting operations while still in touch with their own army.

The extent to which the wireless equipped aeroplane has been developed by France is looked upon as one of the most remarkable developments of the war. The French air fleets have been organized and drilled as thoroughly as fleets of the sea; aerial tactics are being studied as carefully as any other form of strategy. Every day less is heard about smoke bombs signaling from aircraft to locate artillery fire, but practically nothing definite has been said about the increase in wireless signaling. Yet in the words of one of our greatest war correspondents in France we are told that an "officer got out one of the machines and exhibited its tricks and its wireless apparatus." And from the same source it is learned that an army consisting of eight corps has fifty-four of these aeroplanes, to which this significant remark is added: "I am speaking now of the particular type of aeroplane employed for regulating artillery fire."

John Hays Hammond, Jr., who has just returned from the other side, is now advocating, as part of the American defense program, the acquisition of 2,000 air scouting machines for land forces alone. Henry A. Wise Wood has begun an agitation through the Aero Club of America to establish a chain of aero-radio stations at intervals of 100 miles along our coasts. His plan embraces aeroplanes patroling a circle of 100 miles in diameter and reporting by wireless every hour to a base on shore. Two hundred wireless equipped aeroplanes would thus protect America from surprises by sea.

From all viewpoints, aircraft fitted with wireless appears absolutely essential. Whether 200 will do, or 2,000 will be needed, I am not prepared to say. The recommendation of the Department of War which the President endorses provides for four aero squadrons. Incidentally the present aerial equipment of our army reaches the grand total of ten machines. The navy is just as badly off—and this is the land in which the aeroplane was born!

SOME day we will know what the horrors of warfare really mean. It may be years off, but there is little question that this country will eventually come to grips with some other nation. And it is equally safe to predict that we will not be prepared. The defense of the nation will, as in the past, fall on the shoulders of the volunteer.

There is only one quick way to wake up the nation; that is for the people themselves to wake up. The heroism of the American volunteer is traditional, his behavior under fire has been written brilliantly in the annals of the wars of the past. But organization when war is upon us means the useless sacrifice of thousands of young men, the flower of the nation, as it were, snuffed out of existence because we are now blind to our peril, too cocksure that we'll be ready when the time comes. Our geographical problems are enormous, the very size of our country multiplies our difficulties beyond those that other nations have to face. And yet we placidly contemplate taking the field a million patriots strong at the sound of the first gun fired. Where are we going to get officers who know enough about this modern, highly specialized business of fighting to direct this theoretical army?

According to military authorities the world over, a soldier who has had less than a year's training is useless in battle; even with the equipment at hand our volunteers would be pitifully inadequate until they had undergone the experience that makes trained soldiers.

Unmistakably, the solution lies with you. You may lie back in fancied security, or you may prepare.

IF war comes wireless operators will be needed—a great many wireless operators. Up to now you have probably considered the navy's problems only; it is natural to link up any thought of wireless with the sea, and we hear the naval appropriation more frequently discussed in public. But so far as the amateur wireless man goes, the sea forces don't need him, don't want him. If there is one thing the most useless in this universe of ours it is an untrained man aboard a fighting vessel. Those among you who are ready to consider a war time career in charge of a battleship set had better see the recruiting officer right now. As an enlisted man the navy will welcome you, will treat you famously in time of peace as well as war, but as a volunteer when war arrives—well, you would simply be in the way. No, if you are going to get ready to serve as a volunteer, turn your thoughts to coast defense and the land forces, learn something of military strategy, do actual field communication under the conditions which would apply in time of war and, above all things, strive for mastery of the code and a technical understanding of efficient apparatus.

You can't do this alone, you can't do it as a loosely governed radio club. But there are some among you who have spirit enough to get a wireless corps together, others who have had militia experience and are willing to serve as instructors. Somewhere in this country an amateur is going to start something, to blaze the trail for others to follow. The general public has long looked upon the amateur as a nuisance; someone is going to change that opinion and show what can be done in the way of elementary training of defense units. The radio signal corps, as a distinct and highly specialized branch of the service, can easily set the pace in civilian preparedness.

LET me show you the cumulative effect of concerted action on the part of amateurs. A wireless corps is organized somewhere to-morrow, we will say. The members, all boys between the ages of 12 and 18, affiliate with a local battalion of the Junior American Guard or some similar organization and faithfully attend the weekly drill and the summer encampment; they learn what military discipline means, accustom themselves to the rigors of camping and forced marches, perfect themselves in the operation of portable wireless equipment and become trained soldiers in embryo. Others then follow this example and signal corps are formed all over the country. These finally attain such proportions that they are given the opportunity of participating in parades and reviews in large cities. What will be the effect on the sidewalk spectator? Don't you think that he will then begin to realize his shortcomings and take action of some kind, either consider service in the militia for himself, or come to a realization that the handicaps placed on our paid defensive forces should be removed and these brought up to, at least, the safety point?

Assume now that a period of years has elapsed and the boys of the original corps have grown into manhood. Some of them still remain as military signaling instructors and are training the younger generation. Others have decided that the elementary training has been beneficial and they would like to continue it, for reasons of health, patriotism and recreation; they have gone into the militia and are devoting one night a week to drilling and studying the higher branches of training. Through sheer force of numbers and purpose these men have made the radio signaling corps what it is not today: a properly equipped, dependable branch of service, composed of *trained men* and ready for any emergency. That the regular army would then bring its radio divisions up to the proper standard is certain; seeing the militia well equipped, the people would demand that the regulars be even better provided for. And once we are properly organized in one branch there is hope that the American defensive program will permit proper organization throughout both land and sea forces. The conditions that exist today should certainly not be tolerated longer.

THINK over this matter of preparedness carefully. When you get ready to take up the matter seriously, have determined that you will not only start your signal corps but will continue it with faithful attendance at all drills for at least one year, let your Association know that you have secured a competent instructor and are ready to organize. When a sufficient number of such communications have been received the details will be worked out to fit all cases.

That is all for the present. The next step is up to you.

Acting President.

The eyes of many are blinded to fact and their minds closed to reason by an abhorrence of what they term "militarism," without any actual conception of just what this means or how it should affect the proper consideration of the subject. Those who really fear militarism, or, more accurately stated, those who dread real militarism, should be the strongest advocates of reasonable preparation. The latter is the preventive of militarism. If they unwisely defeat reasonable preparedness, they leave the country in a condition where the inevitable result of defeat, humiliation or acute apprehension will be hasty and ill-advised provisions as to armament far beyond anything which calm reason and wise provision would deem necessary.—From the annual report of Secretary of War Garrison.

An armored automobile train. Recently a line of machines ended a run of 5,000 miles at San Diego, Cal.

Wireless on the Armored Auto

A Train which Ran from Wisconsin to California

By Felix J. Koch

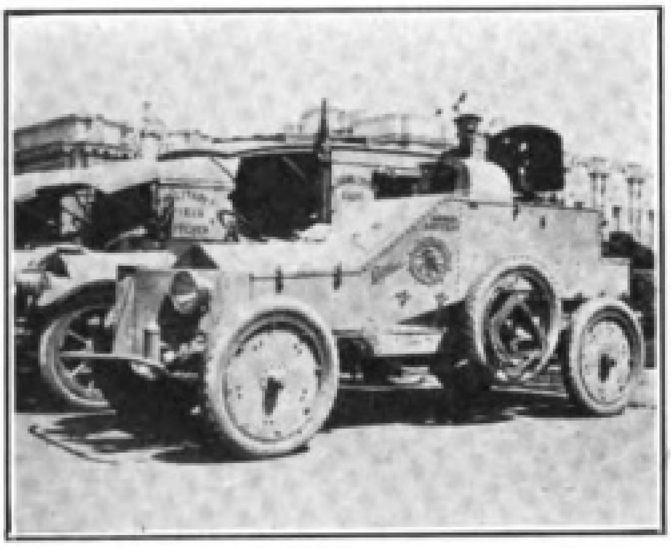
MEXICAN imbroglios, with their constant rumors of secret understandings between Mexican leaders and Japan, make the possibility of war-clouds on the American horizon not absolutely remote; cautious Americans are therefore not without interest in what preparations there may be with us in event of war.

Not the least valuable of such phases of both defence and aid to offense is the means of communication between fighters and base, and in that connection especial interest attaches to the arrangement of the wireless station on the armored motor-car of today.

The pictures tell the story better than words; in them are shown the arrangement of the wireless station occupying the rear end of one of the cars in the armored automobile train of a military and naval academy of Lake Geneva, Wis, which recently ended a run of some five thousand miles at the exposition at San Diego, Cal.

The prime purpose of the unique expedition, it appears, was to demonstrate the usefulness of motor-cars in transporting light rapid-fire guns and wireless equipment over great distances. The horseless caravan, comprising eight cars, several of them armored, left Lake Geneva on June 10. A direct route to the Pacific coast was not taken, for the itinerary permitted of several side trips; the run did not end at the San Diego Exposition until July 22.

The cars are the first of their kind to be sent on a cross-country trip of this length and the run was made primarily that an informative report could be given to the War Department. The trip, as a matter of fact, came to a successful



Ready to ride

The wireless station aboard

end, without accidents en route to cars, drivers or cadets, and the commander is now preparing a report which will include the map of all roads, full details of fuel consumed, tires used, speed maintained and the like. The wireless car contains full equipment which the boys are able to set up for almost instant use.

SOMETHING ABOUT SKAGWAY

Writing from Skagway, Alaska, W. R. Barnes and A. E. Kindell offer some interesting facts for the benefit of the readers of this magazine.

"We are hemmed in on all sides with mountains ranging from 4,000 to 8,000 feet," says the letter, "less than five miles distant. These are laden with gold and copper ore and a recent find of molybinite. We have a seven-wire aerial, No. 17 phosphor bronze, suspended solely at each end and 1,998 feet long. It is 75 feet high at the lowest end and rises to a bluff 584 feet high, upon which rests a 27-foot pole; the wire has a sag of 90 feet. It is used for receiving together with valve detector, 2,000 ohm phones, series and parallel variable condensers across secondary, loose coupler and detector. The loose coupler is of special construction with a wave-length range of from 600 to 7,000 meters. We copy NTL (San Diego) every night and have also heard the station on the Panama Canal as well as all the government stations and commercial stations in the Alaskan interior and the coast.

"We are entirely surrounded by mountains, being situated at the head of the Lynn Canal in the Skagway River Valley.

"We use a horseshoe magnet on our vacuum valve, thereby increasing its life and sensitiveness two-fold; the battery to light the filament lasts longer on account of requiring less current strength to get the desired results.

"We hope to do considerable long distance work this winter. Alaska has every other place—no matter where—skinned for freak work. The nights are cold and clear and signals come in very distinct."

Naval Station Temporarily Closed

Orders from Washington on October 9 closed the new radio station at the Great Lakes Naval Training station for two weeks. The government explanation was that during the manoeuvers of the fleet off the Atlantic Coast there was a probability that messages sent to captains of the ships would be interfered with by activity at the Great Lakes station.

Designing Your Own Transformer

Information That May be Used Under Any Conditions Encountered by the Average Experimenter

By R. H. Chadwick

WHEN the experimenter in radio telegraphy undertakes to build a transformer from parts which he can obtain readily and cheaply, he often finds that he has available a coil or a core which could be used if the design as a whole were suitably proportioned. It is the purpose of this article to set forth certain general principles, which will serve to guide the amateur in building a correct transformer, but which at the same time will allow much flexibility in design.

We shall designate the low-voltage coil as the "primary," the high-voltage coil as the "secondary," and the magnetic circuit interlinking these coils as the "core."

The first step is to decide on the capacity of the transformer and the secondary voltage required. Then we may calculate the current which each coil is to carry from the following formula:

$$I = \frac{1000W}{E} \qquad (1)$$

where W is the capacity of the transformer in kilowatts, E is the primary or secondary voltage, and I is the corresponding current in amperes.

Having determined the current, we may select the size of wire to be used. The cross-section of the wire should be such that the current density does not exceed 1,300 amperes per square inch in the primary coil, and 1,100 amperes in the secondary coil. The cross-section is

$$A = .785\, D^2 \qquad (2)$$

where A is the cross-section and D is the diameter of the wire in inches. D corresponding to the various B&S gauge numbers may be found in any electrical hand-book or wire table. The

current density is $\frac{I}{A}$ (3)

The next step is to determine the cross-section of the core and the number of primary turns. These should be so related that the "flux density" in the core will not exceed approximately 60 kilolines per sq. in. at 60 cycles, or 70 kilolines at 25 cycles. The flux density is calculated from the following:

$$B = \frac{100000\, E}{3.77\, f\, N\, C\, H} \qquad (4)$$

where B = density in k. l. per sq. in.
E = primary voltage
f = frequency in cycles per second
N = number of primary turns
C = width of core
and H = height of core

Dimensions of the core other than the cross-section are determined merely by the size of the coils. The core is built up of sheets of iron, preferably silicon or "transformer" steel. Silicon steel, however, is not absolutely necessary to the success of the transformer.

It will be found most convenient to build a "core type" transformer in

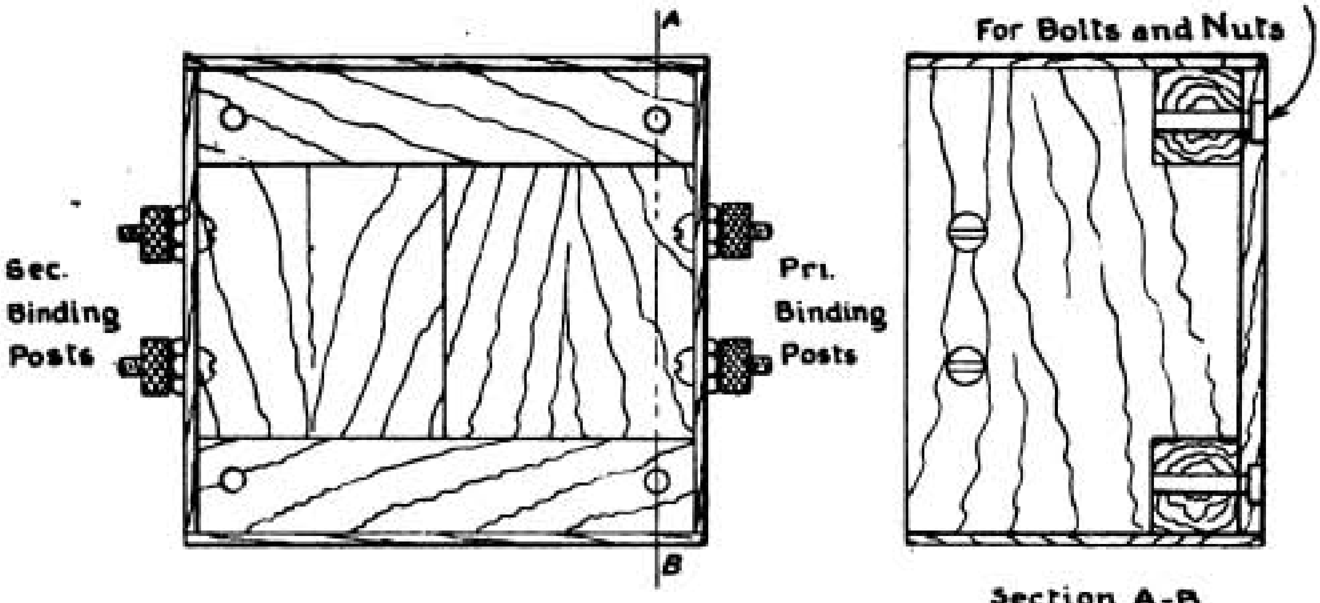


Fig. 1

which the core is a simple rectangle, and the coils should preferably be placed on opposite legs of the core. If it is desired for any special reason to use "shell type" punchings, the two coils may be placed side by side on the middle leg. In any case there should be a space of ¼ inch to 1 inch between the coils. If it is found that too much energy is discharged through the gap, overheating the transformer or blowing fuses, this space should be filled with sheets of the same iron used in the core, which device will reduce the energy output.

