THE MARCONIGRAPH

An Illustrated Monthly Magazine of WIRELESS TELEGRAPHY

EDITED BY J. ANDREW WHITE

Volume I. MAY, 1913 No. 8

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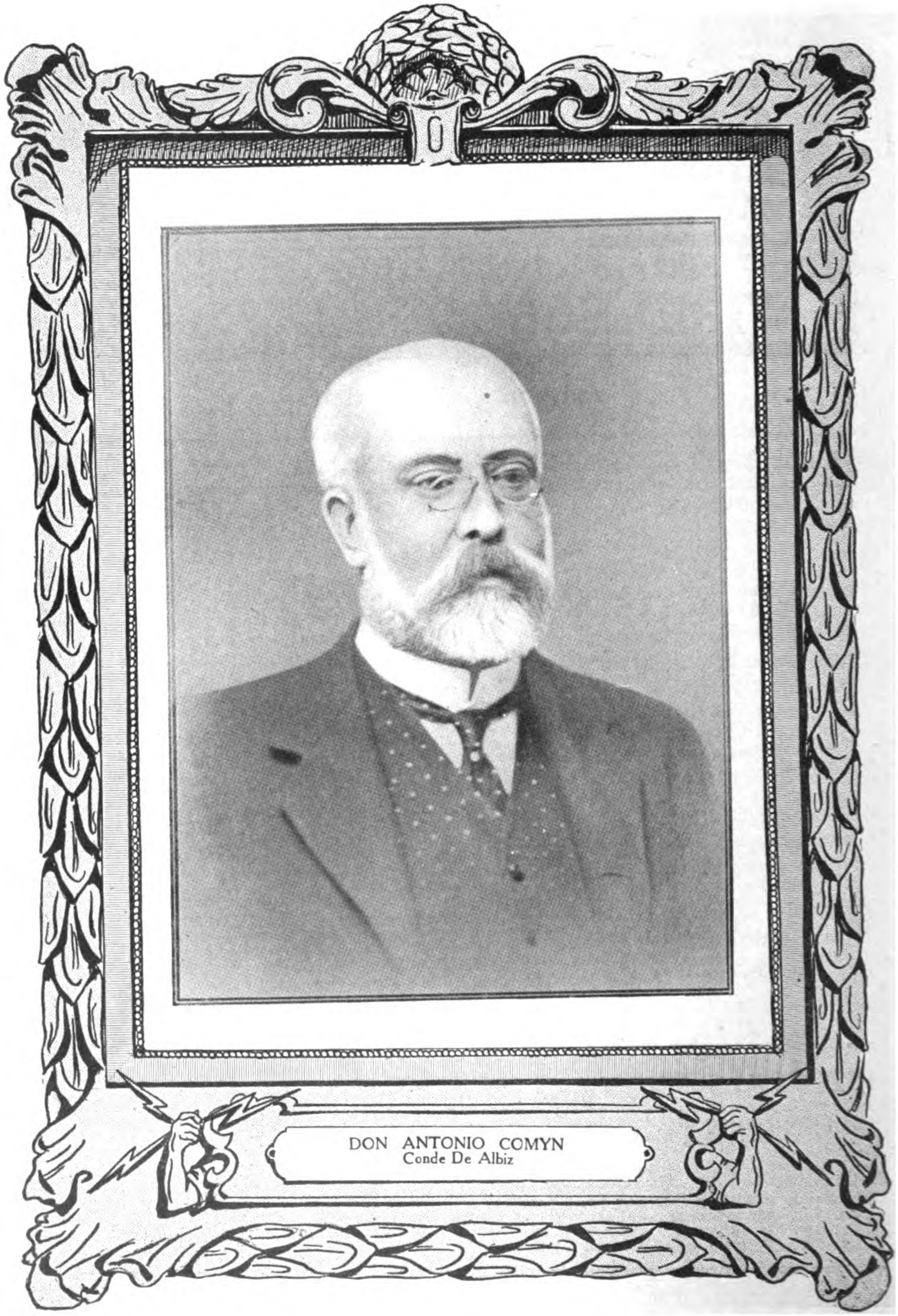
ISSUED MONTHLY BY MARCONI PUBLISHING CORP'N, 456 FOURTH AVE., N. Y. CITY
YEARLY SUBSCRIPTION, $1.00 IN THE U. S.-$1.35 OUTSIDE THE U. S.; SINGLE COPIES, 10c.
Entered as second class matter at the Post Office, New York



DON ANTONIO COMYN
Conde De Albiz

THE MARCONIGRAPH

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Vol.I. **May, 1913** **No. 8**

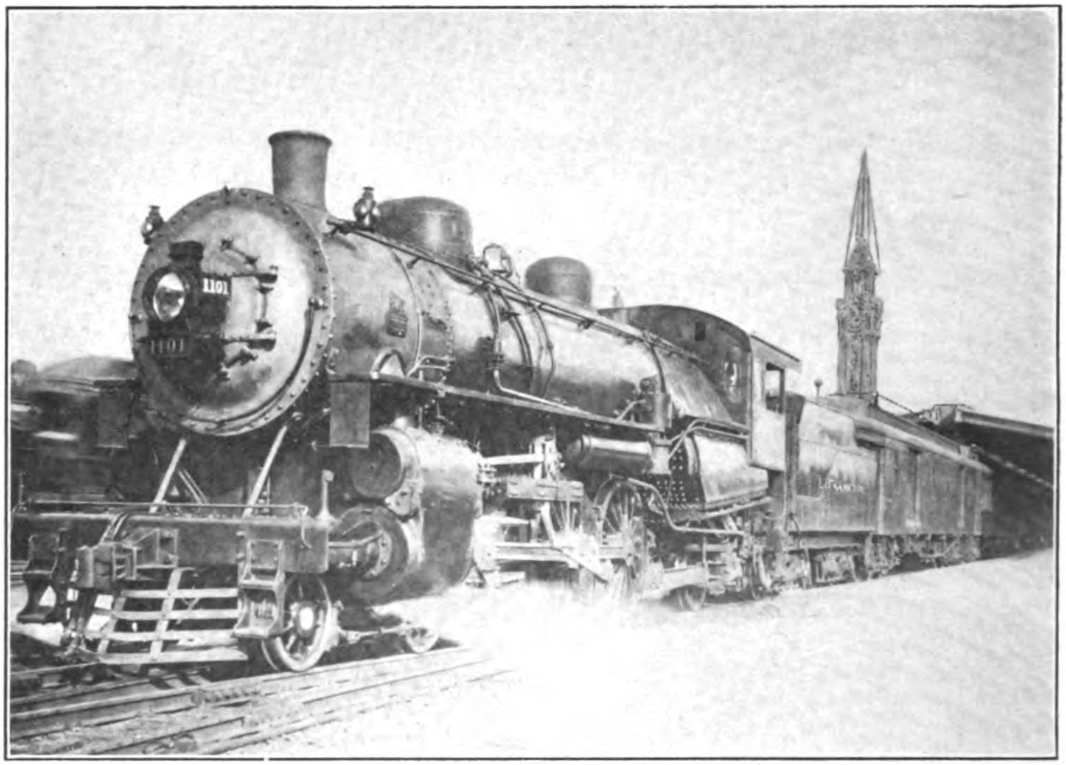
DON ANTONIO COMYN, Conde de Albiz, managing director of La Compania Nacional de Télégrafia Sin Hilos, is a typical specimen of the men who have made wireless telegraphy a great world power.

Moreover, he combines qualities which are, unfortunately, not too commonly found in association. A man of high social standing, and holding a distinguished position at the Court of His Majesty King Alfonso, the courtly nature of Señor Comyn covers a genius for work which comprises legal, political, and commercial spheres. The hackneyed saying that genius is an infinite capacity for taking pains is a sort of half truth. The man of genius possesses that capacity, but it is simply because he is inspired by a great idea. He sees the object of his quest before him like a light which he must follow. He is intensely possessed by it, and can not desist from the search until he finds it. He is forced to take infinite pains by the fire within him, and that is the real genius.

Señor Comyn was born in Madrid in the year 1858. His father, who was for a considerable number of years Minister Plenipotentiary for Spain at the Court of St. James, before Spain was represented in London by an Ambassador, is of Scottish origin, but the family have been settled in Spain for several centuries. On the maternal side Señor Comyn is of Irish descent, but there is no mistaking his loyalty and devotion to the country of his birth—Spain. The early training of the subject of our sketch was well conceived with a view of fitting him for the distinguished rôle which he was destined to fulfil in later life. He has had a cosmopolitan education, having studied at the University of Madrid, at University College, London, in Austria, and elsewhere. He is a gifted linguist, and in addition to his native tongue he speaks fluently French, German, Italian, and English. He graduated as a Doctor of Law at the Madrid University, and was later engaged in the Spanish Diplomatic Service, leaving that to enter the legal profession, where he became distinguished as an international jurist. As already mentioned, Señor Comyn is a prominent figure at the Spanish Court and moves in the highest society in Madrid. It is no wonder to find a man of his patriotism, his extensive knowledge and instinct for work absorbed for many years in political life. He was elected in the Conservative interest a Member of the Spanish Cortes, and served, first as a Deputy and later as a Senator during the last twenty years. He has held the office of Attorney General in the Court of Accounts, and has been the Under Secretary of State in the Ministry of General Azcarraga.