The primary coil may be either hand or machine wound, using enamel or cotton covered wire. The coil should be wound around a wooden form of suitable dimensions to admit the core decided upon. Several turns of stiff paper or cardboard should be placed around the form, and after winding the form may be removed, leaving the paper to support the coil. A strip of paper not less than .005 inch thick should be placed between layers. This paper, as well as the paper under the coil, should extend at least ¼ inch beyond the actual winding layer on each side, unless special precautions are taken to insulate the coil after winding. The size of the coil may be calculated roughly from the diameter of the wire and the thickness of insulation used, but if the coil is hand wound liberal allowance should be made for the spring of the wire.

The secondary coil should always be machine wound. Enameled wire is preferable, and the insulation between layers should consist of two or three thicknesses of rice paper or similar material. Standard coils suitable for the secondaries of wireless transformers may be obtained from a number of manufacturers at a small cost. Usually the secondary coil will be the starting point from which the various characteristics of the transformer are determined. The number of turns in the secondary coil will determine the number of turns necessary in the primary coil from the ratio:

$$\frac{\text{Pri. Turns}}{\text{Sec. Turns}} = \frac{\text{Pri. Volts}}{\text{Sec. Volts}} \quad (5)$$

The number of primary turns will determine the cross-section of the core. In selecting a coil from manufacturers' "standards," it must be remembered that the inside dimensions must be such as to admit the core which the foregoing calculations show to be necessary to go with the number of turns on the coil.

The secondary coil must be well insulated. Probably the best method is to tape it three or four times around with strips of varnished cloth or similar material, well lapped. If such material is not available, some ingenuity must be exercised to provide several thicknesses of solid insulating material between all parts of the secondary coil and the core or primary coil. Sometimes it is possible to sufficiently protect the ends of the coil with collars cut out of paper, with tongues extending under the coil.

After the core and coils are assembled and the core is properly wedged in place, the transformer may of course be used by simply connecting to the wires coming out of the coils. However, a housing is very much to be desired from the standpoint of both safety and convenience.

may be filled with paraffin or sealing wax, if it is desired to protect the coils against moisture. A well-made box, shellaced or stained, will leave nothing to be desired so far as appearance is concerned.

In a few cases it is thought desirable to provide taps in the primary to vary the secondary voltage. These may be provided by soldering leads at any desired numbers of turns during the winding of the primary coil; remembering always that the ratio of voltages is equal to the ratio of turns, and remembering also that the flux density in the core depends on the number of primary turns actually used and not on the total number in the coil. In general the

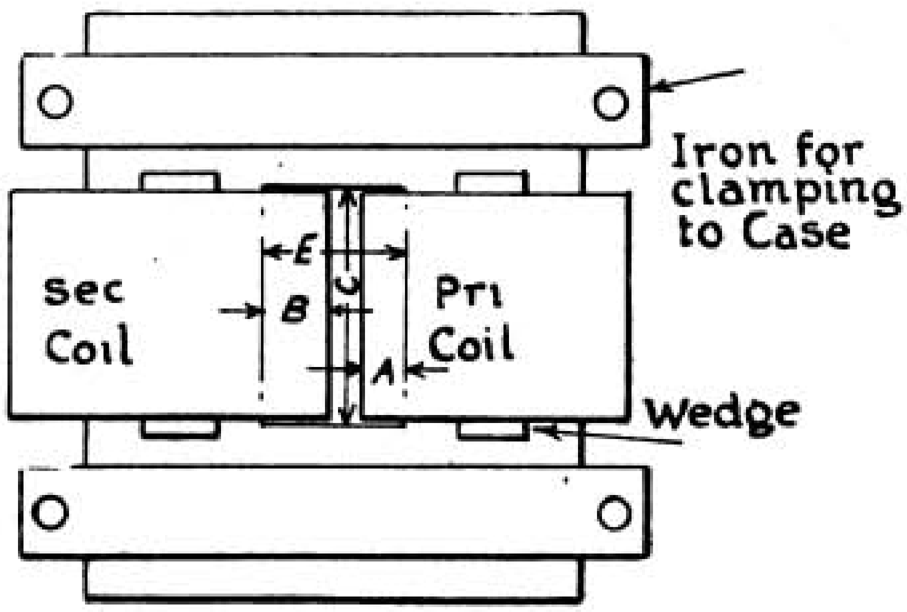


Fig. 2

The accompanying diagram, Fig. 1, is a suggestion for a housing that may be easily constructed. It consists simply of a wooden box of suitable dimensions, with two cleats high enough and far enough apart to support the edges of the core, while the ends of the coil are suspended between them. The core may then be clamped by strips of band iron fastened by bolts to the bottom of the box. The leads from the coils are fastened to binding posts, consisting of ordinary brass machine screws, with contact nuts such as may be obtained from old dry cells. Before fastening the cover in place, the box

writer would recommend that a single secondary voltage be decided upon, and the taps be omitted.

To illustrate the method, suppose it is desired to build a ¼ k.w. transformer, having a 12,000 volt secondary, to operate on a 110 volt, 60 cycle, circuit; and suppose we have available, or can obtain from manufacturers' standards, a coil of the following specifications:

No. of turns...........	20,000
Size of wire..........	No. 36 B & S
Inside dimensions.....	2½" x 2½"
Max. outside dim.....	4½" x 4½"
Width	2½"

The currents which the transformer must carry are as follows (Formula 1):

$$\text{Pri. I} = \frac{250}{110} = 2.27 \text{ Amps.}$$

$$\text{Sec. I} = \frac{250}{12000} = .0208 \text{ Amps.}$$

From the wire table it is found that No. 36 wire has a diameter of .005" and cross-section of .0000196 sq. in. If the coil described be used for the secondary the current density will be $\frac{.0208}{.0000196}$ = 1060 Amps. per sq. in. The coil, therefore, is satisfactory so far as the size of wire is concerned. From formula (5) the number of primary turns for the correct voltage ratio is 183.

Now, if we allow 3/16" all around inside the secondary coil for insulation, we may use a core 2⅛" square; that is, built up of pieces 2⅛" wide, and stacked to a height of 2⅛". From formula (4) the flux density, with a coil of 183 turns, and a core 2⅛" square, is

$$B = \frac{100000 \times 110}{3.77 \times 60 \times 183 \times 2.125 \times 2.125}$$

= 58.9 k. l. per sq. in.

This indicates that a core 2⅛" square is satisfactory. If the density had been found to exceed 60, we might have crowded the insulation and put in a slightly larger core; but if the discrepancy had been very great, we should have been obliged to either select a different secondary coil, or put more turns on the primary and use a lower secondary voltage.

Now to select the primary wire, look through the wire table, and choose a wire having cross-section large enough to keep the current density within the limit specified above. It is found that No. 16 wire has a diameter of .051" and cross-section of .00204 sq. in., which gives a density of

$$\frac{2.27}{.00204} = 1112 \text{ Amps. per sq. in.}$$

We will, therefore, use No. 16 wire, unless it happens to be more convenient to obtain a slightly larger size.

If possible, the primary coil should be wound before the core iron is cut in order to determine the outside dimensions of the coil. Otherwise these dimensions may be calculated closely enough, as the build of the coil will be small in any case. We will wind the coil 2½" wide to correspond with the secondary, and will assume that dimension A in Fig. 2 is ⅝".

From the dimensions of the secondary coil and core, it is readily seen that dimension B is 1 3/16" for the uninsulated coil; but allowing for insulation we will call B-1⅜". Now, allowing ½" between the coils make dimension E 2½". Making C's dimension 3" allows ample room for insulation at the ends of the secondary coil.

It is now seen that the core may be built up of rectangular pieces, 2⅛" wide, one-half of them 4⅝" long, and the other half 5⅛" long. To find the number of pieces of each size, divide the height of stack by the thickness of sheets and multiply by 2.

The results of our calculations may be summarized as follows:

Primary coil, 183 turns of No. 16.

Second coil, 20,000 turns of No. 36.

Core, 4¼"; stack of pieces 4⅝" x 2⅛", and 4" stack of pieces 5⅛" x 2⅛".

A few extra pieces of iron should be available for filling in between the primary and secondary coils, in case it is found necessary to reduce the energy.

PUPIN PERFECTS A NEW RECEIVER

Professor Michael I. Pupin recently delivered an address before the National Academy of Science in the American Museum of Natural History, New York city, in which he declared that he had succeeded in perfecting a receiver which is sensitive only to such waves as the operator wishes to employ.

In his address Professor Pupin explained how he had evolved the idea of the amplifier which made the recent wireless telephone conversations between Arlington and Honolulu possible. He said the idea had come to him from the tiny cells in the human ear that amplify and make audible the faintest sounds. He explained his idea to scientists who developed it later under his direction.

With the Amateurs

Reporting football games by wireless is increasing in popularity. Among the games covered in this manner may be mentioned the annual combat between the University of Iowa and Northwestern. A detailed report of the game's progress was sent out by the University of Iowa station.

A waiting throng of Pittsburgh rooters also learned the details of the gridiron clash between the Carnegie Tech. eleven and the rival Case team by wireless flashes from Cleveland. Members of the radio club and other students interested in wireless telegraphy, assisted Prof. A. F. Van Dyke in receiving the news. Among the rooters who accompanied the Tech. team to Cleveland were C. K. Little and J. J. Pannabaker, electrical engineering students, who formerly were Marconi operators on the Great Lakes.

Among the December activities of the Atlanta Wireless Club is the maintenance of an interesting exhibit of Georgia amateur apparatus at the electrical show to be held in Atlanta, Ga., during the week ending December 4.

A complete Marconi wireless set, including a two-kilowatt sending set and a cabinet receiving set, has been recently purchased by the electrical department of Union College. It is planned to build an addition to the laboratory to house this new wireless apparatus and make it a first-class radio station, and a club will be formed at the college for all men interested in wireless.

The University of Wisconsin is also operating a new station under the supervision of the physics department and the course in electrical engineering.

The preparedness principles advocated by the National Amateur Wireless Association proved a good thing for David F. Snow, the Arlington, Mass., youth, charged by the United States Government with having transmitted radiograms and signals without a license. United States Commissioner Hayes, before whom the boy appeared on October 23d, gave him three months in which to perfect himself in wireless telegraphy, on the assumption that he will then be in a position to give valuable service to the State or Nation in time of need.

Young Snow was instructed to appear before the Boston United States radio inspector at the end of three months. If qualified he will then be licensed.

Six Los Angeles, Cal., amateurs have run afoul of the radio law and their names have been referred to the United States district attorney for prosecution. Three have been using wave-lengths in excess of 200 meters and the other three operating without licenses. One of the wave-length offenders is also accused of using improper call letters, the maximum penalty for which is a fine of $100 and imprisonment for two months.

The trend of thought in boys' organizations is illustrated by the report from Orange, Texas, that Stanley Barners, master of the local boy scouts, is to purchase wireless telegraph apparatus with the fifty dollar check received for services rendered in taking care of the Johnsons Bayou flood sufferers during the month of August.

Charles E. Apgar the amateur who aided the government secret service operatives in securing phonographic records of the Sayville station's transmitting, has recently given several demonstrations of his methods in Y. M. C. A. lectures. Mr. Apgar is using circuit diagrams which have appeared in The Wireless Age to illustrate his addresses.

Twenty Massachusetts members is the nucleus upon which the Amateur Radio Association of New Bedford has recently been founded. Douglass Tripp is secretary and invites correspondence with other clubs.

The Wireless Club of the Central Y. M. C. A., of Trenton, N. J., is contemplating the purchase of a high-powered sending set, according to Norman Steward, secretary.

At a recent meeting of the Arlington Radio Club of the Arlington High School (Mass.), the following officers were elected: W. C. Clark, president; Eliott Perkins, vice-president; Harold O. Bixby, secretary-treasurer. The club is under the direction of experienced men and will soon have in operation an efficient ½ or 1 k. w. transmitting set.

Coming into official existence on November 2d, the Inter-city Radio Association has established headquarters at 722½ N. Penn street, Allentown, Pa. John S. Bernhard is president and announces that meetings are held every Tuesday evening, each member owning a complete station equipment and lending enthusiastic support to the weekly programs.

The Ann Arbor High School Club has been merged into the Y. M. C. A. Radio Club of Ann Arbor, Mich., and has retained its full membership. Communication has been established up to distances of 50 miles, using a ½ k. w. transmitter and straight gap, reports Walter R. Hoffman, secretary.

A state-wide organization is the object in view for the fifteen charter members of the Oklahoma Radio Experimental Association, of Oklahoma City. A central station is now under construction and an invitation is extended to the whole amateur fraternity of Oklahoma to communicate details of the range and power of their stations. Clifford A. Smith, 922½ W. Main street, Oklahoma City, Okla., is secretary.

The regular meetings of the Franklin-Janvier Wireless Club are to be held on Thursday evenings throughout the winter. Sydney Haynes, Franklinville, N. J., R. F. D., is secretary.

A library for the use of members has been added to the equipment of the Rockaway Radio Club, 296 Washington avenue, Rockaway Beach, N. Y. L. Wagerer reports a material increase in membership as a result of two interesting meetings held recently. H. Conway has been elected president.

In a list of special stations published in the November issue of The Wireless Age appeared 9ZE, Claude Sweeney. This should have read 9ZE, Philip E. Edelman.

The Carrollton Wireless Club was reorganized in the laboratory of the public school, at Carrollton, Illinois, November 25th, and will henceforth be known as the Carrollton Radio Intercommunication Club. Ward Dickson was elected president; David Roberts, vice-president; Stuart W. Pierson, secretary and chief operator, and Owen Jarboe, treasurer. The purpose of the club is to regulate the wireless traffic in Carrollton, to make the members proficient operators and to study the art of radio communication. The club will meet every other Tuesday. At each meeting papers pertaining to some special topic will be read and a discussion will follow.

RADIO INSTITUTE MEETS

A meeting of the Institute of Radio Engineers was held on Wednesday evening, November 3d, in room 301, Fayerwether Hall, Columbia University, New York City. A paper on "The Impedances, Angular Velocities, and Frequencies of Oscillating Current Circuits," by Professor A. E. Kennelly, was presented. Professor Kennelly has developed a new method of finding the true periods and dampings of any system of oscillating circuits. A second paper on "The Use of Multiphase Radio Transmitters," by William C. Woodland, was also presented. The advantages obtained by using multiphase currents and a number of rotary gaps, insofar as high spark frequency and low high-tension condenser capacities are concerned, were discussed.

From and For those who help themselves

Experimenters' Experiences.

The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.