Possessing a natural aptitude for finance, he quickly discovered his *métier* in the Cortes, and was for four years Secretary to the Budget Commission, one of the permanent committees of the Parliament, and took a very prominent part in the deliberations of this commission and in the discussions on financial subjects in Parliament.

Some time ago, while serving as legal adviser to the British Embassy and Consulate at Madrid, he became acquainted with the Marconi system of wireless telegraphy, and on the formation of La Compañia Nacional de Telegrafia sin Hilos, two and one-half years ago, he was elected director and legal adviser and soon afterward he was appointed managing director. So absorbed did Señor Comyn become in the Marconi system of wireless telegraphy, and so zealous was he for the promotion of its interests, that practically the whole of his time and efforts have been devoted to the development and extension of the Marconi system in Spanish territory, with results that are alike creditable to himself and to his eminent coadjutors on the Spanish Board.



Railroad Installs Wireless

AN experiment which may result in radical changes in the movement of trains is to be tried by the Lackawanna. Plans are under way for the installation of Marconi wireless telegraph apparatus at the stations in Scranton, Pa., and Binghamton, N. Y. The railroad company has entered into a contract with the American Marconi Company for the installation of two 2 kw. high frequency sparks sets at the railroad stations just named, and for one 1 kw. set to be installed in a special compartment built into one of the day coaches of the Lackawanna Limited.

A horizontal antenna will be constructed over the entire train and the immediate experiments will be confined to Scranton and Binghamton keeping in communication with this train. These stations are to test the practicability of the use of wireless telegraphy for railroads. While the work is to be largely experimental in nature, successful results will ultimately be followed by the erection of wireless apparatus at Elmira, Buffalo, and Hoboken.

It needs little reflection to show what a far-reaching effect in the way of comfort, convenience and added safety this remarkable innovation, if proven feasible, will create in the service of the Lackawanna. For instance, in approaching a station, a conductor of a train could notify the agent there that he is in need of an extra car, that he can drop a car, and transmit similar information which will enable the station authorities to be ready to make the necessary changes or repairs immediately upon the train's arrival. For the passengers' comfort, it would be perfectly possible to transmit news items, stock quotations and other items of interest to a train while in motion and give them to the passengers either in the form of bulletins or ticker service.

As a safety device, the wireless service would prove of inestimable advantage and in combination with other precautionary measures would add another element to the safety of modern travel. Again, the wireless in use between stations would prove a most satisfactory substitute for the regular wire lines in the event of the crippling of the latter through storms and conditions beyond human control.

At Scranton, on the 175 ft. brick stack at the works of the railroad company, a steeplejack has placed a pulley and halyards from the top of which will be suspended an antenna some 700 feet long, terminating in the Scranton depot building of the Delaware, Lackawanna Railroad. A similar antenna is being erected at Binghamton by other available means.

It is hoped that the success of these experiments will demonstrate the practicability of the scheme and open up a new field for the use of wireless apparatus.

On this 175-ft. brick stack at Scranton, Pa., will be suspended an antenna about 700 feet long.

Orders Auto by Wireless

What is probably the first order ever taken via wireless by an automobile salesman was recorded recently by G. N. Jordan, Los Angeles branch manager for the R-C-H and Hupp-Yeats electric. The order came from C. E. Hansen, a Los Angeles capitalist who was aboard the steamer *Mauretania,* returning from Europe, where he had been traveling with his wife. It was received by Jordan while he was experimenting in his wireless room at his home, being relayed to him by the Los Angeles wireless operator, who reported: "Have a message here from *Mauretania.* This is the local wireless office and we are transmitting what came from the ship and overland by telegraph to us. Here is the message: 'Have Hupp-Yeats runabout prepared for delivery to wife. Notify her of gift—Hansen.'"

It did not take Jordan long to figure how the order "happened." C. E. Hansen, a local capitalist, had been visiting Europe with his wife, and while on the way home on the *Mauretania* decided to present his wife, who remained behind in England for a few weeks, with a Hupp-Yeats.

Getting in touch with the Los Angeles wireless station, Jordan soon had the following going by wire and air across the ocean:

"Mrs. Hansen, 6 Sinclair Gardens, Kensington, England: An electric Hupp-Yeats runabout awaits your arrival, gift from husband. Boys well.—Jordan."

Jordan is highly elated at the part the wireless played in ordering a car. "After I learned that Mr. Hansen's order originated via the *Mauretania's* wireless, I tried to carry the idea through as completely as possible," he explained. "I make wireless one of my recreations, anyhow, so was glad to be able to arrange that the message was both received and dispatched here by that method of communication. I believe Mrs. Hansen will own the first electric automobile ever ordered in such an up-to-date manner, and know that she will be pleased with the gift."

Move Brewery Station

The Marconi wireless telegraph station at the Pabst brewery, in Milwaukee, will be moved in a few weeks into the Railway Exchange building, Broadway and Wisconsin streets. The large increase in the business of the company necessitates the removal into more centrally located quarters.

The Practical Aspects of the Propagation of High-Frequency Electric Waves Along Wires

By John Stone Stone*

FOR the past three years or more Major Geo. O. Squier, of the Signal Corps of the United States Army, has conducted a systematic investigation of the propagation of high-frequency electric waves along wires, and of the practicability of their use in the transmission of signals and of speech along actual telephone cables and air lines. His investigations have also dealt with electrical resonance as a means of segregating, at the reciving end of the line, high frequency currents of different frequencies simultaneously propagated along the line, and the selective reception of the energies of these different currents, each in a different receiver circuits made responsive only to the variations in the amplitude or strength of the current it is resonantly tuned to receive. The results of his labors are to demonstrate that not only Morse signals but speech may be transmitted over the ordinary telephone cable and pole line circuits, and to very considerable distances, by means of high-frequency electric currents or waves, and that a large number of telegraphic or telephonic messages may thus be transmitted simultaneously over a given telephone or telegraph circuit without interfering with each other through the use of electrically tuned or electrically resonant receivers. Moreover, he has shown that the new high-frequency multiplex telegraph and telephone system may be superimposed on the older systems or the new high-frequency apparatus added to lines equipped with the usual telegraph or telephone apparatus without interfering in any way with the operation of this older apparatus, or being interfered with by it.

Major Squier has dedicated to the public his patents relating to this new art—an act which, though laudable in the spirit it displays, is nevertheless unfortunate, as it is more likely to retard the progress of the new art than to advance it, since what is everybody's business is nobody's business, and capital may hesitate to enter a new field and promote an undertaking in which it is led to believe that it will meet with unrestricted competition as the reward for its enterprise.

The frequencies of the electric waves or currents propagated along the wires in this new art are, so to speak, "above the limit of audibility of the receivers" or are ultra-sound frequencies. In other words, each of the electric currents propagated along the telegraph or telephone line is of so high a frequency that it can produce no audible effect in the telephone receiver through which it passes as long as its strength or amplitude remains constant. In fact, the frequencies of the currents used in this new telegraphy and telephony are 20,000 or more alternations per second, and correspond, therefore, to the frequencies of the air vibrations of sounds whose pitches are above the limit of audibility of the human ear. In the new telegraphy and telephony the telegraphic signals and the voice are transmitted over the line wire by suitable variations in the amplitude or strength of the otherwise uniform high-frequency current, and the signals and the voice are received in a magneto-telephone receiver connected in a local circuit which includes a device capable of rectifying the high-frequency current used. The rectifier employed is preferably an Audion, though a Wollaston electrode, and perhaps other radiotelegraphic detectors, particularly the so-called crystal rectifiers, may also prove serviceable.

The rectifier in the local circuit at the receiver converts the high-frequency current of the line wire into a pulsating

*Abstracted from the Journal of the Franklin Institute.

current of double the frequency, or, what is the same thing, it converts the high-frequency current into a normally uniform unidirectional current with a superimposed alternating current of double the frequency of the line current. The telephone receiver is mute to the alternating component of the rectified current, but responds to the most minute variations in the strength of the unidirectional component of this current. Variations in the amplitude or strength of the high-frequency line current are faithfully reproduced in the strength of the unidirectional component of the local reciver current, and in this way the telephone reciver is made highly sensitive to variations in the strength of the high-frequency line currents, while absolutely mute to that current when its amplitude is constant.

The relation of the new high-frequency telegraph and telephone to radiotelegraphy and radiotelephony is to be readily seen in Fig. 1, which illustrates the new system in its simplest practical form. The diagram shows, in fact, two radiotelegraph or radiotelephone stations with a connecting wire between them to guide the waves from the transmitter to the receiver.

In this arrangement the current is supplied by a high-frequency alternating current dynamo, A, which must be capable of supplying 20 watts at 10 volts and at not less than 20,000 cycles per second. In the case of high-frequency telephony this dynamo has to meet a further requirement which is not demanded of it by high-frequency telegraphy, and this requirement is perhaps the most difficult one to satisfy. It is that the amplitude of the current the dynamo supplies must be absolutely smooth, and can have no variations or ripples on it of periods corresponding to the periods of audible tones.

The arrangement of apparatus illustrated in Fig. 1, when the switches at the transmitter and at the receiver are both thrown up as shown, is that of a high-frequency telephone system, while when the switches are both thrown to their lower contact points the arrangement becomes a high-frequency telegraph system, so that the one diagram may be used to sketch the operation and requirements of both the new telegraph and the new telephone.

In the new telephone system, when the transmitted T is spoken to, it modifies the amplitude of the high-frequency current in the primary circuit of the induction coil, I_1, in exactly the same way that it modifies the strength of the battery current in the primary circuit of the induction coil in the old telephone system, and, as already described, the telephone receiver, R, at the receiving station responds, owing to the fact that exactly corresponding fluctuations result in the unidirectional component of the rectified current in the local circuit at that station.

In the new telegraph system the operation of the new telegraph key, K, to send Morse signals, alternately throws the high-frequency current on the line, and cuts off the supply of this current from the line. The result of this would

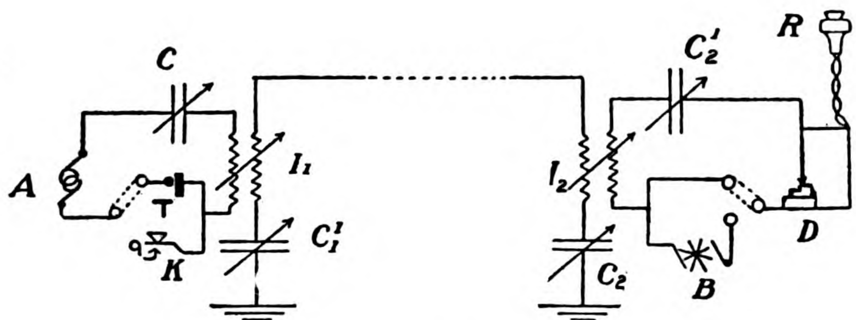


Fig. 1.

be only to make successive faint clicks in the telephone receiver, R, as the current on and off, except for the periodic interrupter, B, which may be of the nature of a revolving commutator or a mere buzzer. This interrupter serves to break the incoming wave trains constituting the Morse signal elements into a succession of much shorter wave trains having a frequency of about 450 impulses per second, which, when rectified, give rise in the telephone receiver to a high-pitched musical tone of great audibility. The Morse signals are now audible as a succession of long and short intervals of a high-pitched musical sound, as in radiotelegraphy. From the foregoing and the diagram of Fig. 1 the essential difference between the new telegraphy and the new telephony will easily be seen.

Some of the more essential characteristics of the simple system shown in Fig. 1 may prove of interest, particularly as they have not as yet, so far as I am aware, been clearly set forth. The induction coils, I_1 and I_2, are wound without any iron in their cores, since in the first place the presence of iron is not needed to secure a large mutual inductance between the primary and the secondary circuits, because a high degree of coupling between these circuits is not desirable, and, in the second place, the presence of iron in the core of the coils would introduce a loss of energy, through hysteresis, owing to the high frequencies used, which would give rise to an effect equivalent to the presence of a considerable dissipative resistance in the primary and in the secondary circuits. The arrow through the symbols for the coils indicates that these coils are adjustable with respect to their degree of coupling in the same way and for the same reason that the coupling of the corresponding coils is made adjustable in radiotelegraphy and radiotelephony. Similarly, the arrows through the symbols for the condensers, C^1, C'_1, C_2, and C'_2, indicates that these condensers are of adjustable capacity.

The function of the variable condensers at the transmitting and receiving stations is to electrically "tune" these stations. In the transmitting station of the system shown in Fig. I the so-called tuning is quite different in the case of the telephone and telegraph systems. In the case of the telegraph the coupling of the coil I_1 and the capacities of both condensers at the transmitter are adjusted with reference to the production of a maximum current in the line wire, as indicated by a hot wire ammeter connected in the secondary circuit. In the case of the telephone system the coupling of the coil I_1 is made very small, and each of the condensers at the transmitting station is then independently adjusted to make the current in the circuit in which it is included a maximum, as indicated by hot wire ammeters connected in each circuit. The coupling of the transmitter coil is then increased till the tuning adjustment of one circuit interferes with the tuning adjustment of the other, and the circuits are readjusted, each by its own condensers, for a maximum of current in itself. The reason for the radical difference in the tuning of the transmitter station in the telephone and telegraph systems may not be obvious. It is due to the fact that in the telegraph it is the actual amplitude of the high-frequency waves propagated along the

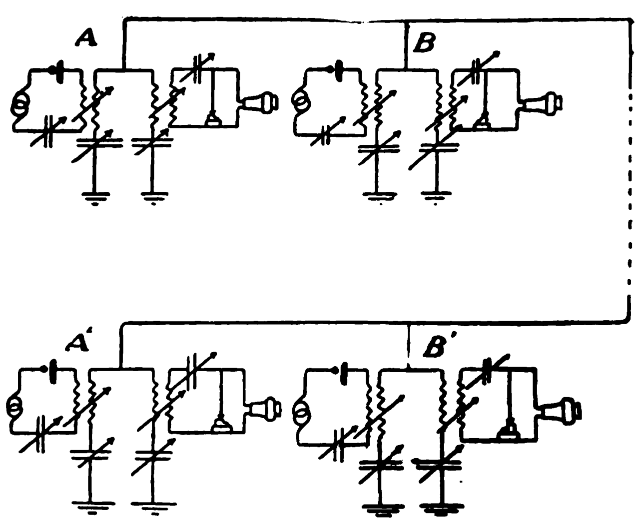


Fig. 2.

line that determines the strength or loudness of the signals heard in the receiver, while in the telephone system it is the magnitude of the variations in amplitude of the high-frequency waves propagated along the line that determines the loudness of the received speech. Moreover, in the case of the telegraph the loudness of the received signal is the sole object, while in the case of the telephone a still more important requirement is excellence in the quality of articulation of the transmitted speech. In the case of the telegraph, therefore, the adjustment of the transmitter station is such as to produce the maximum amplitude of the transmitted waves, while in the case of the telephone system the adjustment is primarily adapted to securing the best quality of the transmitted speech, and, incidentally, to produce the maximum variation in amplitude of the transmitted waves.

Thus, by loosely coupling the primary and secondary circuits at the transmitter and then adjusting the primary circuit for a maximum of current, the reactance of the primary is made zero, and the impedance of the primary is reduced to the mere resistance of that circuit, so that the resistance of the telephone transmitter becomes practically the sole factor in determining the primary current. Obviously this makes the variations in the amplitude of the high-frequency current due to variations in the resistance of the telephone transmitter a maximum, and, on the other hand, telephone engineers will realize that the elimination, so far as possible, of all reactance and resistance except that of the telephone transmitter, from the primary circuit at the transmitter station, is a requisite to good quality or articulation of the transmitted speech.

At the receiving station of the system shown in Fig. 1, whether it be used as a telegraph or telephone system, the tuning of both primary and secondary is directed merely to the production of a maximum current in the secondary circuit, and for this tuning the telephone receiver is used as the indicating device, since the current at the receiving

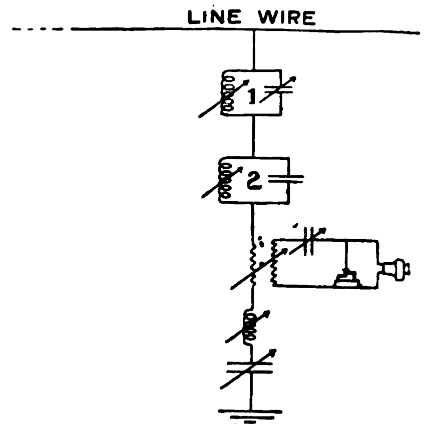
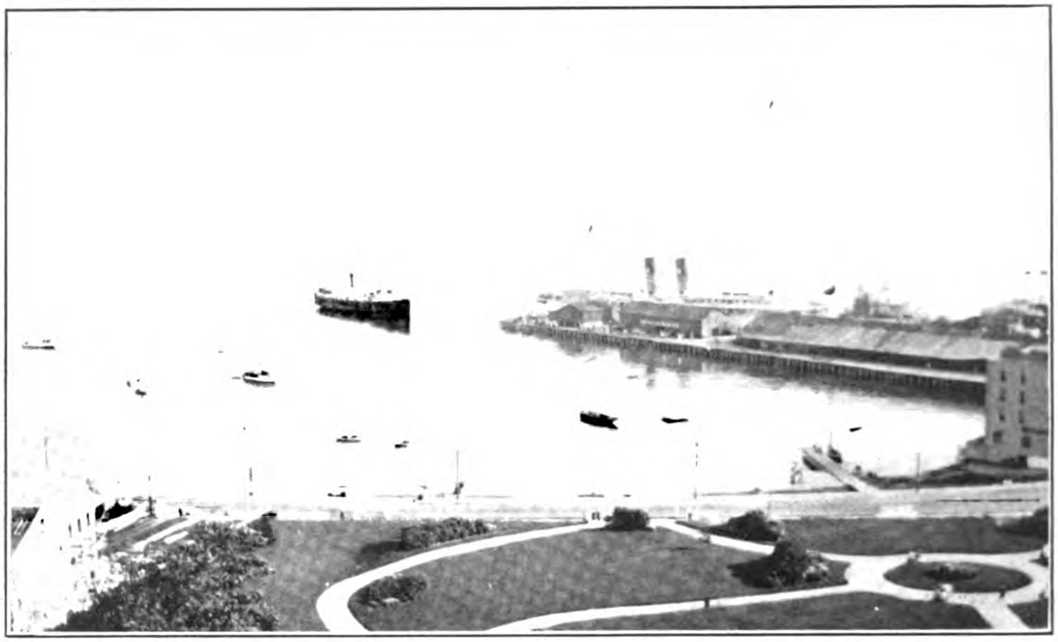


Fig. 3.

station is not sufficient to permit of the use of a hot wire ammeter. A sensitive galvanometer may sometimes be used with advantage for tuning purposes in place of the telephone receiver.