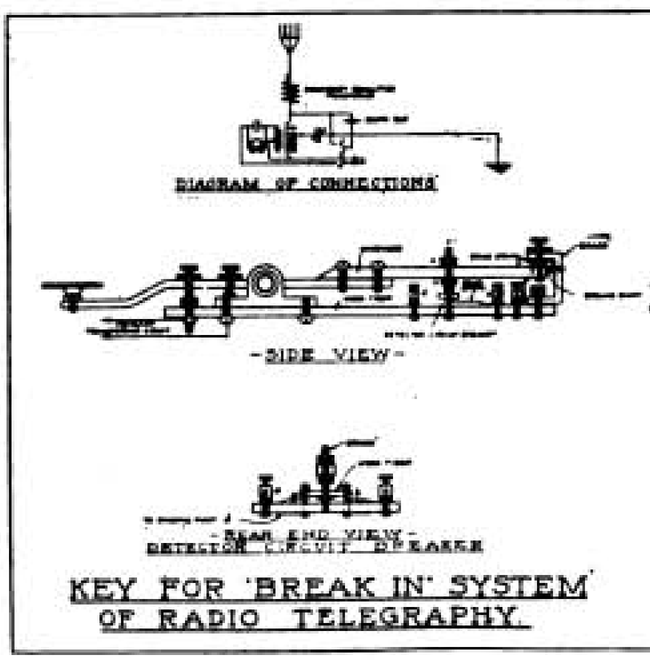
FIRST PRIZE, TEN DOLLARS

A Break-in System Which Has Simplicity of Operation

Seven years of experience in amateur wireless telegraph work have so far failed to bring my attention to a break-in system suitable to amateur radio apparatus. Either the key works awkwardly, the detector refuses to remain in adjustment while transmitting, or an open circuit causes trouble. The key I now use does not entirely fulfill the requirements of a perfect system, yet it is the best I have been able to develop and is superior to those described by other experimenters. My design is a combination of features common to the ordinary break-in keys with certain added mechanical advantages which simplify the operation and make it less awkward to manipulate.

With mineral detectors it is necessary that the key disconnect the detector entirely from the crcuits of the receiving apparatus. It is likewise essenial that the telephone receivers be protected by shunts placed across the entire receiving apparatus while the key is closed for sending. In ordinary break-in systems extra contacts are added to the common key and must be very carefully adjusted for satisfactory operation. In addition, they are not apt to stay in that condition for an indefinite period. The key shown in the accompanying illustration performs the necessary functions and does not need readjusting once it is properly set. The operation is easy, the construction simple, but the necessary parts must be carefully made as play in the fulcrum is bound to cause trouble.

To a large extent the illustration is self-explanatory. It will be observed that instead of the adjustment at the rear of the common telegraph key, the space through which the lever swings is regulated by the nut, N, on the bolt, R. The "back click" of the key is therefore made by the contact which shunts the detector circuit and not by the set

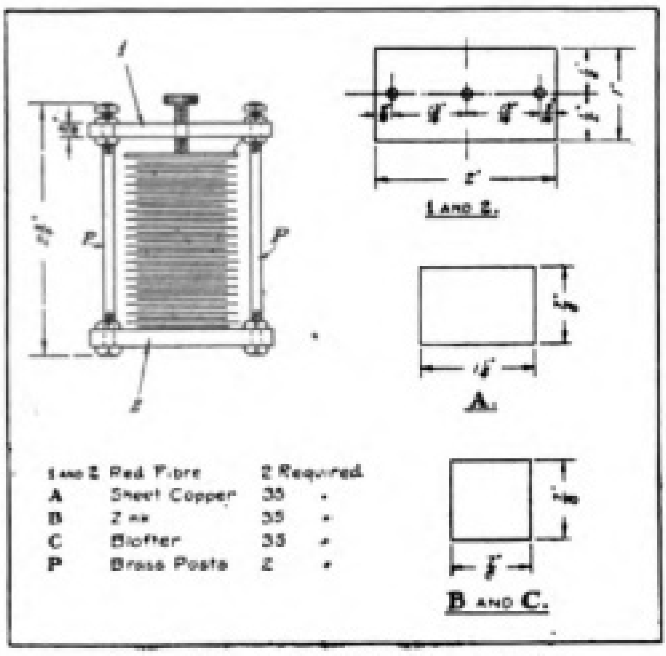


Drawing, First Prize Article

screw usually employed. When the transmitting key is depressed, the rear end rises, allowing the brass springs, A and B, to break the circuit at A′ and B′. These springs should be made of No. 30 brass. In pressing against the fibre plate above them they compensate for the extra weight added to the lever of the key.

At the same time the spring, C, comes in contact with the screw, F, closing the circuit about the entire receiving set, thus affording a direct path from the oscillation transformer to the earth. An anchor-gap made of two one-cent pieces with a small washer of mica between, affording a minute space, is shunted about C. This will shunt to earth the greater part of the current from the oscillation transformer in case the short-circuiting contact on the key gets out of adjustment.

The illustration shown is not drawn to scale, but the key I now employ has a wooden arm four inches in length measured from the fulcrum of the key. The short-circuiting contact is at the extreme end, while the circuit-breaker for the detector is one inch nearer the fulcrum. It may improve the operation of the key to add a compensating spring between the detector circuit-breaking contact and the fulcrum. If in constructing such a key other improvements are added by amateurs, so much the better, but I should like to hear about them in order that I may avail myself of the advantages.



Drawing, Second Prize Article

John E. Waters, *California.*

SECOND PRIZE, FIVE DOLLARS

Constructing a 35-Volt Vacuum Valve Battery and Rheostat

If the editor of The Wireless Age will allow me a little space, I am satisfied that I can present the readers of this magazine with a money-saving tip. The majority of us are familiar with the vacuum valve detector; its initial cost is not high, but what about the cost of the secondary batteries, particularly when the fact that certain bulbs require from twenty-five to seventy-five volts potential for satisfactory operation is taken into consideration? To be sure, the Fleming valve requires less potential, but many readers possess one of the three-element type.

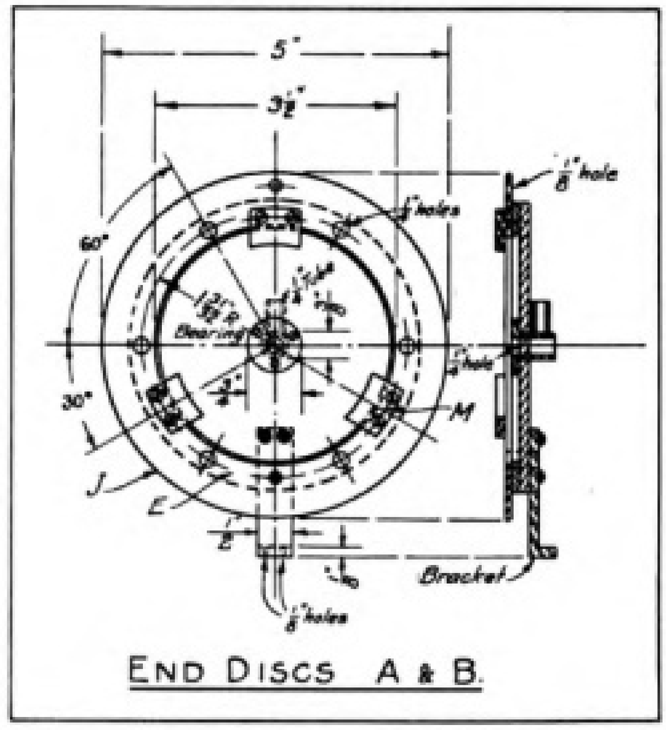


Fig. 1, Third Prize Article

This article contains instructions for constructing a thirty-five volt battery and rheostat combined which weighs six ounces when complete. It was constructed at an exceedingly small cost.

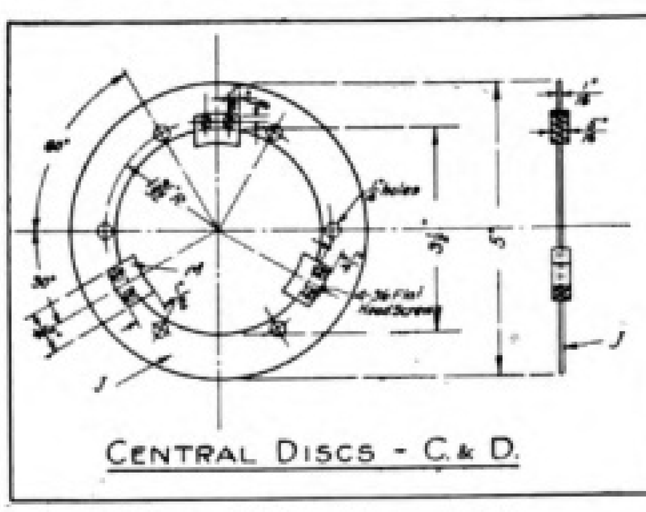


Fig. 2, Third Prize Article

The battery can be made for a high or low voltage; and it will be found by experiment that each galvanic couple (copper, zinc and blotter) will give a little in excess of one volt pressure.

The drawing is almost self-explanatory. Work up the different parts as

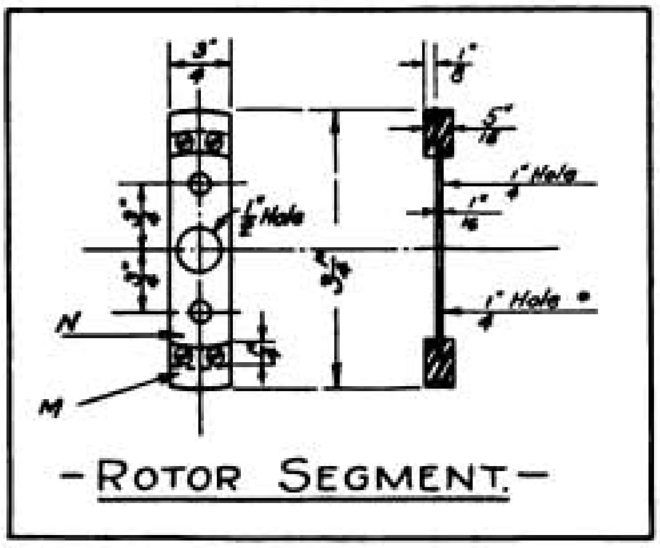


Fig. 3, Third Prize Article

shown, then with a little patience assemble carefully as follows: First, a sheet of zinc; second, a sheet of blotting paper, and third, a sheet of copper; repeat until a full number of plates is in position. Leave one zinc plate with an extension for connection. This goes to form one pole and is placed between the fibre bottom and its lock-nut.

After all couples are assembled as shown and the rheostat adjusting screw

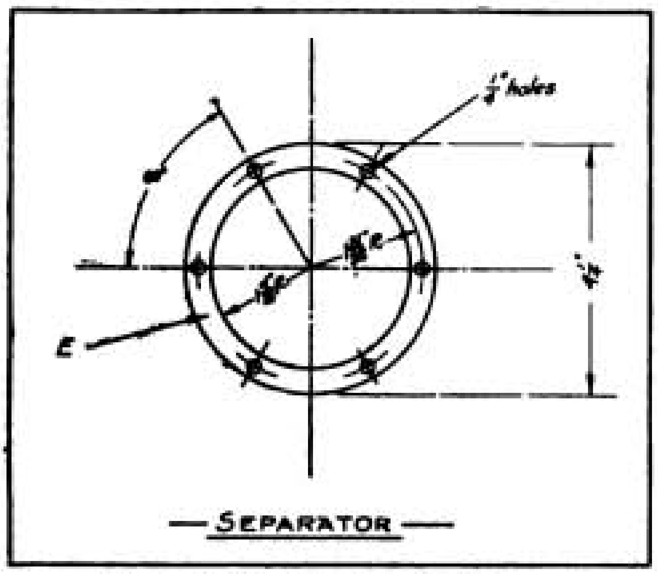


Fig. 4, Third Prize Article

screwed up just tight enough to hold them in place, take a ten per cent. solution of sulphuric acid and with a medicine dropper saturate all your blotters. Let the acid stand for a few minutes; then remove all excess solution that is visible. Next connect a suitable voltmeter to the terminals and you will be surprised to see the value of voltage which the battery will give. Variation of the voltage is effected by tightening or loosening the set screw. Once the preliminary tests are completed, ample wire connections should be left and attached to the binding posts. The bat-

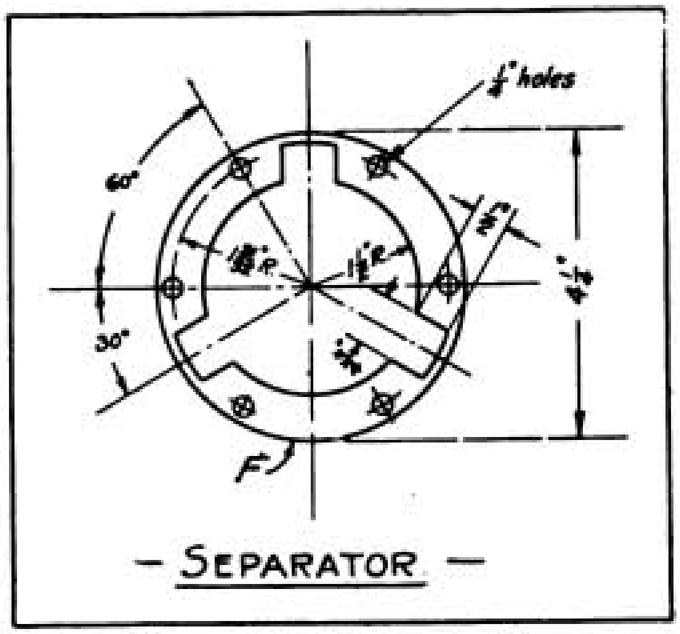


Fig. 5, Third Prize Article

tery then should be given a complete coat of paraffine, this tending to prolong its life.