Having thus outlined the fundamental ideas of the method in the simplest form, Mr. Stone goes on to describe its application to a pair of duplex stations for two-way transmission for each station, which he illustrates by Fig. 2, and then proceds to the "more complex, but more perfect" multiplex shown in Fig. 3.

In Fig. 3 the receiver circuit is shown alone, and it is to be noted that in the branch from the line wire there are two loop circuits, 1 and 2, each consisting simply of circuits which are each made resonant *per se* to a condenser and a coil. These loop one of two frequencies, currents of which frequencies it is particularly desired to exclude from the receiver. Thus, if this receiver were to be used at stations A or B of Fig. 2, its loop circuits 1 and 2 would be individually made resonant each to one of the two frequencies generated by the transmitters of stations A and B; while if it were used at one of the stations A′ or B′, its loop circuits would individually be made resonant each to one of the two frequencies generated at the transmitters of stations A′ and B′. The effect of the presence of one of these looped resonant circuits in the receiver branch is practically to make the branch electrically opaque to currents of the frequency to which the loop is made resonant.



Working on the Great Lakes

By Laramie C. Dent

Chief Marconi Operator and Inspector of the Lake Michigan Division

WIRELESS operators coming from either coast to the Great Lakes invariably wonder at what seem to be very short distances worked with wireless when compared with the distances worked on the ocean. This deficiency in transmission and reception of wireless messages on the Great Lakes is generally attributed to the prevailing atmospherical conditions, the proximity of boats to the shore and the size of the boats compared with the great ocean liners.

In discussing the subject of atmospherical conditions on the Great Lakes it may be stated that this is one question pertaining to wireless telegraphy to which scientists not alone here but all over the world are giving the closest attention.

Upon this condition more than any other depends the success or failure of radio transmission. It is no longer a question of apparatus. With the mechanical problems solved, the atmospherical conditions are next to be understood and overcome. The mastering of these should mean absolute success in radio communication.

There is no standard scale or measure which we use to show the effect of the atmosphere on wireless waves; however, we may compare the effect in one portion of the globe with that of another portion and draw some interesting conclusions therefrom.

We will compare the effect of conditions on the Great Lakes with the effect in another locality, say, the Pacific Coast.

It will be noticed first that there are two conditions of atmosphere to be considered. They are: absorption and static. Absorption effects the transmission of signals and the static effects the reception of signals. The absorption of waves by the atmosphere is infinitely greater on the Great Lakes than on the Pacific Coast; due to the air containing less moisture on inland lakes than on the coast, and to the sun's rays having less penetrating and absorbing effect there than on the lakes. With the limited knowledge obtained relative to absorption of waves a satisfactory explanation of the phenomena cannot be given, but, like the fundamental of electric waves, electricity, we deal with its effect, not its elements. It will suffice to say then, that this is an effect of conditions not to be overlooked and this effect is more pronounced in the vicinity of the Great Lakes than in any other part of this country.

Static, the electrical condition of the atmosphere, varies in different portions of the country. Static and electrical storms are very bad on the Great Lakes in the summer, but are not so obstructive in the winter. The heaviest static an operator has to contend with on the lakes is on bright but sultry and hot days, but on the Pacific the only static that interferes with signals is found at night, for while there are no electrical storms on the Pacific Coast and one never sees lightning and seldom hears thunder, on the lakes lightning flashes come in on the aerial in such quantity as to be dangerous to life and property. It may be stated that static does not cause the signals to become weak, but, on the contrary, seems to make them stronger, but the static itself makes so much noise in the receivers that the signals are rendered unreadable. There is always more or less static on the lakes, while on the Pacific it is infrequent and never so strong as on the lakes.

Proximity of boats to the land: We know that the earth absorbs electric waves more readily than water, consequently a greater distance will be worked by a wireless set over water than over land. Let us see how this works out on the lakes. The boats are always close to the shore, and this has its effect on the waves sent out from them.

Lake Michigan may be used as an example. A boat will easily work from one side to the other, but to work from the north end of this lake to the south end requires a high power station. In a sense, this would be working over water all the way, but as the width of the water is very small compared with the length, the land has apparently the same effect as if waves were being sent entirely over land. Ether waves traveling from one end of Lake Michigan to the other may be compared to the flow of water in a small pipe. The friction on the pipe holds the water back to a great extent, in the same way that the shore lines on each side of the lake interfere with the waves traveling between them. Every point of land extending into the lake catches these waves and absorbs them, and every body of water extending into the land forms a basin which acts as a condenser and loads itself with electric energy from these waves.

The size of the vessels: The ships on the lakes, as a rule, are very much smaller than those on the ocean. This limits the size of the aerial which can be used, and, generally speaking, the higher the aerial wires the better the results obtained from the wireless set.

Yet, with all the disadvantages, the vessels on the Great Lakes have better wireless protection than those off either coast, for there are more land stations in operation to-day on Lake Michigan than on the Pacific Coast from Canada to Mexico It must be remembered that in case of accident to a ship it is not so important to be able to work with some station several hundred miles away. The station close at hand which would be able to inform a nearby ship of the disabled vessel's plight so the rescuing craft may speed to her assistance without delay, is the station of greatest consequence and benefit. So we on the Great Lakes are not at any great disadvantage, even if we do not work the long ranges of the ocean-going vessels.

Bermuda Ban Lifted

Capt. Richard Hayes, of the Royal Mail Steam Packet *Orotava* was notified on his arrival from Bermuda a few days ago that the Lords of the Admiralty in London had granted his petition, made several months ago, that messages from the steamers to the agents in Hamilton be sent through the naval wireless station at Grassy Bay. The letter said this permission referred only to official messages from the Captains, and not to private messages from passengers.

How to Forward Messages Through Naval Radio Stations

THE rules for ships desiring to forward wireless messages through naval shore stations have been issued by the United States Government. As it is likely that a knowledge of the abbreviations to be used after July, 1913, by ships of all nations and which are expected to come into immediate use by all American ships, will be required for future license examinations, every commercial operator should study these time-savers. This valuable list will be found at the end of the article.

1. The charges to be collected on board ship consist of:

(a) The ship charge.
(b) The coast station charge.
(c) The charges for land line or cable transmission.

(a) Is fixed by the company operating the radio set on board ship. (b) Is fixed by the Secretary of the Navy for naval radio stations. (c) Is fixed by the Secretary of War for Alaskan telegraph and cable companies in the United States.

2. Each ship should have on board tariff sheets showing the charges for each station open to general public business and the telegraph and cable rates from each station to any point in Alaska, the United States, or Canada, and as far as possible to any part of the world. However, should the ship not be provided with these rates, they may obtain them by means of a service message to a coast station. Call the station and send the interrogation signal twice, followed by: "——— rate to ———." Naval stations will be prepared to furnish rates by cable to foreign countries, also the radio rate through any foreign coast station open to general public business, and the ship rate of any ship whose name is to be found in the international list of radio stations.

3. The charge for a radiogram must in every case be paid in full by the sender. A receipt for charges prepaid should be demanded and retained by the sender for possible future inquiries. A sender may designate the coast station to which he desires his radiogram to be sent. The operator will then wait until that station is the nearest; if no station is designated the message must be sent to the nearest coast station. In case there are alternative routes for the transmission of a message beyond the coast station, the sender should designate the route. In the United States, he should state whether the radiogram is to be forwarded by the Western Union or Postal Telegraph Companies. In routing the message the letters "W" and "P" should be used to designate these companies respectively.

PRIORITY OF MESSAGES.

4. Ordinarily the business between the ship and coast station should be carried on in the following order:

(a) Messages relating to the navigation of the ship.

(b) Service messages relating to the conduct of the radio service, or to previous radiograms transmitted by the stations concerned.

(c) Commercial messages.

5. Messages of the same rank will be transmitted in the order in which they were handed in. The coast station will direct whether the ship and station are to send messages in alternate order or in series of several messages. The time occupied by a series of messages may not exceed 12 minutes.

NUMBERING OF MESSAGES.

6. Messages for certain coast stations should be numbered in sequence, beginning with one, each station to have a separate series of numbers. A new series should commence with midnight each day.

CODE.

7. The International Morse Code only will be used by naval stations.

SHIP TO CALL COAST STATION.

8. As a general rule, the ship calls

the coast station when its distance is less than 75 per cent. of the normal range of the coast station, as given in the International list. Before beginning to call, the ship operator should adjust the receiver for the calling wave-length of the coast station and his detector for maximum sensitiveness, after which he should listen in to see if the station he wishes to call is not engaged. If he finds that the station is working with another ship or station, the operator must wait for the first break before calling. Too much care cannot be taken in carrying out these regulations, as by calling a station already busy an operator is liable to interfere and cause delay, not only for his own message, but for any others that may be in progress. On the request of the coast station, a ship will immediately cease calling, and the station will then indicate, approximately, the time it will be necessary to wait.

COAST STATION THE CONTROLLING STATION.

9. Operators should remember that the coast station controls all communications in its neighborhood, in which it is guided solely by the desire to handle as much work as possible. When a coast station receives calls from several ships, it shall decide the order in which the ships shall be received in order that each ship may be allowed to exchange the greatest possible number of messages before going out of range. Preference is therefore given to the ship whose position, course, and speed indicate that she will be the first to pass out of range.

FAILURE TO REPLY.

10. No reply having been received to a call repeated three times at intervals of two minutes, a call should not be renewed until after an interval of 20 minutes, and then only if no communications are going on which will be interfered with.

PROCEDURE WHEN SIGNALS BECOME DOUBTFUL.

11. When signals become doubtful, a message will be repeated at the request of the receiving station three times only. Should the signals be unreadable in spite of being thrice repeated, the message will be canceled. If an acknowledgment of receipt is not received, the ship again calls the station. If no reply is made after three calls, they shall not be continued. Should the station think that the message may be delivered, it acknowledges receipt, inserts the service instruction, "reception doubtful," at the end of the preamble, and sends on the message.

SUPERFLUOUS SIGNALS.

12. Every effort should be made to cut down the number of superfluous signals and words exchanged between ships and coast stations open for public business.

OPERATING RULES.

13. The following extracts from the "Revised Operating Rules for Naval Radio Stations," should be noted by ships:

CALLS.

5. A call shall be preceded by the ATTENTION signal

—.—.—

The call of the station shall be made three times and separated from that of the calling station, also repeated three times, by

—.. . (DE)

6. The signal

—.—. ——.— (CQ)

shall be known as the INQUIRY signal, to be used for calling any ship or station which may be within range, when its name is not known. It shall be preceded by the ATTENTION signal,

—.—.—

followed by

—.. . (DE)

and the call of the inquiring ship or station repeated three times.

7. A station called shall reply by giving the ATTENTION signal,

—.—.—

followed by the call of the calling station repeated three times, the signal

—.. . (DE)

her own call repeated three times, and the GO AHEAD SIGNAL

—.— (K)

The use of GA or G shall be discontinued.

8. If a station called does not answer the call repeated three times at inter-

vals of two minutes, the call shall not be resumed until after an interval of 15 minutes, the station making the call having first made sure that no communications are being interfered with.

9. When a station is called by several ships it shall decide the order in which it will work with them. In general, a station controls all radio communications within its range as far as commercial work is concerned.

EXAMPLES.

(1) Ship KSA calls NAN thus:

—.—.—

NAN NAN NAN

—.. .

KSA KSA KSA

NAN replies:

—.—.—

KSA KSA KSA

—.. .

NAN NAN NAN

—.—

(2) KSA sees a ship on the horizon, or, having nothing in sight wishes to inquire if there is any ship or station within range:

—.—.— (ATTENTION signal)

—.—. ——.— (INQUIRY signal)

—.. . (DE)

KSA KSA KSA

NJS answers:

—.—.—

KSA KSA KSA

—.. .

NJS NJS NJS

—.—

POSITION REPORTS.

10. A position report shall be preceded by the letters TR and shall be made as follows:

(a) The approximate distance, in nautical miles, of the vessel from the coast station;

(b) The position of the ship given in a concise form and adapted to the circumstances of the individual case;

(c) The next port at which the ship will touch;

(d) The number of messages, if they are of normal length, or the number of words if the messages are of exceptional length.

The speed of the ship in nautical miles shall be given specially at the express request of the coast station.

Commercial ships may be expected to use the form required by the Berlin Convention.

12. Special care shall be taken not to interrupt the business of the station, which may be receiving signals at the time that cannot be received on board ship on account of the lower aerial; the ship shall, therefore, cease calling promptly on demand.

13. The signals

.—... (WAIT)

and QRM, QRW, QRX and QRY (see par. 73), shall be used to cover cases of interference.

EXAMPLES.

(1) After station acknowledges ship's call, ending with

—.—

the ship sends: TR, 50 (nautical miles).

Off Cape Fear

Havana

4 (number of messages).

(2) A commercial vessel, especially if foreign, may be expected to send:

50 (distance),

93 (bearing from station),

184 (course),

9 (speed),

40 (number of words).

The numbers may be separated by the BREAK sign or the signals QRB, etc. (par. 73), may be used.

TRANSMISSION OF RADIOGRAMS.

16. The station, after acknowledging the position report, shall reply, giving either the number of words or the number of messages to be sent to the ship and the order of transmission, if the station is ready to send or receive at once; if not the station shall inform the ship of the approximate length of the wait.

17. In case the ship is not ready to receive for the moment, she shall inform the calling station of the approximate length of the wait.

18. The object aimed at must always be the handling of the greatest amount of business before ships get out of range.

19. Before beginning an exchange of messages the station shall inform the ship whether the messages shall be

sent in alternate order or by series of so many messages, in case there are several to be sent each way. The abbreviations given later (par. 73), may be used to indicate the order, or the word "series," if there are less than five messages.

20. The transmission of every message shall be preceded by the ATTENTION signal.

21. When a message to be sent contains more than 40 words, the sending ship or station shall interrupt the transmission after each series of about 20 words with an interrogation

..——..

and shall not continue until the receiving station repeats the last word received and —.—

THE PREAMBLE.

22. The preamble consists of all the items sent before the address. It follows the ATTENTION signal

—.—.—

and is separated from the address by the BREAK or DOUBLE DASH

—...—

NUMBERING OF MESSAGES.

24. Each message, regardless of class, sent by a ship or station, will be numbered in sequence, the first message of each day sent to a certain ship, station, or land line office, to be numbered 1. Each ship or station will have a separate series of numbers for each station or land line office to which it transmits, a new series to begin each day at midnight.

25. The receiving number is that given by the ship, station, or office received from, and will not be transmitted, but a new number will be assigned, in case the message is retransmitted, and will be the next number in sequence for the station sent to. The number will be transmitted as the second item of the preamble of the message (following the abbreviation "Ofm", "Svc", or "Msg"), without the abbreviation "No" or "Nr." In receiving a series of messages the sequence of the receiving numbers will be noted, and in case a break in the sequence should occur, inquiry for the missing message shall be made immediately.

EXAMPLES.

(1) The first ten messages received at the station on a certain day are from the S.S. *Amazon.* They should be numbered 1-10 by the *Amazon.* The next two messages are from the *Reid,* numbered 1 and 2 by the *Reid.*

(2) The next messages from the *Reid* are sent to the *Louisiana* direct. They should also be numbered 1 and 2 by the *Reid.*

(3) All of the messages received by the station from the *Amazon* and the *Reid* are turned over to a land line or cable office for further transmission with the numbers 1-14, being the first messages sent that day through that office.

STATION CALL.

26. The station call shall follow the number. The sending operator's sign shall not be transmitted, but shall be recorded on the message blank. No operator shall change his personal sign without the authority of the electrician in charge of the station, or the radio or signal officer on board ship. No two operators at a station or on board a ship shall use the same sign.

THE CHECK.

27. The check shall consist only of the number of words, including the address and signature, with the exceptions noted in the following paragraph and under the heading "Counting of words" (Par. 68). The number or numbers only shall be sent without the indication "Ck."

DATING.

29. After the check, the ship, station, or office of origin shall be sent, except by the originating station itself, followed by the original date should the message not be forwarded or delivered on the original date. The name of the original station, ship, or office shall always be sent in order to avoid errors on account of similarity of call letters. A message forwarded over a land line by a coast station shall show its own name as office of origin, followed by that of the ship.

30. On board ship and at stations which receive messages from the public direct, the time when a message is

filed—i. e., handed in for transmission—shall be noted on the sending blank. This time shall be known as the "time of filing."

35. For a message to be forwarded by land, wire or cable, the particular line or cable shall also be indicated after indicating the ships and station handling it by radio. For land lines in the United States, use "W" for Western Union Telegraph Co., "P" for Postal Telegraph Co.

THE ADDRESS.

36. The address must consist of at least two words. Telegraph companies will register radio addresses at all offices without charge. The cable addresses prescribed by Navy Regulations shall be used for radiograms.

BODY OF MESSAGE.

37. The message and signature, if any, must be sent exactly as received. The address, message and signature must be sent with special care, the sending operator regulating his speed to suit the ability of the receiving operator, avoiding a jerky style of sending. Slow, steady sending at the rate of about 20 words per minute will give best results. Messages containing code words or cipher should be sent more slowly than those entirely in plain language. Government messages containing code words and cipher shall be immediately repeated back by the receiving station, with the following exceptions:

(1) In repeating a message of more than 10 words, containing few code words or cipher groups, the code words or cipher groups shall be repeated.