In conclusion, it might be said that the dimensions, the gauge and number of couples are optional with the builder,

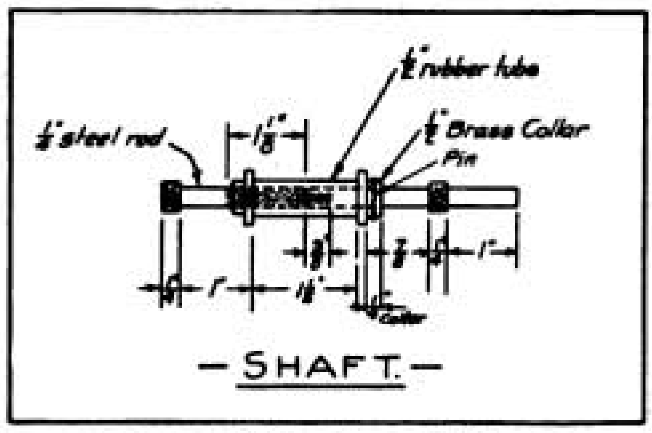


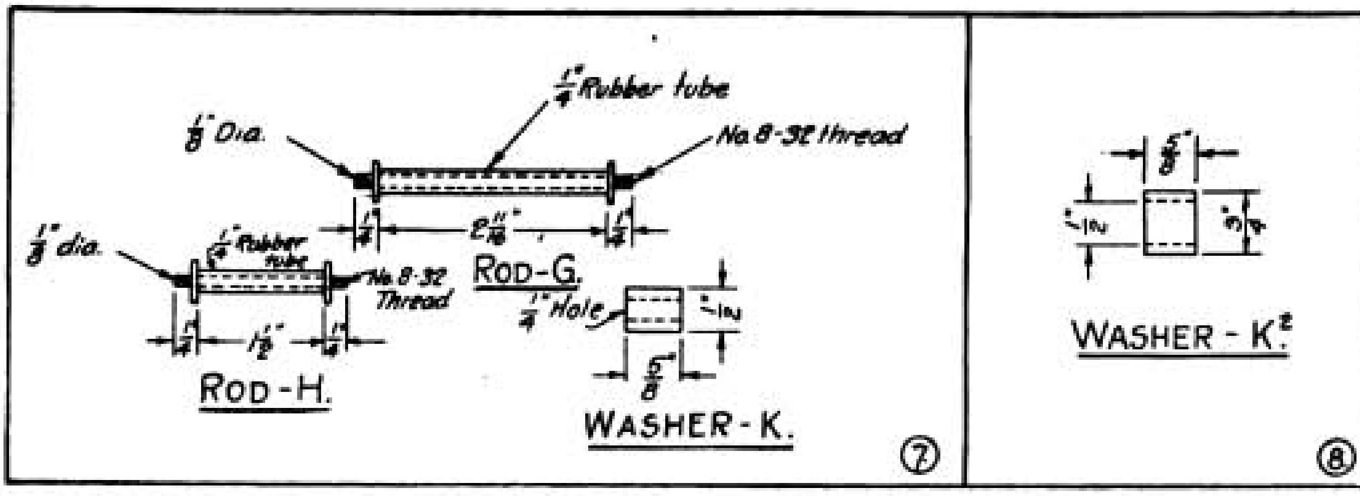
Fig. 6, Third Prize Article

but with careful construction this battery will last for years. Try it and be convinced of the accuracy of my statements.

CHARLES E. WILLIAMS, *Georgia.*

THIRD PRIZE, THREE DOLLARS
A Rotary Quenched Spark Discharger With a Good Sending Radius

For the average amateur work the rotary spark discharger is considered superior to the plain gap, but increased



Figs. 7 and 8, Third Prize Article

range can be obtained by the use of a properly designed quenched gap. The design herewith described combines the advantages of both and with a certain amount of care and patience in construction may be made with an ordinary set of tools. However, if access can be had to a lathe a much neater piece of work will result.

When operated on sixty-cycle current with a motor having a speed of 1,200 R.P.M. this gap will give six sparks per revolution or 7,200 per minute. It has been my experience that it will give an increased sending radius unobtainable with any other type of gap. It is intended that this gap be operated on transformers of ¼ k. w. or less, but it can be employed in connection with higher power sets if more plates or discs are added.

The materials required are as follows: One strip of brass 1-16 of an inch in thickness, 20 inches in length, and 6 inches in width; one piece of zinc or brass 5-16 of an inch by ¾ of an inch, 8 inches in length; two and one-half square feet of black fibre ⅛ of an inch in thickness, and a quarter inch steel rod 5 inches in length. One inch of brass tube with a ¼-inch hole by 1½-inch outside diameter, and one strip of brass, ⅛ of an inch by ¾ of an inch also are required for the brackets.

Take the 1-16-inch brass strip and cut from it four discs 5 inches in diameter; then cut a 3½-inch hole in the center and drill as per the diagram (Fig. 2). This will make the "ring" parts, A, B, C and D. From the remainder of this strip cut the rotor arms, 2¾ inches by ¾ of an inch by 1-16 of an inch and drill as shown (Fig. 3). Three are required. Next make twelve pieces as at M (Figs. 2 and 3), six for the discs, C and D, and six for the rotor arms. These are made from the zinc piece and drilled for 4-36 flat head screws. The M pieces on the discs A and B are only ⅛ of an inch in thickness. The 5-16-inch pieces have a 1-16-inch notch cut in them as shown.

The foregoing having been completed, fasten the parts in place and assemble the end discs (Fig. 1). Each of these discs is made of one brass circle as described, one separator, E, and one solid piece to which is attached a brass bearing as shown in the drawing. In addition, a hard rubber binding post is attached as shown. Next construct the separators (Figs. 4 and 5); eleven of E and six of F; also two end pieces. This work can be done to the best advantage on a lathe. First cut them out rough with a hacksaw, then space off the holes; drill accordingly. Then, by bolting them together, they can be turned down in a few minuntes to the correct size. Next take each separator and turn out the inner circle, after which the notches in the pieces, F, are cut by hand. Take the steel rod (Fig. 6) and cut it in two pieces, one 2⅜ inches and the other 3 inches in length. Take the short piece and turn it down to ⅛ of an inch diameter for a length of ⅜ of an inch; drill the other piece to a depth of ⅜ of an inch and tap with an 8-32 thread. Thread the other one with the same size die. Then thread it from the shoulder (¼—24) for 1⅛ inches.

Take the joint and drill a small hole through it, then rivet it with a piece of wire brad. Make two brass collars 1½ inches in diameter by ¼ of an inch in length with a ¼-inch hole in them; each is to have a 4-36 set screw to hold them on the shaft. Make another, ¼ of an inch in length by ½ inch in diameter with a ¼-inch hole and place it in

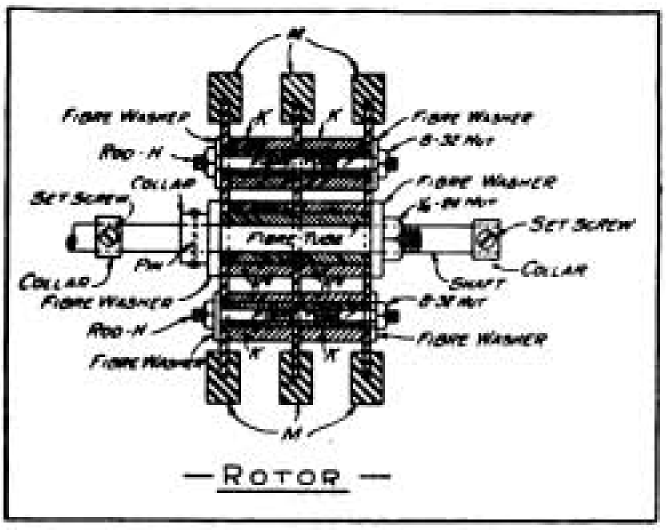


Fig. 9, Third Prize Article

position on the shaft. Drill a 1-16-inch hole through it and the shaft, to take a pin. Then slip a fibre tube over the shaft 1½ inches in length by ½ inch in diameter (o.d), and fasten it with two or three pins so that it cannot slip.

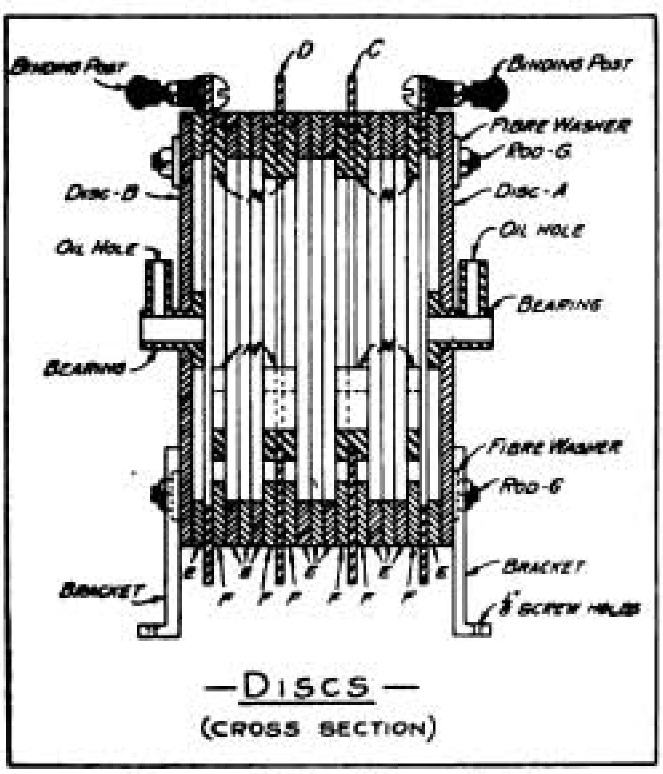


Fig. 10, Third Prize Article

Next make two fibre washers to fit against the tube, having an outside diameter of ¾ of an inch and a thickness of ⅛ of an inch.

Next make two rods as shown at H (Fig. 7) and six as shown at G (Fig. 7); also the fibre washers K (Fig. 7) and K-2 (Fig. 8).

The two bearings (Figs. 10 and 1) are made from a ¾-inch brass rod turned down to ⅜ of an inch in diameter by ½ inch in length with a flange on one end, ⅛ of an inch in thickness and having ¾ of an inch o. d. Drill a ¼-inch hole in them and solder a tube in it as shown in details. Now assemble the parts as follows:

Take the shaft and the parts that go with it, making sure that the ¼ 24 notch is on it before fastening the fibre tube. Now put a fibre washer against the nut and place one of the rotor seg-

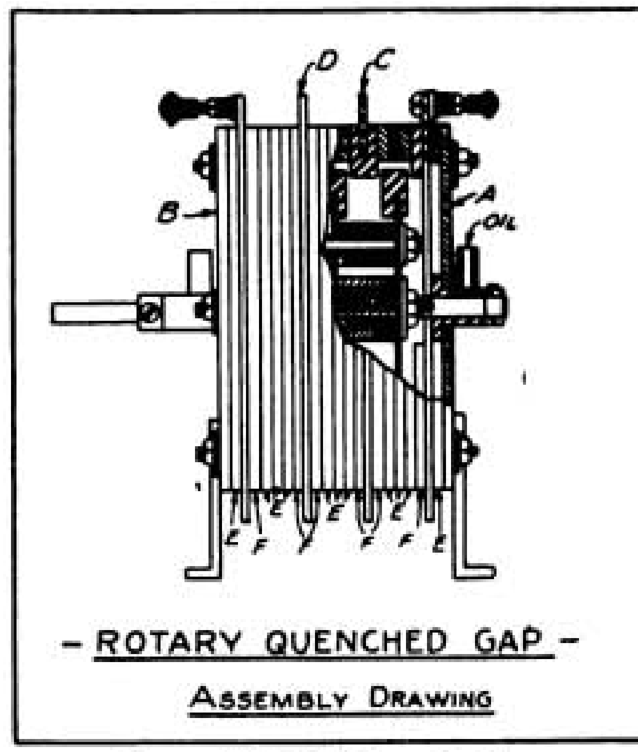


Fig. 11, Third Prize Article

ments in place with the two rods, H, and place the washers, K and K-2, in their respective places as per the assembled diagram (Fig. 9). Now take a disc, C, and put one separator, F, on each side; then place the six (G) rods in their respective holes. Place the foregoing parts next to the rotor segments and then insert three separators, E. Repeat this, beginning with a rotor segment until the third rotor segment is in place. Next put the pin in the collar and rivet it tight (Fig. 9); then put the end disc, D, on, after which the nuts and washers for the six rods are placed at this end. Tighten the nut on the other end of the shaft. Now put one of the collars on the (B) disc end of the shaft and fasten it so that the space between the rotor plug and the plug on the disc, C, is 1-32 of an inch. When this is completed, place the end disc, A, in position and put the nuts and washers on the rods, G. Be sure to tighten them securely. Then put the other collar on the shaft, after which

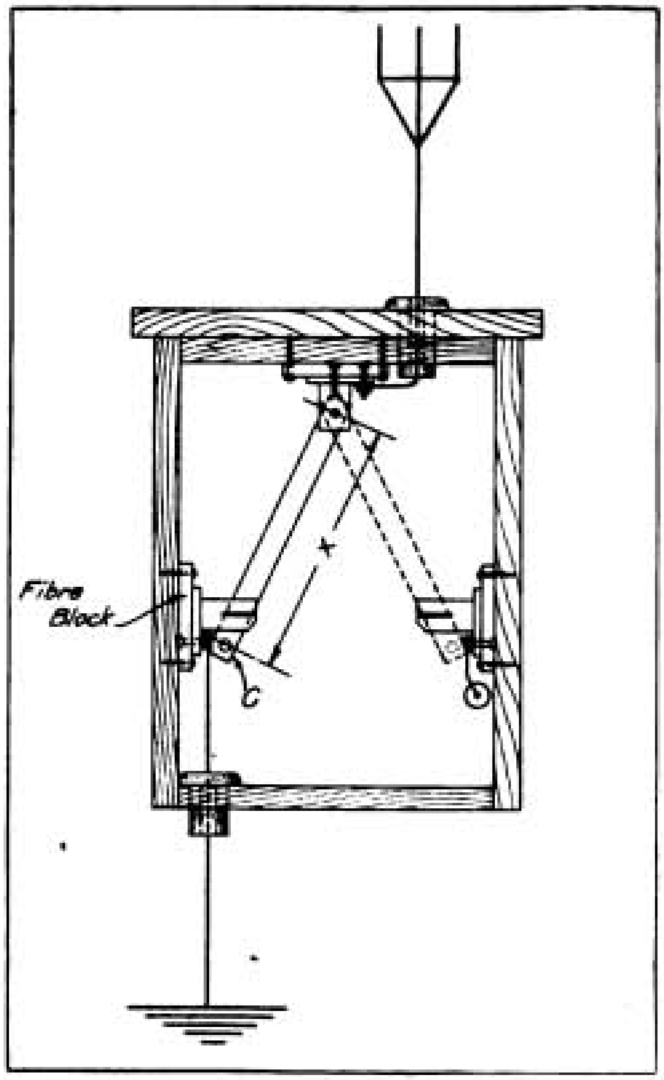


Fig. 1, Fourth Prize Article

attach the brackets; the length of these must be left to the discretion of the builder. They should, however, be just long enough to bring the shaft to the same height as that on the motor.

It is best to couple the two shafts together with some sort of an insulating connector. Be sure that only the best insulation is used, as trouble will follow otherwise.

J. E. PUGSLEY, *New Jersey.*

FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

A Switch That Can Be Worked From the Operating Room

The amateur who is compelled to go outside the building to ground his aerial during a thunder storm will be interested to learn of a switch which can be worked from a distant point without leaving the operating room. The switch which I am about to describe I have found to be very handy and efficient.

Practically any S. P. D. T. switch ot the right current-carrying capacity will do for this purpose, whle the box can be made of good, straight lumber, the size depending upon the size of the switch. The box indicated in Fig. 1 is 6 inches by 12 inches by 16 inches, inside dimensions.

Any single pole double throw switch that will carry 100 amperes should be demounted from its slate or marble base and each of the contact clips mounted on a piece of fibre ½ inch in thickness and large enough to extend 1½ inches clear of the clips on all sides. If fibre is not obtainable a piece of 1-inch hard maple boiled in paraffine will do.