(2) Weather reports and other reports made up of code words with which operators may become familiar from frequent use need not be repeated. Should the receiving operator have any doubt about one or more words, he should repeat and get

. . . — . (UNDERSTOOD)

from the sending operator.

SIGNATURE.

38. The indication "Sig" before a signature shall not be transmitted. No signature is required for any except official messages. In case a message is not signed, no mention of the fact shall be made, as the check will be a sufficient indication.

END OF MESSAGE.

The message is ended by the END OF MESSAGE signal, the cross (+) of the International Morse code,

. — . — .

followed by the station call.

EXAMPLE.

Order of transmission of a radiogram after receiving the signal "K" (go ahead). (*Prairie* sending to Key West.)

1. — . — . — Attention signal.
2. OFM (or) Government message, SVC (or) or service message, MSG or commercial or private message.
3. 5 Number.
4. NQM Station call.
5. 5 Check—number of words.
6. USS. *Wyoming*—Originating station.
7. 12 Original date, if other than date of transmission.
8. Via NAR W Route.
9. — . . . — Double dash or break (end of preamble).
10. Larrimer. Registered radio address. New York.
11. — . . . — Double dash or break
12. Leaving tonight. Message.
13. — . . . — Double dash or break.
14. Wilson Signature.
15. . — . — . End of message.
16. NQM Station call.

ERRORS.

39. A sending operator shall indicate an error by sending eight dots followed by the word before that sent incorrectly or before a word omitted.

Example:

"Arrive ten tonight, stay in waters indefinite

. . . .

in these waters indefinite."

40. In addition to its uses as an interrogation, the signal

. . — — . .

shall be known as the REPEAT signal, and shall be used to obtain a repetition of messages or words, as follows:

1. To have a single message entirely

repeated, send, (a), call of station sending message, (b), the REPEAT signal three times, (c), station call.

2. To have one of a series of messages repeated, send, (a), call of station sending message, (b), number of message, (c), the REPEAT signal three times, (d), station call.

3. In case the first part of the message is received satisfactorily, indicate the last word received and get a repetition of the last part of the message by sending, (a), call of station sending message, (b), number of message, if necessary, (c), last word received, (d), REPEAT signal, (e), station call. This will be taken to mean "Repeat after ——"

4. In case the last part of the message was received satisfactorily, indicate the first word of the part received and get a repetition of the messages as far as that word by sending, (a), call of station sending message; (b), number of message, if necessary; (c), the REPEAT signal; (d), first word of part received; (e), station call. This will be taken to mean, "Repeat as far as ——."

5. To get a repetition of one or more lost or doubtful words, send, (a), call of station sending message; (b), number of message, if necessary; (c), word received just before lost or doubtful word or words; (d), the REPEAT signal; (e), word after lost or doubtful words; (f), station call. This will be taken to mean "Repeat all between —— and ——."

Examples:

(1) NAC
..——..
..——..
..——..
NAB

(2) NAM
6
..——..
..——..
..——..
NAL
(Repeat your No. 6)

(3) NPC
1
Report
..——..
NPD
(Repeat after word "Report")

(4) NPO
..——..
Nicholson.
NPT
(Repeat as far as "Nicholson.")

(5) NLC
4
Several
..——..
Instruct.
NAO.

"Received" Signal

41. To acknowledge a single message or series, send:

(1) The RECEIVED signal, R.

(2) Number of message, or numbers of first and last messages of a series.

(3) Ship or station call.

(4) Operator's sign.

(5) The GO AHEAD signal if ready to receive another message; the ATTENTION signal, preamble, etc., if a message is to be sent; or the FINISHED Signal,

...—.—

followed by ship or station call if all business is cleared, which shall be answered by the other ship or station in the same manner.

Examples:

(1) .—. (RECEIVED).
4
NPC
XP

(2) .—.
1
5
NJC
GL

(3) .—.
11
15
NAX
V
...—.—
NAX

NAR answers:
...——
NAR

LANGUAGE.

42. A radiogram may be sent in plain language, code language, or cipher:

(1) Radiograms in plain language are those composed of words, figures, and letters which offer an intelligible meaning in any of the European languages. The words and letters must be written in Roman characters. In case of unfamiliarity with the language being sent, the sending operator's statement that a message is in "plain language" shall be accepted.

(2) Code language is composed of real words not forming intelligible phrases or of artificial words consisting of pronounceable groups or letters, such as words in which the letters are alternately consonants and vowels. No code word, whether real or artificial, may exceed ten letters in length. The real words may be drawn from any of the following languages: English, French, German, Italian, Spanish, Portuguese, and Latin. The artificial words must be formed of syllables which must be pronounceable according to the current usages of one of those languages. Combinations formed by running together two or more real words, whole or contracted, or a real word and some other expression, are prohibited.

(3) Cipher is composed of:

(a) Arabic figures or groups, or series of Arabic figures having a secret meaning, or letters or groups, or a series of letters having a secret meaning.

(b) Combinations of letters not fulfilling the conditions applicable to plain language or code.

Letter and figure cipher cannot be combined in one group.

COUNTING OF WORDS.

44. The word system of counting shall be observed, and all words in the address, text, and signature must be counted and charged for.

ABBREVIATIONS.

73. The following abbreviated signals will go into effect with the London Convention, July 1, 1913, and will be used by ships of all nations which may ratify that convention. They shall be used between stations and, wherever practicable, with commercial ships that are familiar with them, after receipt of these instructions:

—.—. ——.— (CQ)

Signal of *inquiry* made by station desiring to communicate.

—.—. (TR)

Signal preceding position report; or "Send position report."

——..—— (!)

Signal indicating that a station is about to send at high power.

Abbreviation	Question	Answer or Notice
PRB	Do you wish to communicate by means of the International Signal Code?	I wish to communicate by means of the International Signal Code.
QRA	What ship or coast station is that?	This is ——.
QRB	What is your distance?	My distance is ——.
QRC	What is your true bearing?	My true bearing is —— degrees
QRD	Where are you bound for?	I am bound for ——.
QRF	Where are you bound from?	I am bound from ——.
QRG	What line do you belong to?	I belong to the —— Line.
QRH	What is your wave-length in meters?	My wave-length is —— meters.
QRI	How many words have you to send?	I have —— words to send.
QRK	How do you receive me?	I am receiving well.
QRL	Are you receiving badly? Shall I send 20 ...-. for adjustment?	I am receiving badly. Please send 20 ...-. for adjustment.
QRM	Are you being interfered with?	I am being interfered with.
QRN	Have you much static?	There is much static.
QRO	Shall I increase power?	Increase power.
QRP	Shall I decrease power?	Decrease power.
QRQ	Shall I send faster?	Send faster.
QRS	Shall I send slower?	Send slower.
QRT	Shall I stop sending?	Stop sending.
QRU	Have you anything for me?	I have nothing for you.
QRV	Are you ready?	I am ready. All right now.

QRW	Are you busy?	I am busy (or: I am busy with ——). Please do not interfere.
QRX	Shall I stand by?	Stand by. I will call you when required.
QRY	When will be my turn?	Your turn will be No. ——.
QRZ	Are my signals weak?	Your signals are weak.
QSA	Are my signals strong?	Your signals are strong.
QSB	Is my tone bad?	Your tone is bad.
	Is my spark bad?	Your spark is bad.
QSC	Is my spacing bad?	Your spacing is bad.
QSD	What is your time?	My time is ——.
QSF	Is transmission to be in alternate order or in series?	Transmission will be in alternate order.
QSG		Transmission will be in series of 5 messages.
QSH		Transmission will be in series of 10 messages.
QSJ	What rate shall I collect for ——?	Collect —— for ——.
QSK	Is the last radiogram canceled?	The last radiogram is canceled.
QSL	Did you get my receipt?	Please acknowledge.
QSM	What is your true course?	My true course is —— degrees.
QSN	Are you in communication with land?	I am not in communication with land.
QSO	Are you in communication with any ship or station (or, with ——)?	I am in communication with —— (through ——).
QSP	Shall I inform —— that you are calling him?	Inform —— that I am calling him.
QSQ	Is —— calling me?	You are being called by ——.
QSR	Will you forward the radiogram?	I will forward the radiogram.
QST	Have you received the general call?	General call to all stations.
QSU	Please call me when you have finished (or) at —— o'clock	Will call when I have finished.
QSV	Is public correspondence* being handled?	Public correspondence* is being handled. Please do not interfere.
QSW	Shall I increase my spark frequency?	Increase your spark frequency.
QSY	Shall I send on a wave-length of —— meters?	Let us change to the wave-length of —— meters.
QSX	Shall I decrease my spark frequency?	Decrease your spark frequency.

Additional abbreviation proposed for international use, and authorized for naval stations:

QSZ		Send each word twice. I have difficulty in receiving you.

When an abbreviation is followed by a mark of interrogation, it refers to the question indicated for that abbreviation.

Examples

Station A. QRA?=What is the name of your ship or station?

Station B. QRA *Celtic* MLC=This is the *Celtic*. Her call is MLC.

Station A. QRG?=To what line do you belong?

Station B. QRG *White Star*=I belong to the *White Star* line.

QRZ=Your signals are weak.

Station A then increases the power of its transmitter and sends:

Station A. QRK?=How are you receiving?

Station B. QRK=I am receiving well.
QRB 80=My distance is 80 nautical miles.
QRC 62=My true bearing is 62 degrees, etc.

*Public correspondence is any radio work handled on the commercial tunes 300 or 600.

Progressive Magazine Changes Title

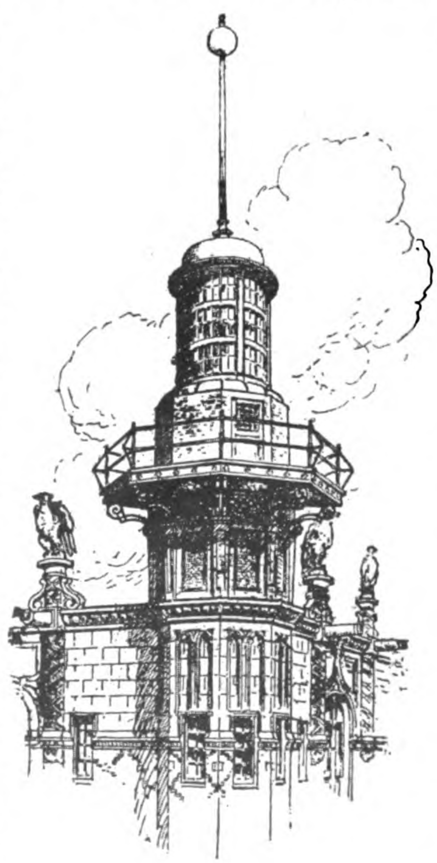
An achievement worthy of red letter recording in the annals of scientific publishing is represented in the first number of *The Wireless World*, which made its bow to the British public last month.

Formerly published under the title *The Marconigraph*, the magazine which now appears in an entirely new guise, increased its size from 16 pages to 96 pages, in exactly two years. The first issue of the new series is especially meritorious and future growth of contents and popularity in ever greater ratio is cordially wished the newcomer by its American contemporary.

Titanic Memorial Lighthouse Dedicated

ON Tuesday, April 15, one year from the day on which the *Titanic* sank, the Lantern Tower and Time Ball which has been erected on the new Seamen's Institute in New York City, was dedicated as a memorial to all those who lost their lives when the steamship *Titanic* made her maiden voyage.

At the dedication ceremonies, held on the roof of the new institute, brief addresses were made by Bishop David H. Greer, Rev. William P. Merrill (of the Brick Church—Presbyterian), and Dr. Henry Lubeck, formally declaring the Lighthouse Tower to be given in memory of the engineers who sent their stokers up on deck while they went to certain death; of the members of the heroic band of musicans who played even while the water crept up to their instruments; of the postal clerks who bravely put duty ahead of personal safety; of the Marconi operator; of the officers and crew who stayed by their ship. It is given in memory of those in the steerage who perished without ever realizing their hopes of the new land, the America of endless possibilities. It is given in memory of all the heroic deeds by first and second-cabin passengers. In short, it is a monument to every person without regard to rank, race, creed or color, whose life went down when the giant vessel slipped beneath the waves.



This tower is identical with the accepted form of lighthouse with stairs in the rear, a lantern gallery and a fixed green light, which will shine out over New York harbor and be visible to all the lower anchorage down through the Narrows to Sandy Hook.

Surmounting the tower is a time ball. Just at five minutes before twelve each noon the gleaming ball will be hoisted to the top of the steel rod. And promptly at noon when the time is flashed over the wire from Washington the ball will drop.

By it chronometers will be set on the schooners creeping along the coast; on the great four-masted ships loaded with oil for the Far East; on the tramp steamer setting out for South Africa. and on the passenger and cargo boats sailing for the West Indies and South America.

Situated just where the island of Manhattan turns, on the corner of South street and Coenties Slip, the new building of the Seamen's Institute commands the attention of every vessel entering the great harbor of New York, whether by way of Sandy Hook or through Hell Gate. And because of its close relation to sailors and the sea, its roof was chosen for the "Titanic Memorial Lighthouse" by the two societies responsible for raising the fund to erect the memorial — the Seamen's Benefit Society, of which Miss Catherine S. Leverich is president, and the American Scenic and Historic Preservation Society, of which Dr. George F. Kunz is president.

The firm of the late J. Pierpont Morgan acted as treasurer for this fund, Mr. Morgan having also contributed $100,000 toward the new Seamen's Institute.

An oval tablet of bronze, beautifully designed, is placed on the corner of the building sufficiently near the street to make its inscription visible. It is inscribed:

"This Lighthouse Tower
is a Memorial to the
Passengers, Officers and Crew
of the Steamship Titanic
who died as Heroes When that Vessel
Sank After Collision with an Iceberg
Latitude 41° 46′ North,
Longitude 50° 14′ West

APRIL 15, 1912

ERECTED BY PUBLIC SUBSCRIPTION
1913."

The new Seamen's Institute on which the Lighthouse Tower is erected is a twelve-story building equipped to care for about fifty thousand of the half million seamen who come to the port of New York each year. It is a social welfare plant.

It is many things combined: a chapel, a hotel, a savings bank, an employment bureau, a lyceum for entertainment, a school for nautical instruction, a relief society. It maintains a steam launch in the harbor, and with this new building it is possible to take a crew from an incoming ship, transport it to the institute, feed it, lodge it, entertain and instruct the men, give relief to the sick and disabled, visit them in the hospitals, secure them fresh employment, outfit them properly and place them on their outgoing vessels, having in the meanwhile taken charge of their baggage, their mail and their money, and having transmitted the latter, free of charge, to their dependents anywhere in the world.

Prominent on its Board of Managers are Mr. Edmund L. Baylies, chairman of the building committee and almost solely responsible for raising the $1,050,000 for the new building; A. T. Mahan, rear admiral U. S. N., retired; Vincent Astor, Col. Herbert L. Satterlee and Franklin D. Roosevelt, Assistant Secretary of the Navy.

This Lighthouse Tower Memorial will make all thoughtful persons realize afresh that the *Titanic* spirit did not die with the ship; it will stand as a symbol of man's appreciation of heroism and self-sacrifice.

The Spirit of the Memorial Speaks

Sorrowfully

"The mocking city lies, far, far below me,
Constant I hear the cries and puny protests.
Of those small bits of God I know as men,
Restless, unceasing in their poor endeavor
To turn their lives to gain, but not to beauty,
Loving a little, but pursuing always.

Thoughtfully

"And yet I tower here; their hands have raised me,
The very gain I mock has been my purchase,
Given by them in memory of their fellows
Who gave their lives, in charity unbounded.

Exultantly

"Beneath the agony of strife and turmoil,
Hidden so deep it passes oft unnoticed,
Burns surely in each heart the flame of Heaven,
Welding their lives to God and to each other.
I stand, symbolic of man's recognition
That brother love still lives and still must conquer."

—*Edward Hale Bierstadt.*

THE MARCONIGRAPH

An Illustrated Monthly Magazine of WIRELESS TELEGRAPHY

Published by

THE MARCONI PUBLISHING CORPN.,

456 Fourth Ave., New York.

JOHN BOTTOMLEY, President. JOHN CURTISS, Treasurer.

J. ANDREW WHITE, Editor.

SUBSCRIPTION

$1.00 PER ANNUM IN THE UNITED STATES

$1.85 PER ANNUM OUTSIDE THE UNITED STATES

SINGLE COPIES, 10 CENTS

Forms close the 15th of each month. Advertising rates on application.

The Editor will be pleased to receive original articles of timely interest pertaining to Wireless Telegraphy and Telephony. Articles accompanied by good drawings and clear photographs especially desired. If accepted, such articles will be paid for on publicaton, at regular rates.

No manuscripts will be returned unless return postage is enclosed.

Vol. I. MAY No. 8

Editorial

In the normal course of development the wireless telephone will probably be next on the list of modern achievements. Through the experiments of Professor Vanni, in Rome, and Professor Pierce, in Cambridge, the world has learned something of the difficulties that at present stand in the way of radiotelephony for general use. It but remains to overcome these. And as precedent has shown that time will bring the solution of most any minor problem we may confidently look forward to a practical wireless telephone at no distant date.

Whatever renders the wireless telephone possible, whether it arises from the old discovery that an electrical current can penetrate the earth and sea, or by some new device improving on the aerial current in use, such an exploit unfolds a vision of the vastest possibilities.

Perhaps too freely we prophesy the speedy evolution of the commercial wireless telephone. But when we recall how many equally difficult tasks have been accomplished within the past few years it is a pretty safe guess that many of us will soon be talking by wireless with friends in European cities.