In the corner of the fibre pieces and at a considerable distance from the switch, contact holes should be drilled

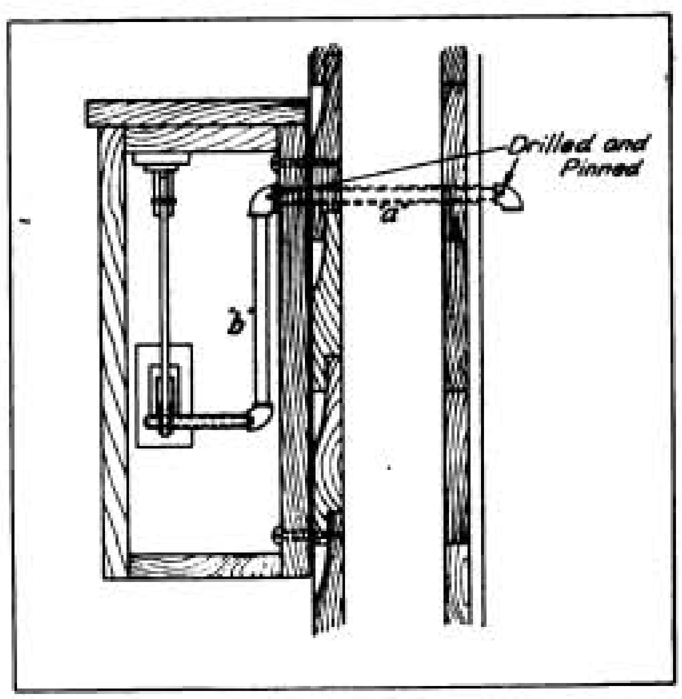


Fig. 2, Fourth Prize Article

for fastening the fibre pieces to the inside of the box. The box should be made wide enough so that the clearance between the clips on the opposite side of the box is about the length of the switch blade. This distance will be sufficient to prevent lightning discharges from reaching the receiving apparatus by direct discharge. The blade of the switch should be at least

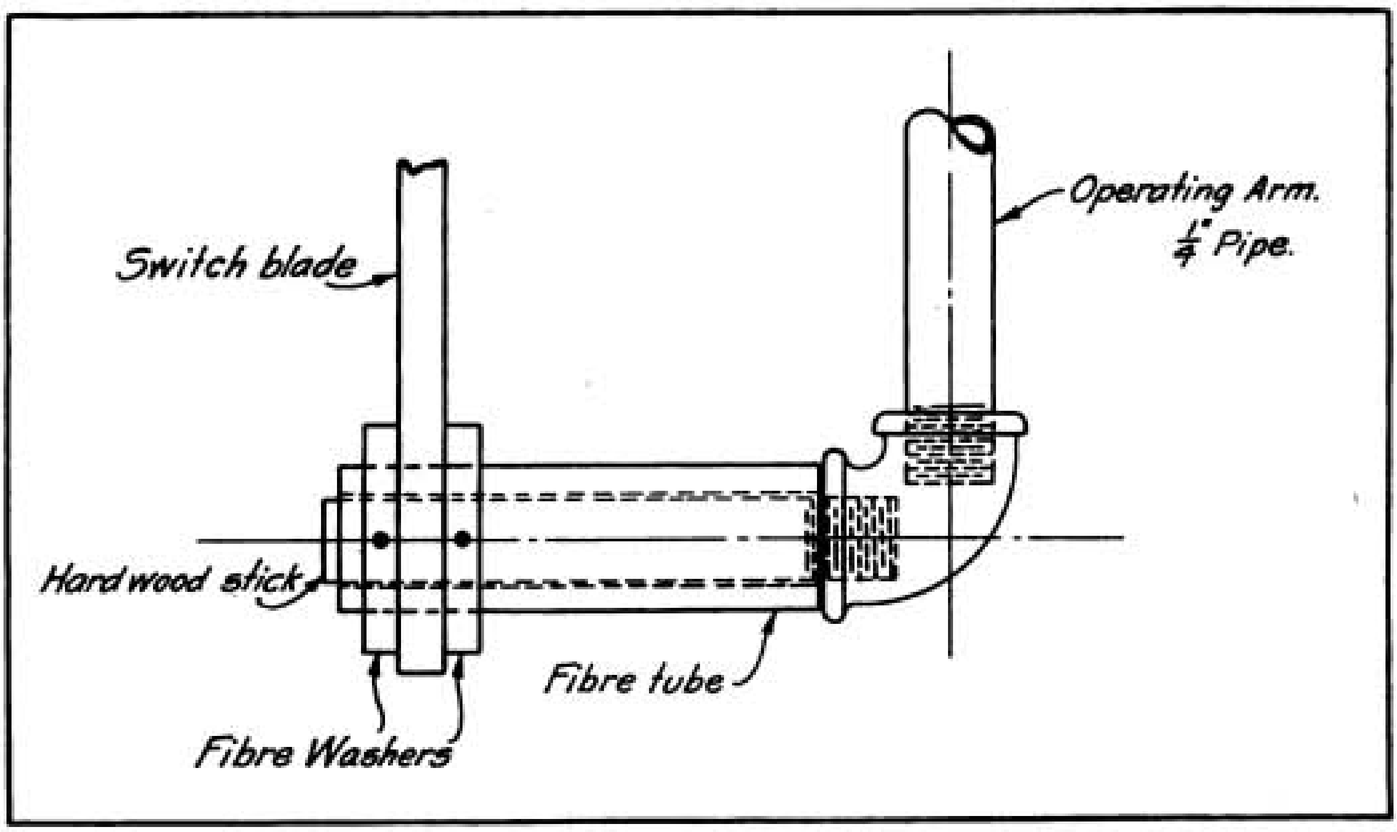


Fig. 3, Fourth Prize Article

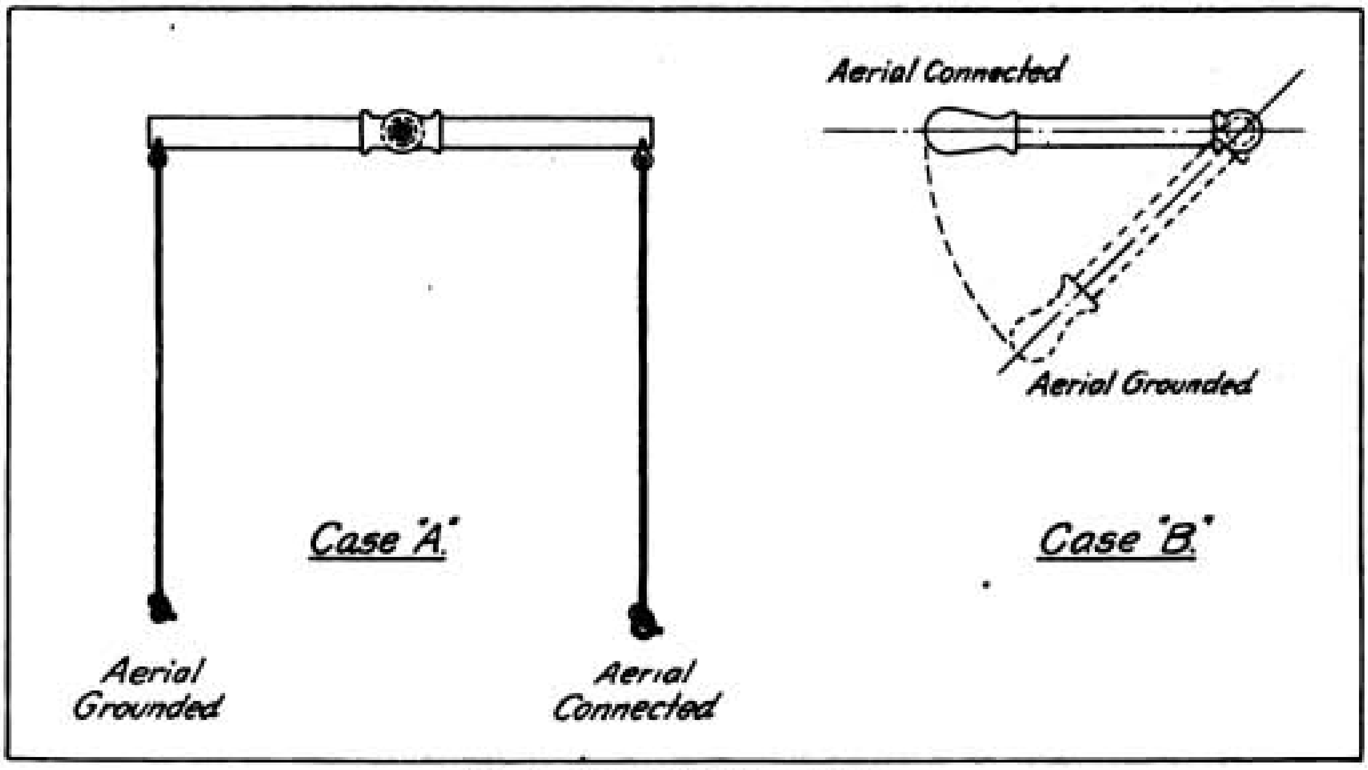


Fig. 4, Fourth Prize Article

7 inches in length.

We shall next consider the operating arm which, as indicated, is made of a piece of gas pipe shaped in the form of a crank.

Referring to Fig. 2, the piece of pipe, A, (1/4-inch size) should be just long enough to go through the wall and the back of the box, plus 1/2 inch on each end for thread. The piece, B, with an ell on each end, should just equal the distance, X, in Fig. 1, which, of course, depends upon the length of the switch blade. In the lower ell on the piece, B, drive an insulating rod of hard wood, over which slip a fibre tube taken from an inclosed fuse of the right type. A hole should be drilled in the end of the switch blade just below the clips as in C (Fig. 1) to fit the fibre tube. When assembling, a fibre washer should be placed on the tube on each side of the switch blade and pinned into place to prevent any side play of the switch.

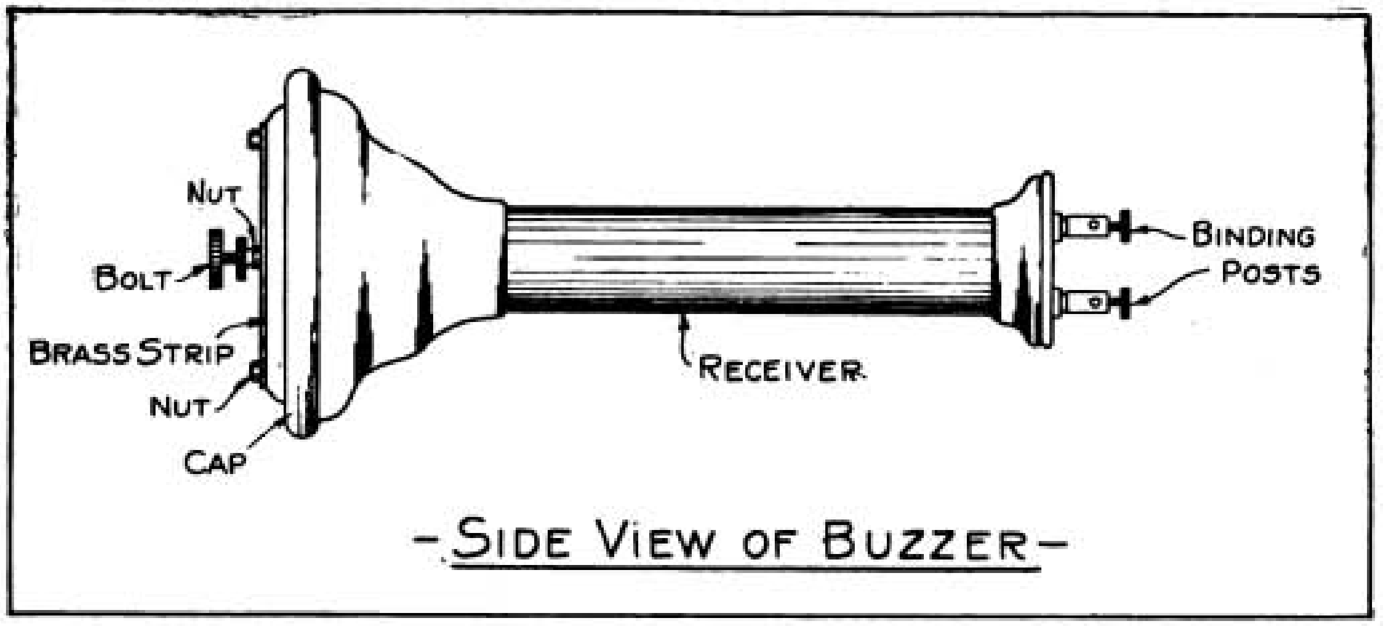


Fig. 1, Honorary Mention Article, R. M. Dasher

A porcelain tube should be placed in the top of the box for the aerial leads and as near as possible to the top clip. Proceed similarly with another one immediately below one of the side clips for the ground wire. Then a few inches below and in the back of the box, directly behind the other side clip, bore a hole for the insulating tube carrying the instrument wire which should be fastened to that clip.

If the operating arm is too high to be reached conveniently from the floor a "T" may be screwed on the end and a piece of pipe about 8 inches long screwed into each side of the "T." Then a piece of heavy cord should be tied to the ends of the pipe as shown at A in Fig. 4. If the pipe is close at hand a lever may be made to operate the switch by screwing an ell on the end of the pipe and fastening a wooden handle in the ell as shown at D in Fig. 4.

In case A is employed the ground handle should be weighted and if B is used the arm should be placed so that the lower position always grounds the antenna. In either case it is advisable to drill a small hole and drive a pin through the pipe and fitting at both ends of the piece, A, in Fig. 1, to insure positive action, for if the joints were not made up rather tight the pipe might turn in the fittings and the switch fail to operate.

I believe that with the aid of the accompanying drawings anyone with slight mechanical ability and a few tools will be able to construct a switch of this type with very little difficulty.

W. K. Danvers, *Oklahoma.*

HONORARY MENTION

No Difficulty in Finding Material to Construct a Buzzer of This Type

The buzzer I am about to describe may not be new to some, but I have never seen a similar design published in any magazine. The majority of buzzers described are not satisfactory for test work for many reasons. The drawings (Figs. 1 and 2) will give an idea of the appearance of my apparatus when finished and with a little explanation the amateur will have no difficulty in constructing a set along similar lines. The greater part of the material required can be found in the scrap heap of any amateur experimenter.

The first requirement is an old telephone receiver. Next secure a piece of brass, a few battery bolts, nuts and a couple of contact points. Remove the cap of the telephone receiver and, after scraping a clean spot in the center of the diaphragm, mount one of the platinum contact points in position. By observing the end view of the receiver, it will be seen how the brass strip is fastened to the cap. Drill a hole in each end and one in the center large enough to admit an 8-32 bolt. Then solder an 8-32 nut over the center hole, as shown. Through this the adjusting bolt is to be passed, one end of which is fastened to the other contact point.

Drill holes in the cap corresponding

to those in the brass strip and bolt the strip fast to the cap. The set is now complete except the wiring and this task, after looking at the diagram, will be found easy. If the diaphragm does not vibrate rapidly enough, it can be made to work better by cutting out

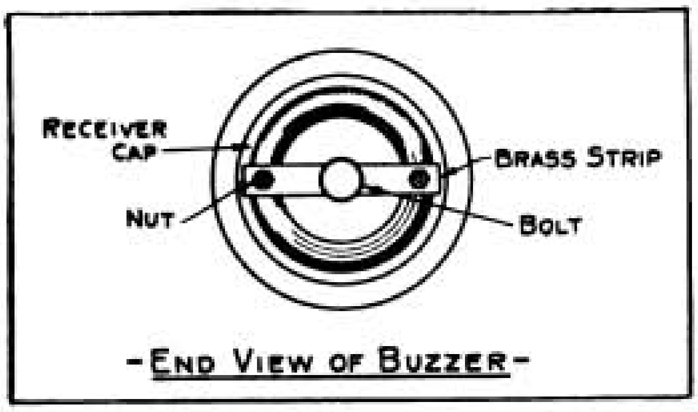


Fig. 2, Honorary Mention Article, R. M. Dasher

cardboard rings, placing them on the inside and outside of the diaphragm.

R. M. DASHER, *Ontario.*

HONORARY MENTION

It is a known scientific fact that negatively charged ions exist around the filament of an ordinary incandescent

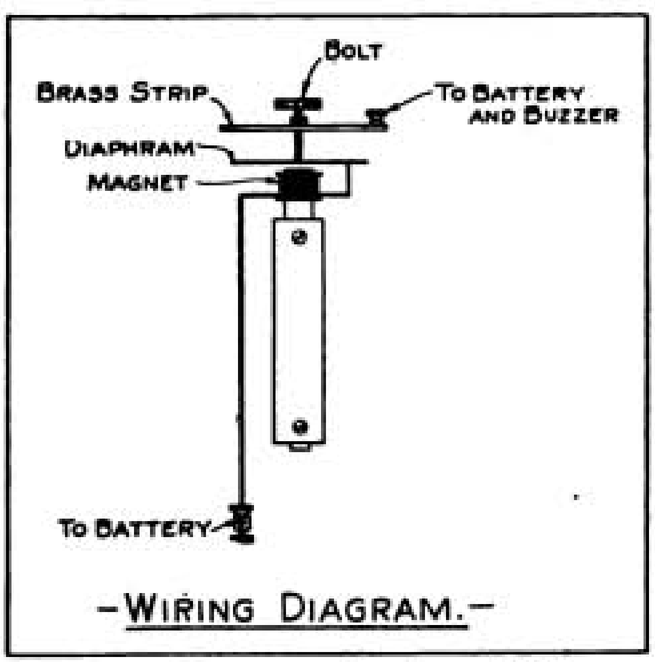
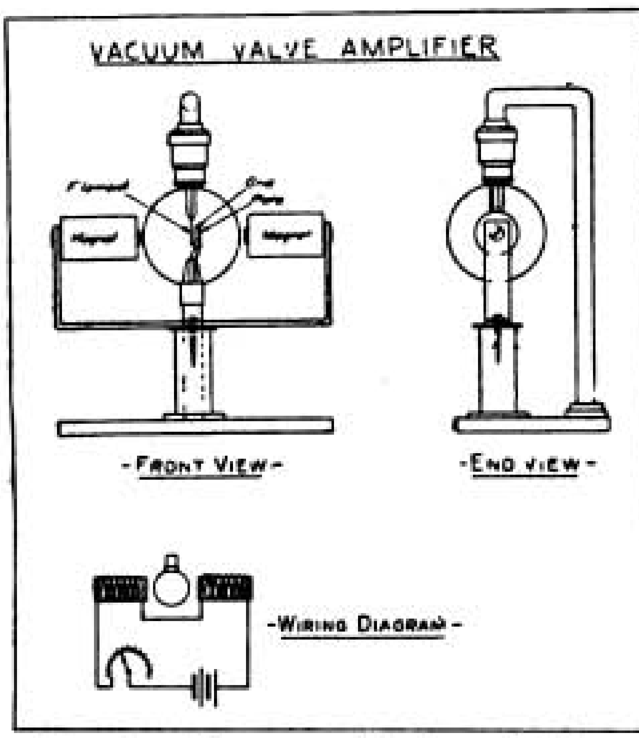


Fig. 3, Honorary Mention Article, R. M. Dasher

lamp. It is on this principle that the working of the ordinary vacuum valve relies. But, according to my theory, if these ions spread in all directions, only a few of them are available for actual use in the valve for carrying the current between the grid and the plate. If these ions can be concentrated in one direction the charge that they will convey will be much greater. This has often been effectively accomplished by the use of either an electro-magnet or a permanent magnet which either attracts or repels, according to the polarity; but to still further increase the effectiveness of the action, two electro-magnets of opposite polarity will augment the results. A diagram of this apparatus is shown in the accompanying drawing where two electro-magnets are mounted oppositely on the bulb and connected to the source of electrical energy in such a way that the polarity of the magnets will be opposite.

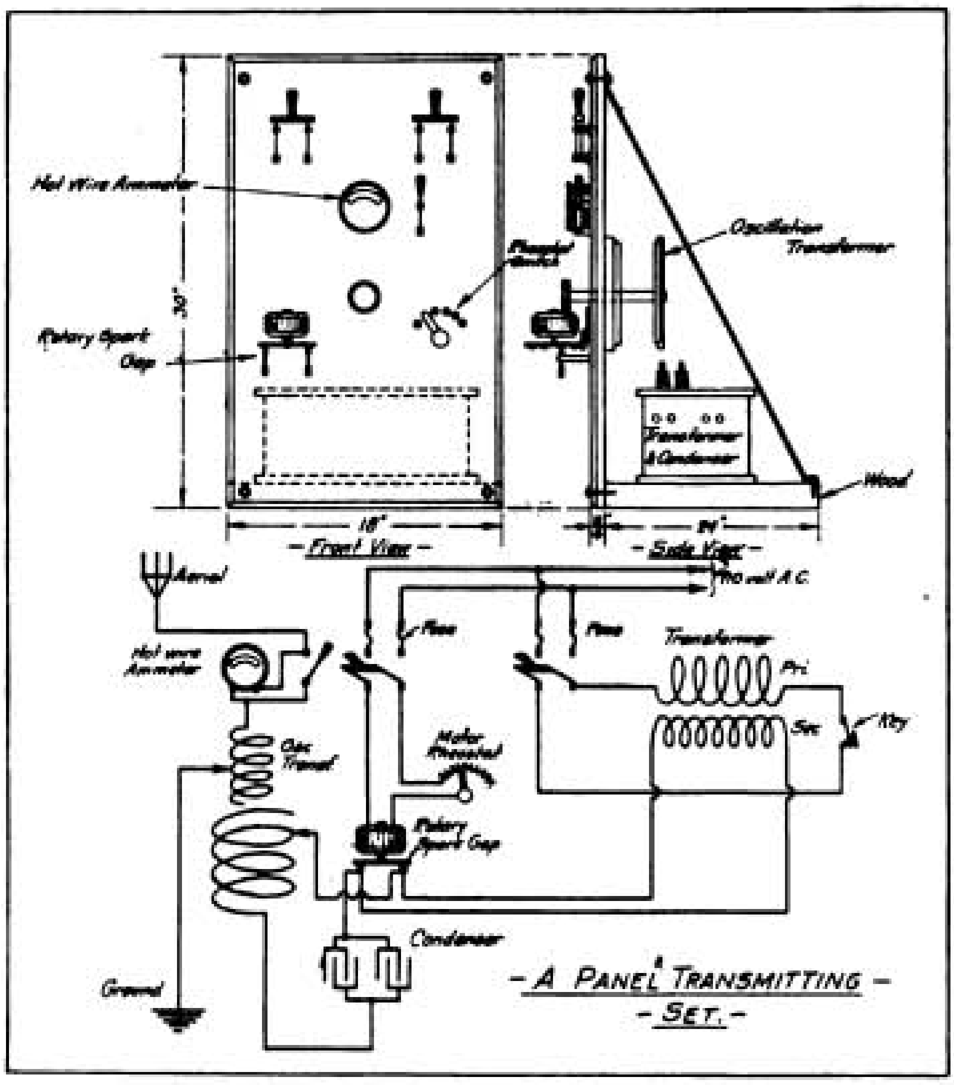
The magnet is screwed to a "U"



Drawing, Honorary Mention Article, Ralph Davenport

shaped piece of iron. This is drilled in the center and screwed to any suitable upright piece of wood or hard rubber of the proper height to bring the magnets in line with the plate and grid of the vacuum valve. This strip must not be screwed up tight, but should be given a little play in order that the magnets may be swung around the bulb to the correct position for maximum strength of signals. The remainder of the drawing is self-explanatory; the dimensions may have to be altered according to the size of the stand and the box upon which it is supported.

With an attachment as shown in the accompanying drawing, the writer has been able to obtain amplifications from



Drawing, Honorary Mention Article, S. E. Dietrichs

one to three times greater than those obtained with the ordinary vacuum valve. For given stations it allows the filament current to be reduced and hence the life of the vacuum valve is considerably prolonged. I believe that if similar magnets were applied to a double or triple vacuum valve amplifier, all the magnets being connected in series, the signals would be enormously increased.

Ralph Davenport, *New Jersey.*

HONORARY MENTION

In the accompanying drawing I offer a suggestion for the design of an amateur transmitting set. No particular type of apparatus is described, but I have outlined a design which I have had in mind for some time. It will be observed that the transmitting condenser and transformer are mounted at the rear of the panel on the base. The inductively-coupled oscillation transformer is mounted on the middle of the board, the knob for controlling the coupling extending through the panel. The rotary spark gap of the average amateur design is mounted to the left of the panel, the regulating rheostat to the right and the aerial hot-wire ammeter to the center of the panel toward the top. The speed-controlling switch for the rotary spark gap and for the circuits to the primary winding of the transformer are mounted at the top of the panel.

I advise that the panel be constructed of marble and have dimensions of 30 inches in length by 18 inches in width, the thickness to be three-quarters of an inch. The connections of the oscillatory circuit are made of high tension automobile cable, the other connections being made of rubber-covered copper wire of the proper size to carry the current.

S. E. Dietrichs, *Missouri.*

Vessels Recently Equipped With Marconi Apparatus

Names	Owners	Call Letters
Princeton	Standard Oil Company of New Jersey	KST
Orleanean	R. L. Smith & Company	KON
Eurana	Walker, Armstrong & Company	not assigned

THE SHARE MARKET

NEW YORK, December 2.

Inactivity in trading prevails, but the brokers believe that this will be succeeded by a revival of interest. Marconis were, of course, influenced by the apathy.

Bids and asked prices today:

American, 3⅞—4; Canadian, 1¼—1⅝; English, common, 9—12½; English, preferred, 8—11½.

PERSONAL ITEMS

Miss Claire Randel, daughter of Mr. and Mrs. O. A. Randel, of New York City, and Elmer E. Bucher, instructing engineer of the Marconi Wireless Telegraph Company of America, and an associate on the staff of THE WIRELESS AGE, were married in New York on November 1. They are making their home for the present at a hotel in that city. The bride, who has a reputation as a concert singer, is the possessor of a mezzo soprano voice. Mr. Bucher has been connected with the Marconi Company for the last three years.

What was announced as a visit to home folks in Boston, proved to be the occasion of entrance into the bonds of matrimony in the case of F. S. Monschau, Marconi operator on the Brilliant.

C. D. Campbell, manager of the Marconi station at Galveston, Tex., has been elected president of the Galveston Jovian League, composed of business men and officials of that city.

Operator Griffiths, senior Marconi man on the Vauban, has reported that on the night of September 1 at ten minutes after ten o'clock he copied time signals and the weather report from Arlington, the vessel being 3,325 miles distant from the land station. On the night of September 2 he copied time signals and the weather report from Arlington. The Vauban was 3,597 miles away from Arlington. Griffiths said that the signals were distinct.

THE MARCONI QUIT AGAINST SIMON

Judge Charles M. Hough in the United States District Court, New York City, handed down a decision on November 18th, denying a motion for an injunction by the Marconi Wireless Telegraph Company of America, which had instituted suit against Emil J. Simon, of New York City, employed to construct radio apparatus for the United States Navy, alleging infringement of one of the Marconi patents. The following statement regarding the decision was made by Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America:

"It was conceded to the Marconi Company that its patent was valid and that Simon had infringed upon it, but it was contended that because Simon's infringement was only in connection with the United States government that, therefore, he was immune from all liability.

"This decision raises a question which is of interest to all manufacturers of patented apparatus which may be used by various departments of the United States government, and if Judge Hough's opinion is correct it is believed that it will have an effect not only on those engaged in wireless telegraphy, but also in many other branches of industry. In order to have the matter finally determined, the Marconi Company proposes to carry it to the highest courts, as they believe it will be of interest to many others besides themselves to have this question finally determined."

THE WIRELESS TELEPHONE, AS SEEN BY ARTISTS

"ALLO, NEW YORK, EES T'AT YOU?"

From the New York World.

From The Portland (Ore.) Telegram.

RADIO RAVINGS

Conducted by D. Phectiff Inslater

That Station

Of all the stations I have worked,
  This station is the best.
A "haunt" for all the lazy boys—
  And those who *need* a rest.

Hard at work at six o'clock,
  Off come coats and vests,
You carry in a pile of wood
  To smoke away the pests.

These pests are mainly different bugs,
  (The skeeters are the worst),
And on the war-path all the time
  For naught but blood they thirst.

With head 'phones on at seven bells,
  You shoot some N-I-Ls.
The spiders get so thick just then
  You pray for shrapnel shells.

At eight o'clock the 'larm is set,
  To wake you up for lunch;
You dim the glim and pull the shades—
  And roll up in a bunch.

At one o'clock you Q-R-U,
  And set your clock for four;
To get that M-S-G report,
  The P & O waits for.

At four o'clock your work is done,
  You've got that M-S-G;
So nap till six, then doctor up
  The log, artistic-ly.

A (Modest) Reader.

Like the small boy whose letter to Santa Claus "covered everything" by asking for two toy shops and a candy store, Operator Jones recently dismissed a great subject with a few words. An electioneering suffragette had become indignant over his indifference to the Cause; with the battle-light in her eye, she denounced him thus: "Why, I really believe you don't know the first thing about the fundamentals of government. Tell me, if you can" (very scornfully delivered), "what *is* political economy?"

"Easy," replied Jonesy. "Political economy consists of getting the most votes for the least money."

One of the first to join the National Amateur Wireless Association is a man connected with this magazine. Among his military activities may be reckoned recent participation in the mimic warfare conducted by the militia.

The first day he took one of the Red's officers.

The next day he took eight men.

The third day he took a valuable portable wireless station.

And the day before the manœuvers ended he took three transport wagons and a big gun.

He is our staff photographer.

I love the Merry Yuletide—yet,
  I notice more, each year I live,
Tho' I always like the gifts I get,
  Oh, how I *love* the gifts I give!

Dear E. M. G.:—

Your thoughtful Christmas gift arrived, a little early, but quite safely. Since you ask, you shall know: up to this date the words gracing this page have been turned out regularly with a plain and simple fountain pen. But thanks for the quill; it's most ornamental. Mayhap, in some rash moment, I shall e'en use it—torn from one goose's pinions, it may yet spread opinions of another, as 'twere.

Received in the Same Mail

Talk about tuning, aerials and spark,
The wireless 'phone if you must,
Talk of detectors till all men depart
Enswirled in a dark cloud of dust.
The National Association you may even
  discuss,
And the volumes that rest on your shelf,
But believe me, ol' kiddo, there'll sure be
  a muss
If you continue to talk of yourself.

Ossie.

All right, Oswald, not another word.

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 an individual can be answered. To receive attention these rules must be rigidly observed.

Positively no Questions Answered by Mail.

C. S. H., Paterson, N. J.:

Ans.—A receiving tuner for use with a vacuum valve detector, without variable values of inductance and capacity, is certainly not feasible for the average amateur's wireless work. If the receiving station is intended to receive from a single transmitting station, it is possible to design a set with fixed values of inductance and capacity, but since the average amateur desires to place his apparatus in touch with stations having different wave-lengths, the apparatus must be fitted with variable inductances and condensers.

* * *

H. R. H., Hartford, Ct.:

Ans.—The natural wave-length of the aerial described in your communication is about 385 meters, which is, of course, too long for the satisfactory reception of amateur signals. A series condenser will hardly allow the reduction of the wave-length to 200 meters. For amateur work, the flat top portion of a receiving aerial need not be more than sixty or seventy feet in length.

It is preferable that three telephone receivers of unequal values of resistance be connected in series rather than in parallel. The extent to which the signals will be reduced by this connection depends upon the type of receiving apparatus employed and the amount of energy available. With the average crystalline detector, a reduction in the strength of signals takes place when three telephones are connected in series.

* * *

L. H., Bennington, Kas.:

Ans.—A receiving apparatus, fully equal in sensitiveness to that described by Mr. Apgar in a recent issue of The Wireless Age, is told of in detail in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. This volume can be obtained by enrolling as a charter member of the National Amateur Wireless Association. At the present writing the Sayville station operates with undamped oscillations at a wave-length of about 9,000 meters; in consequence your apparatus is not suitable for the reception of the Sayville signals.

Ques.—To eliminate dead-end effects, is it necessary to break up the dead end portion of a winding or simply disconnect it from that part of the coil in the circuit?

Ans.—It is preferable to disconnect the dead-end portion and wholly remove it from inductive relation to the used portion. However, simply breaking the circuit to the dead end portion assists in elimination of the dead end effect.

It is utterly impossible to give advice concerning an antenna erected in a mountainous district. Freakish reception on aerials thus located has been observed, the aerial responding more violently in one direction than in the other. The effectiveness of such an aerial is best determined by actual experiment.

* * *

G. H. D., Jr., Baltimore, Md.:

The construction of the variometer and a diagram of connections for its use are contained in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. It is a part of the equipment of charter members of the National Amateur Wireless Association.

There is an advantage in employing three slides on a tuning coil. By proper connection the use of three slides enables the coupling between the antenna and the local detector circuit to be altered as required.

* * *

A. B., Seattle, Wash., inquires:

Ques.—(1) Which, in the opinion of radio engineers, is the more efficient type of receiving transformer, the common loose coupler with single layer coils or the Blitzen rotary type with multi-layer windings?

Ans.—(1) The single-layer type of coil is preferred. Multiple-layer windings with an excessive number of turns are to be avoided. For receiving tuners of small range, the multi-layer winding is feasible, but the best results are obtained with the single layer.

Ques.—(2) Please advise which of the types should be used for "loading" coils.

Ans.—(2) The single-layer coil is preferred for "loading" purposes.

Ques.—(3) Please give the number of turns required to construct a 1,000-meter coil with the following conditions: No. 24 D. C. C. cotton wire in a single layer on a 5-inch tube.

Ans.—(3) Unless you state specifically the type of circuit in which this coil is to be employed, it is difficult to give advice. For example: If it is to be used as the secondary winding of a receiving tuner, it would be necessary to know the value of capacity to be connected in shunt. If it is to be used as the primary winding of a receiving transformer or as a loading coil, it would be necessary to know the dimensions of the antenna with which it is to be employed. Unless this information is at hand, we can make no calculations.

Ques.—(4) Is the strength of received signals proportional to the height of the receiving aerial?

Ans.—(4) In a vertical aerial yes, provided the aerial is not raised to such height as to exceed the wave-length of the distant transitting station.

Ques.—(5) Which station nearest to Seattle, Wash., employs undamped oscillations?

Ans.—(5) The nearest commercial station which we know of is that of a wireless telegraph company at South San Francisco, Cal. The call letters are KSS.

* * *

W. C. S. Joliet, Ills., inquires:

Ques.—Please give the dimensions for a receiving tuner applicable for 600-meter work?

Ans.—(1) The primary winding of this receiving tuner may be 3¼ inches in diameter by 2½ inches in length, wound closely with No. 28 D. S. C. wire. The inductance may be varied by a sliding contact or multiple-point switch. The secondary winding may be 2¼ inches in diameter by 2 inches in length, wound closely with No. 30 D. S. C. wire. The turns of this winding should be divided between the taps of a six or eight-point switch. The secondary winding should also be shunted by a small condenser of about .0005 microfarad. The aerial described in your communication has a natural wave-length of about 480 meters, which, of course, is not feasible for the reception of signals from amateur stations.

* * *

O. L. G., Brooke, Va.:

The wireless station at Hanover, Germany, can be heard sending to the corresponding station at Tuckerton, N. J., during the early hours of the morning, eastern standard time. The wave-length employed at Hanover is about 8,400 meters. The station at Nauen, Germany, sends at intervals throughout the day. The wireless telephone conversation which you heard was probably that from the naval station at Arlington. The wave-length employed for that work is said to have been 6,000 meters, although measurements made in New York City indicated that the wave-length was in the vicinity of 7,000 meters.

* * *

M. L. N., Woodston, Kans.:

There is no reason why the windings of an inductively coupled receiving transformer cannot be made on a square form. It is generally easier, however, to make the windings on a tube, for obvious reasons.

No one can advise you as to the wave-length of a telephone line, because the conditions vary to such an extent that it would be impossible to make a definite calculation.

We do not advise the use of a multiple tuner in connection with a vacuum valve detector. You will obtain better results by the construction of a receiving tuner, such as is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Each individual who enrolls as a charter member of the National Amateur Wireless Association will receive a copy of this book as a part of his equipment. The receiving circuit referred to is the most efficient one for long distance work that can be devised and is far preferable to that described in another magazine.

* * *

L. A. T., Concord, Mich.:

If your transmitting set is to be operated at a wave-length of 200 meters, the condenser cannot have a value of capacity of more than .01 microfarad. If the foil of the condenser is to be 7 by 7 inches, as you state, and the thickness of the glass is about ⅛ of an inch, the capacity of each plate will approximate .0006 microfarad. Fifteen or sixteen of such plates connected in parallel will give the desired capacity. However, as the glass will not be able to withstand a potential of 20,000 volts, you will require sixty plates, thirty in each bank, connected in parallel and the two banks then connected in series.

A four-wire aerial, 50 feet in height, should not be more than 40 or 50 feet in length for transmission at a wave-length of 200 meters.

The discs for a rotary gap for amateur work may be made of a sheet of hard rubber, bakelite or light insulating material. Six points fitted to a disc about 8 inches in diameter are all that are required at a motor speed of 4,000 R. P. M.

* * *

R. W., Plainfield, N. J.:

Ans.—(1) We cannot answer more than five questions for one subscriber in an issue. The formula you give for the wave-length of a tuning coil is only approximately correct. On page 843 of the August, 1915, issue of THE WIRELESS AGE, a method for the rapid and simple calculation of the inductance of a coil is given. The distributed capacity of a coil may be calculated as per the formula given on page 22, Volume 1, Part 2, Proceedings of the Institute of Radio Engineers for April, 1913. Having determined the inductance of the coil and its effective distributed capacity, the wave-length can be approximated by the following formula:

Where

$$\lambda = 59.6 \sqrt{L C}$$

γ = wave-length in meters

L = inductance in centimeters

C = capacity in mocrofarads.

Ques.—(2) Is there any method by which an amateur can generate alternating current at a variable frequency above the limits of audibility, to be used in creating the heterodyne effect in the local circut of a receiving tuner?

Ans.—(2) This can be accomplished readily by the vacuum valve circuit shown in Fig. 8 on page 256, Volume 3, No. 3, of the Proceedings of the Institute of Radio Engineers. If a vacuum valve is shunted by an inductance and capacity, it becomes a generator of undamped oscillations the frequency of which may be varied over a given range.

Ques.—(3) Must the local circuit of a heterodyne receiver be tuned to the wave-length of incoming signals as is the detector circuit?

Ans.—(3) The local generating circuit is tuned to a slightly different wave-length in order to create the phenomenon of beats.

Ques.—(4) Must the primary and secondary of an ordinary variometer be wound to the same resistance or to the same amount of inductance Can No. 32 wire be used for the inner coil and No. 28 or 30 for the outer coil, provided the same number of feet of wire is used in either case?

Ans.—(4) It is preferable that the inner and outer coils have the same size of wire. As a matter of fact, the inside coil of a variometer should have a few more turns than the outside winding, in order that the inductance values of the two coils may be nearly alike. It is not absolutely necessary, however, that these coils have identical values of inductance, but it is to be desired.

The Eithnoven galvanometer once was considered an extremely sensitive indicating device for wireless telegraph signals. But, since the introduction of the vacuum valve amplifier, increased effects can be obtained. The Eithnoven galvanometer is described in the "Text Book of Wireless Telegraphy," by Rupert Stanley.

To increase the wave-length of a short aerial to 8,000 or 10,000 meters, wind up a coil of No. 20 wire on a form 5 or 6 inches in diameter. Speaking roughly, the coil should have a length of about 22 to 24 inches.

The address of the Institute of Radio Engineers is No. 111 Broadway, New York City. The meetings, however, are held at Fayerweather Hall, Columbia University, New York City.

* * *

S. M. P., Johnstown, Ohio:

A sending set to transmit at a distance of thirty miles may consist of a 10-inch coil such as is described in the used apparatus catalogue of the Marconi Company. If this coil is supplied with the necessary voltage and connected to a condenser and oscillation transformer so as to give a wave-length of about 600 meters, you will be able to communicate the desired distance. It is preferable, however, to employ an alternating current transformer such as is described in the foregoing catalogue.

The natural wave-length of your receiving aerial is about 300 meters. No advantage will be obtained by using a zigzag connection such as you describe. It is preferable that the wires at the far end of the aerial be connected together and that the lead-in wires be brought from the extreme opposite end. It is rather difficult to construct a transmitting set of the ordinary type that will cover a distance of thirty miles at a wave-length of 200 meters unless a supersensitive receiving set, such as a triple vacuum valve amplifier, is employed.

We have no data concerning spiral aerials. We have never heard that they are used and see no advantage in adopting that type of construction.

We advise the use of an electrolytic interrupter which can be purchased from supply houses furnishing X ray apparatus to the trade in connection with the induction coil described in your fourth query.

* * *

R. C. T., Pittsburgh, Pa.:

You may consider 2 or 2¼ amperes as a good value of antenna current with the apparatus you describe. Lacking dimensions concerning the transmitting aerial, we are not able to calculate your wave-length, but the capacity of the condenser employed in the close oscillatory circuit, if the twenty plates are connected in parallel, is about .02 microfarad, which is twice the size it should be for a wave-length of 200 meters. If, however, you are allowed to operate on a longer wave-length it may not be necessary to make a change in any of your circuits. The closed oscillatory circuits of a ½ k.w. set should be connected up with at least No. 4 or No. 6 stranded wire. The primary winding of the oscillation transformer should have a No. 4 wire and the secondary may have No. 6. We believe, however, that you are getting the best possible results from the apparatus now in use.

* * *

F. C. T., Plattsburgh, N. Y.:

After careful consideration of your communication we advise you to make no change in construction of the receiving aerial described for use in connection with the reception of Arlington time signals. An aerial 325 feet in length, as described in your communication, is feasible for this work and the fault in reception probably lies in the design and construction of the receiving tuner. We advise a receiving tuner of proper proportions in connection with a vacuum valve or vacuum valve amplifier for the best results.

A receiving tuner for the reception of Arlington time signals should have the following general dimensions: The primary winding should be 3¼ inches in diameter by 5 inches in length, bound closely with No. 24 S. S. C. wire. The secondary winding should be 3 inches in diameter by 5 inches in length, bound closely with No. 32 wire. The secondary winding should be shunted by a small condenser. Multiple point switches should be fitted to both windings such as described in previous issues of THE WIRELESS AGE. With the secondary winding of the dimensions described, at a wave-length of 2500 meters, inductance will predominate in the circuit—a desirable condition for the vacuum valve detector.

* * *

F. L. G., Howell, Mich., inquires:

Do you consider direct coupling superior to loose coupling in a receiving transformer, and if so, why?

Ans.—(1) Equal results will be obtained with either type of receiving tuner provided they are properly designed. The inductively-coupled receiving transformer is more flexible and allows a degree of coupling between the primary and secondary windings to be altered with greater ease, but as far as actual transfer of energy is concerned about equal results are obtained. The inductively- coupled tuner is preferred in commercial work.

* * *

E. M. D., Port Arthur, Texas:

A formula for the inductance value of a multiple layer coil is given in the "Queries Answered" department of the October, 1915, issue of THE WIRELESS AGE.

E. H. H., Salem, Wis.:

Ans.—(1) We are not familiar with the constants of the circuits for the new navy tuner, nor have we an authentic diagram of connections.

Ans.—(2) We cannot give advice as to the probable origin of the inductive noises which you hear in the receiving head telephone. There may be a direct current motor in your district with a sparking commutator, causing the inductive sounds that you hear.

Ans.—It is quite remarkable, as you state, that you are able to cover a distance of thirty miles with one-quarter ampere of current in the sending aerial. It is likely that the receiving station is fitted with a super-sensitive receiving set and on this account receives the signals.

A list of stations using undamped oscillations appeared in the August, 1915, issue of THE WIRELESS AGE, page 860. Seven of the stations given in this list employ feebly damped oscillations.

* * *

M. H. Wilmett, Ill.:

The new naval station at Lake Bluff, Ill., can be heard communicating with Arlington and other naval stations at intervals throughout the day. Undamped oscillations are employed which, of course, cannot be heard on the ordinary receiving apparatus.

A receiving equipment adjustable to wave-lengths of 10,000 meters is fully described in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. The book is a part of the equipment of charter members of the National Amateur Wireless Association.

The dimensions for a receiving tuner applicable to a wave-length of 600 meters are fully given in the answer to W. C. S.'s inquiry, in this issue. A satisfactory diagram of connections for an amateur receiving tuner is published on page 707 of the June, 1915, issue of THE WIRELESS AGE. It is recommended that all amateurs make use of this method of connection, as it is the most efficient that can be devised.

* * *

L. C. M., Weston, Ore.:

It is difficult for us to estimate the range of a transmitting equipment such as you describe. Conditions on the Pacific coast are unusually favorable for long distance transmission and in view of the fact that the greater part of the work is done during the night time it is difficult to calculate the range of a set, even though the dimensions of the apparatus are known.

A good, cheap ammeter for use in connection with sixty-cycle alternating current can be purchased for about $15.

The Marconi School of Instruction at Seattle, Wash., has been transferred to the Y. M. C. A. at that point.

* * *

F. J. R., Jr., Auburndale, Mass.:

A complete diagram of connections for the vacuum valve detector and the associated appliances is shown in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation, 450 Fourth avenue, New York City. Each charter member of the National Amateur Wireless Association will receive a copy of this book as a part of his equipment.

* * * *

A. J. R., St. Louis, Mo.:

A spark station at Arlington, Va., used for transmission of the time signals is said to be of 100 k.w. capacity. The spark frequency is 1,000 per second.

The recent wireless telephone communication was carried on by means of undamped oscillations. It is generally understood that about 300 vacuum valves shunted by inductance and capacity were employed for supplying energy to the aerial circuit.

Galena crystals may be cleaned by soap and water, or by gasoline.

* * *

G. A. B., Alameda, Cal.:

No. 30 wire is too small for use as a loading coil in an antenna system. It is preferable to use from No. 20 to No. 24 wire.

We are unable to state why you do not hear KAK, but we have been informed that the wave-length of this station recently has been increased and possibly your receiving apparatus is not of the proper dimensions to be placed in resonance with it.

An interpretation of the call letters requested is as follows:

VAG, Triangle Isle, Canada; VAK, Victoria, Canada; VAE, Estevan Point, Canada; VAJ, Prince Rupert, Canada.

These stations are under the control of the Canadian government.

The call letters VEN have not been assigned.

The natural wave-length of your aerial is about 255 meters.

* * *

R. B., Sacramento, Cal.:

The natural wave-length of the aerial described is about 200 meters. With the receiving tuner described, wave-lengths up to 3,500 meters should be received, provided the secondary winding is shunted by a variable condenser. If the two loading coils described were connected in series with the antenna system the wave-length would be increased to about 4,500 or 4,600 meters, but unless similar adjustments are made in the secondary winding the apparatus will not be efficient. Loading coils always should be connected in series. There is no advantage in connecting them in parallel except under certain conditions when a lower value of inductance might be required. We do not, in any case, advise the use of a long wave-length receiving set constructed in a haphazard way from pieces of apparatus lying about the station. A supersensitive long distance receiving set is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. The volume is a part of the equipment of charter members of the National Amateur Wireless Association.

* * *

K. B., Gastonia, N. C.:

The July, 1915, issue of THE WIRELESS AGE contained a circuit diagram of a supersensitive receiving set suitable for the reception of damped and undamped oscillations. Somewhat similar circuits are described in United States patent No. 1,113,149.

The Sayville station no longer makes use of damped oscillations. The undamped transmitter is employed exclusively for communication with Nauen.

We advise you to accept C's advice on the subject to which you refer in your third query. Keep in mind that the patents for commercial wireless telegraph apparatus are either owned or controlled by the Marconi Company. The quotations you received from outside sources were without doubt from concerns manufacturing infringing apparatus.

You will be able to hear the telephone conversations from Arlington on any receiving set which is adjustable to wave-lengths of between 6,000 and 8,000 meters. The circuits described in United States patent 1,113,149 are particularly well adapted for the purpose.

Ques.—What station is DB, mentioned each night in Arlington's weather report?

Ans.—This is Delaware Breakwater, which is in the vicinity of Cape May, New Jersey.

* * *

W. T. McC., Philadelphia, Pa., inquires:

Ques.—(1) My inverted L aerial, the natural wave-length of which is 240 meters, is within ten feet of a tin roof where the lead-in joins the aerial. The tin roof is grounded. Can this be the cause of getting a very short sending range with a 3½-inch spark coil? My receiving range does not seem to be effective.

Ans.—(1) The tin roof undoubtedly has a disadvantageous effect upon your sending range. Have you examined the earth connection carefully? See that there are no high resistance joints in it.

Ques.—(2) How far should I be able to send under favorable conditions?

Ans.—(2) The distance you will be able to cover depends upon the type of receiving apparatus employed at the receiving station. With a vacuum valve detector circuit your signals should be readable at a distance of from twenty-five to thirty miles. With the ordinary crystalline detectors you cannot expect to send more than ten to fifteen miles. Of course the actual range is governed by conditions external to either the transmitting or receiving station.

The receiving tuner you have in use at present has insufficient dimensions to be loaded to a wave-length in both the primary and secondary circuits of 8,000 meters. Its construction will not afford a sufficient degree of coupling for the maximum strength of signals. We suggest that you obtain a copy of the book, "How to Conduct a Radio Club," which will give you the details of a receiving set adjustable to this wave-length. The volume is published by the Marconi Publishing Corporation, 450 Fourth avenue, New York City. It can be obtained by joining the National Amateur Wireless Association as a charter member.

* * *

J. E. R., Cuenca, Ecuador:

Ques.—(1) Can I use a rotary spark gap on a transformer coil fitted with an electrolytic interrupter?

Ans.—(1) You can do so, but no adantage will be derived. An electrolytic interrupter properly adjusted will give a high spark note and therefore a rotary gap is not required.

Ques.—(2) Will a wireless station located on top of a hill have the same range as another at the bottom of the hill, both the lower and upper stations operating under the same conditions?

Ans.—(2) The actual effectiveness of either station would depend on other local conditions. Speaking generally, we should prefer to place the transmitting station at the top of the hill. If, however, the hill is largely composed of rock, making a poor earth connection, it might be preferable to place the station at the bottom. However, if the station is located at the bottom of the hill it may exhibit strong directional effects, sending better in one direction than in the other.

Ques.—(3) Please tell me where I can purchase a good book covering the art of wireless telegraphy.

Ans.—(3) There are a number of books on sale by the Marconi Publishing Corporation, 450 Fourth avenue, New York City, which will cover your requirements. We refer you to the "Text Book of Wireless Telegraphy" by Rupert Stanley. This is an up-to-date volume giving the details of modern equipments.

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M. M., Paterson, N. J.:

A receiving tuner suitable for the reception of time signals from Arlington is fully described in the answer to the inquiry of F. C. T., Plattsburgh, N. Y., in this issue. Your four-wire aerial, 50 feet in length by 50 feet in height, has a natural wave-length of about 170 meters and the tuner described in F. C. T.'s inquiry will readily allow adjustments to a wave-length of 2,500 meters.

You should be able to hear the signals from Key West at night time, but not during the day.

* * *

P. J. P., Jamaica, N. Y.:

The aerial which you describe as being 100 feet in length by 40 feet in height, comprising four wires, has a natural wave-length of about 315 meters. The two-wire aerial of somewhat similar dimensions has a wave-length of about 290 meters. With the three-slide tuning coil you describe, the aerial system should be adjustable to a wave-length of about 3,000 meters. You should be able to hear the signals from Key West during the night time, also various other stations located on the Atlantic coast. Your daylight range is problematical. It is best determined by experiment.

* * *

T. J. R., San Francisco, Cal.:

Your reconverted ignition coil used as a radio transmitter will require an exceedingly small condenser. We should say, off hand, that a single plate of glass, 8 inches by 8 inches, covered with foil, 6 inches by 6 inches, would give a sufficient value of capacity. In the book, "How to Conduct a Radio Club," a condenser suitable for a 3-inch spark coil to be operated at a wave-length of 200 meters is fully described. The book, which can be obtained by enrolling as a charter member of the National Amateur Wireless Association, is published by the Marconi Publishing Corporation.

* * *

L. C. G., Mattituck, N. Y.:

Numerous experiments in wireless telephony have been carried on during the last several months in the vicinity of New York City, one station being located at New London, Conn. This is probably the station which you heard. Similar experiments have also been carried on at Montauk Point, Long Island, but not at a wave-length of 2,000 meters.

The call letters BYN are for the British Admiralty station located at Portland Bill, England.

* * *

F. M., Ridgway, Pa.:

We have no record of the call letters for the amateur stations referred to. You might communicate with the Department of Commerce.

The diagram for amplifying vacuum valves, employing a single lighting battery, is given in the "Naval Manual of Wireless Telegraphy for 1915," which can be purchased from the Marconi Publishing Corporation. This diagram is published on page 143 and includes three separate lighting batteries. A single unit may be used, however.

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D. O. A., Bedford, Pa., inquires:

Ques.—(1) What is the wave-length of an aerial of the inverted L type, 125 feet in length, containing four wires? It is 60 feet in height at one end 30 feet at the other. What would be the wave-length of the section if split in two parts with two wires each?

Ans.—(1) As an inverted L system the natural wave-length of this aerial is about 350 meters. We do not understand how you plan to split the aerial or where the incoming leads would be connected in case this were done.

Ques.—(2) Please tell me whether you would advise the use of a variable condenser for secondary tuning, built along the following lines: The dielectric is to be of paper about 1/64 of an inch in thickness between plates of tin, 3 by 3 inches. It is intended to employ fifteen adjustable and sixteen stationary plates. Would this give good results for secondary tuning?

Ans.—(2) We do not understand just how these plates are to be employed. Is the capacity to be altered by interleaving the plates and sliding them back and forth? If so, the construction is feasible, though air dielectric condensers are generally preferred in wireless telegraph work. Perhaps, however, for the ordinary receiving work in which you may be engaged, the dielectric losses in this condenser will not be sufficient to be taken into account.

Ques.—(3) Please tell me which will give the better results for tuning to wave-lengths up to, say, 6,000 meters: A receiving coupler where the primary is wound with No. 24 enameled wire and the secondary No. 28 enameled wire, or a receiving coupler where the secondary is wound with No. 28 S. S. C. wire and the primary with No. 22 S. S. C. wire. The primary tube is to be 8 inches in length by 5½ inches in diameter; the secondary tube 8 inches in length by 4¾ inches in diameter.

Ans.—(3) We should prefer to have the primary covered with No. 24 S. S. C. wire and the secondary with No. 28 S. S. C. wire. Coils wound with enameled wire have a high value of distributed capacity and in some cases occasion considerable energy losses.

Ques.—(4) Can I secure a long and thick spark from a 1½-inch spark coil by employing a single section of the Murdock moulded condenser of .0015 microfarad, or would I secure a better spark by using a glass photograph plate, 8 inches by 8 inches, coated on both sides with tin-foil, 6 inches by 6 inches

Ans.—(4) We should consider a capacity of .0015 microfarad rather high for a 1½-inch spark coil. The single plate of glass referred to will have a capacity of about .0005 microfarad which is more preferable for a coil of this capacity.

Ques.—(5) Have you been informed whether the Government uses the arc system in conducting its wireless telephone work

Ans.—(5) Undamped oscillations are employed for this work, but they are generated by a battery of 300 vacuum valves connected in parallel. The signals can be received on crystalline detectors, provided the receiving tuner has a range of wave-lengths between 6,000 and 8,000 meters.

* * *

E. B. R., Lancaster, Pa.:

The capacity of two one-quart Leyden jars is by far too great for use in connection with a 1-inch coil. A single plate of glass, 8 inches by 8 inches, covered with tin-foil, 6 inches by 6 inches, will give a sufficient value of capacity for this work. This is probably the reason why you do not receive a better spark. There is a possibility that you have insufficient condenser capacity across the vibrator, but we believe the trouble really lies in the abnormal value of capacity in use at the secondary winding.

* * *

P. H., Indianapolis, Ind.:

The March, 1915, issue of THE WIRELESS AGE contained an article on the construction of a variometer. A similar article appears in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Charter members of the National Amateur Wireless Association will receive copies of the book as parts of their equipments.

A receiving tuner suitable for the reception of Arlington time signals is described in F. C. T.'s inquiry in this issue. The aerial you describe has a natural wave-length of about 310 meters.

* * *

G. H., Wauwatosa, Wis.:

The natural wave-length of the 200-foot aerial you describe is about 475 meters, which is too long to be reduced to a value of 200 meters by a series condenser. You will secure better results by constructing an aerial specifically suited for the transmission on wave-lengths of 200 meters. A four-wire aerial, 40 feet in height by 50 feet in length, is quite sufficient for the purpose.

Ques.—(2) How many plates, 8 inches by 10 inches, will be required for a condenser to be used in connection with a Packard ½ k.w. transformer, secondary voltage 13,200.

Ans.—(2) For a wave-length of 200 meters the condenser should have no more than .01 microfarad capacity. Assuming the plates to be covered with foil 6 inches by 8 inches, the capacity of each plate will be about .0006 microfarad. You will therefore require about sixteen plates connected in parallel. It is a little doubtful whether glass of the ordinary thickness will be able to withstand this potential. If it is not found feasible, then the series parallel connection must be employed.

Ques.—(3) I have constructed an oscillation transformer with eight turns of brass strip in the primary and a similar number in the secondary. Is the instrument of correct design?

Ans.—(3) The information provided is not complete enough to enable us to give definite advice. The oscillation transformer will require no more than one or one and a half turns in the primary winding and the connections from the condenser to it must be exceedingly short. The secondary winding may have from eight to ten turns, depending upon the size of the antenna with which it is to be used.

The receiving tuner described will be adjustable to a wave-length in the secondary winding of about 3,800 meters, and for the primary winding we can give no definite data as we do not know the size of the aerial with which it is to be employed. However, if it is to be used with the 475-meter aerial the primary winding described will be adjustable to a wave-length of about 2,800 meters.

* * *

C. H. McS., Pittsburgh, Pa., asks for data for a suitable primary winding for the 10,000-meter coil described on page 378 of the February, 1915, issue of The Wireless Age. The actual dimensions for this coil will depend upon the size of the antenna with which it is to be employed, but, speaking generally, it may be 9 inches in length by about 5½ inches in diameter, wound closely with No. 24 S. S. C. wire. If the aerial with which it is to be used has a capacity of less than .001 microfarad an aerial tuning inductance must be connected in series.

We do not advise an aerial of less than 800 feet in length for reception of signals at a wave-length of 10,000 meters, although with supersensitive vacuum valve detector circuits, this may be readily accomplished with aerials of lesser dimensions.

The series of articles on "How to Conduct a Radio Club," which appeared in The Wireless Age, can be purchased in book form from the Marconi Publishing Corporation. Charter members of the National Amateur Wireless Association will be provided with copies of the book.

Apparently you have read all the prominent authors on the subject of wireless telegraphy and therefore should be able to select the one giving advice suitable to your requirements. We recommend "Wireless Telegraph Instruction for Amateurs" by Arthur P. Morgan, also "Experimental Wireless Stations," by Philip E. Edelman, for advice on elementary amateur apparatus.

* * *

J. G. F., Buffalo, N. Y.:

Ques.—(1) The top of the pole for the support of my aerial is 65 feet above the ground. The four wires are insulated at the bottom only. Is it essential that I have insulators at the top for either sending or receiving?

Ans.—(1) The aerial should be well insulated for both purposes.

Ques.—(2) Would one electrose ball insulator at each end of my aerial wire be sufficient for ¼ k.w.?

Ans.—(2) No. We should prefer several of these insulators connected in series, or a single insulator in each wire from 6 inches to 12 inches in length.

Ques.—(3) What would be the natural wave-length of an aerial 60 feet in height at one end and 45 feet at the other, having four wires spaced 2 feet apart. The flat top portion is 100 feet in length with a lead-in of 35 feet.

Ans.—(3) The natural wave-length of this system is about 284 meters.

Ques.—(4) Will a ground lead of 35 feet, No. B & S. gauged wire, be too long?

Ans.—(4) It is not too long, but a larger size of wire is preferred. It should be of at least No. 4 or No. 2 copper stranded wire.

Ques.—(5) What is the average time required to pass through the Marconi School of Instruction?

Ans.—(5) It depends upon the previous training of the student. If the applicant is able to receive in the Continental code at a speed of from ten to fifteen words a minute upon joining, he will require no more than three months' instruction. Occasionally, however, it requires from four to five months' instruction to attain a speed of from twenty-five to thirty words a minute in receiving. The technical course at the Marconi School generally covers three months of instruction.

Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.