Inventions follow the rule that the first step is the hardest. They multiply in ease according to the ratio of their progress. The first telephone used but a few yards of thread. The first wireless message carried but a few hundred feet. According to reports, the voice has been carried by radiotelephone across the Mediterranean, a distance of seven hundred miles. The present equipment of wireless telegraph stations can receive telephone messages. So all that is needed is the designing of practical sending apparatus, and as the initial experiments give substantial grounds for believing that its future history will compare favorably with the known progress made in other departments of scientific research, it is not unreasonable to expect the practical wireless telephone before many months have elapsed.

* * *

The lack of wireless telegraph stations on land, especially in the immense districts subject to periodical inundations, is one of the most significant things revealed by the great natural calamity in the Middle West.

Dozens of American cities, towns and villages were completely cut off from the rest of the country when the ordinary wire telegraph and telephone systems were interrupted by the great floods. The regular Marconi stations proved of great assistance but if each town in the devasted valleys of Ohio and Indiana had contained one small but efficient wireless set communication could have been established with more powerful apparatus in the nearest unaffected cities and the country would have been kept informed of the fate of whole populations and other neighborhoods could have been warned of the advancing floods.

It is difficult to understand how so many communities in one of the most prosperous and populous parts of the country could be so absolutely isolated in the supreme hour of need. Wireless telegraphy has so definitely established its usefulness that it gives cause for wonder why the various Business Men's Associations and Boards of Trade have not provided for the erection and maintenance of at least one local station.

This vital question should be brought up at the next meeting of each of the many civil improvement organizations scattered throughout the section.

* * *

Representative Cary has introduced in the House a bill authorizing the installation of apparatus and operators for radio communication at all life saving stations, providing for a continuous watch through day and night.

The bill has been referred to the Committee on Interstate and Foreign Commerce, and it is to be hoped that no opposition will be found to this excellent measure designed to increase the usefulness of the justly famed life saving service of the United States.

* * *

Rumors that there was serious friction between groups of the American delegates at the recent international wireless conference at London, have been verified by Dr. Arthur Gordon Webster, of Clark University, who was asked point blank by the American Philosophical Society to confirm or deny the reports.

The controversy resulted in two reports being filed with the government, one signed by John I. Waterbury, William D. Terrell and Dr. Webster, the delegates of the Department of Commerce and Labor, immediately after the close of the conference, and the other more than three months later by the delegates of the army and navy, headed by Admiral John R. Edwards.

"The facts in the case are simply these," said Dr. Webster: "The three delegates representing the Department of Commerce and Labor, and the army and navy delegates, headed by Admiral Edwards, failed to agree in two essential particulars. The Commerce and Labor delegates were impressed with the vital importance of getting a report home as quickly as possible. Congress was then in session. Important legislation bearing upon wireless telegraphy was before it. In fact, in the discussions of the conference itself we had repeatedly urged as speedy action as possible, on the specific ground that our Congress was then considering wireless legislation, and it was of importance that the decisions of the conference be placed before our national legislators with as little delay as possible.

"We urged the matter repeatedly before our colleagues of the American delegation. In fact, I am convinced that most of them were impressed, as were we, with the necessity for quick action, but then there arose the second difference of opinion. We of the Department of Commerce and Labor felt that our report should cover only those broad international subjects which the International Wireless Telegraphy Conference was assembled to discuss. We could not look upon it otherwise than as at least irrelevant, if not actually improper, for us to sign a report recommending this, that or the other to the various departments of our government.

"For instance, I know nothing of military or naval matters. It seemed to me a sheer impertinence for me to sign a report recommending certain specified action by the Navy or War Department. That was the rock on which we split. The delegates representing the navy insisted on these departmental recommendations being embodied in a general report. I, for one, would not sign such a report. My colleagues of the Department of Commerce and Labor were of the same mind. So we three decided to send in a report of our own, and to send it in as quickly as possible.

"On July 5 the conference closed. On July 10 our report was on the water. It reached Congress in time for immediate action. Important changes were made in measures then before Congress, and these measures, enacted into a law, were approved by President Taft on August 13 last. This law, therefore, embodying the results of the London conference, was in full force and operation nearly three months before our colleagues of the army and navy turned in their report—the report which we of the Commerce and Labor Department were invited, but refused to sign.

"This would seem to fully justify our view as to the necessity for speedy action. The report of October 30 is practically a military report, and little else, unless it be the various eulogies it contains, about which there need be no comment. But we did not feel authorized to sign a military report, and we refused to do so."

It is to be hoped that there will be no friction between the delegates at the coming conference at London, and from the careful preparations which are being made it looks as if this will not occur again.

* * *

Secretary Redfield is in receipt of a statement from the Bureau of Navigation showing that during the first four months of the operation of the act to regulate radio communication, which took effect on December 13, 1912, the Department of Commerce, through the Bureau of Navigation, has issued 3,407 licenses to wireless operators and stations in the United States. The first grade commercial operators' licenses number 1,279 and the second grade 186, while 1,185 amateurs have been licensed, although work with the latter class has been delayed to push the licensing of commercial stations and operators.

The Bureau of Standards has designed special testing instruments to measure wave length, decrement, etc., to reduce interference and insure the orderly use of radio communication, and these instruments are now being put into the hands of the ten inspectors in the field.

Thus far forty-six American ship stations and eighteen coast stations have been licensed, and this branch of the work will now proceed more rapidly. Six hundred and eighty-five amateur stations have been licensed.

The Share Market

NEW YORK, April 29.

The trading in Marconi issues has been very light during the past few days and so few sales have been reported that it is difficult to secure accurate quotations.

From reliable sources, however, it is learned that the stocks are holding firm at the following bid and asked prices:

American, 5¼—5½; Canadian, 3⅝—4; English, common, 20—21; English, preferred, 17½—17⅝.

Ground Broken for Biggest Marconi Station

Work on the trans-atlantic station of the Marconi Wireless Telegraph Company at the Reynolds farm on the River Road, near New Brunswick, N. J., has progressed to the extent of placing materials on the ground for a construction house. Chief Engineer Sammis has also rented one of the farm buildings of the Reynolds farm to be used as a tool house.

The progress of the actual building of the masts which are to hold the wires receiving marconigrams will depend largely upon how soon the Somerset Board of Freeholders lays the new macadam road from that city to the wireless station.

The Freeholders have practically decided to build the road, it is understood, and only minor details are holding it back. It can safely be said that the road will be laid before the end of the summer, as it is almost absolutely essential to the building of the plant, because of the tremendous proportions of the task. All of the material will have to be hauled from the company's plant, and the road is in such bad shape that this would be almost impossible.

The masts will be in reality steel towers, built in trestle design, somewhat like the military masts on the newer battleships, or small Eiffel towers. There will be thirteen of them, one located on the meadows and twelve running back from the river over the hills, a distance of a mile and a half. The twelve on the hills will be 400 feet high, and the one on the meadows will rise at least 50 feet higher.

Each tower will have four stays of heavy cable and each stay will be anchored to forty tons of cement and trap rock set in the ground. This will mean 2,080 tons of "anchor" alone that will have to be hauled to the station, without counting the steel of the towers and their foundations. Also there will be an operating building constructed on the meadows. It will take the best part of a year to complete the plant. When completed it will be the most powerful transmitting station in the world.

The residents of the section are advocating the adoption of "Marconi Highway" or "Marconi Boulevard" as a fitting name for the new macadamized road.

Wireless Heralds Opening of Woolworth Skyscraper

President Wilson, from the White House in Washington, gave the signal for the formal opening of the new Woolworth building, the tallest business structure in the world, in which the executive offices of the American Marconi Company are now located. At 7:29 on the evening of April 24, when the 900 guests who had been invited by the owner, Frank W. Woolworth, to a dinner in honor of the architect, Cass Gilbert, were seated at the tables on the twenty-seventh floor, a telegrapher of the Western Union, stationed there, notified the operator in the White House that all was ready for the President to press the button. One minute later President Wilson touched the instrument, closing the circuit, which caused a bell to ring in the banquet hall and in the engine room, thirty stories below, and immediately and for the first time lights flashed from every floor of the fifty-five stories, from the sub-basement, 37 feet below the street level, to the top of the tower, 792 feet above the street.

Professional and business men, the arts, science and literature, were represented in the gathering to make notable an enterprise costing $13,500,000 and having its beginning in the investment of a few hundred dollars, all the outcome of a 5 and 10 cent trade.

A special kitchen and service had been installed for the occasion. It was probably the highest skyscraper dinner ever held in the world. Among the speakers who were seated at the Park Place and Broadway corner, were F. Hopkinson Smith, the novelist, who presided as toastmaster; Frank W. Woolworth, the owner of the building; Cass Gilbert, the architect; Louis J. Horowitz, the builder; William Winter, the veteran writer and dramatic critic, and Patrick Francis Murphy. After the President had pressed the button, a toast was drunk to him, and an orchestra played the "Star-Spangled Banner." as a message heralding the formal opening of the building was sent broadcast from the Marconi station at the top of the building.

Bids for Wireless on Canal Zone Opened

Bids were opened at the Navy Department on April 12, for the construction of the towers and buildings for the great wireless plant which the Government purposes to erect in the Canal Zone. The plant will be a duplicate of the one recently completed at Arlington. It will be located on the San Pablo site, at the station of Caimito, on the relocated line of the Panama Railroad, about midway between the terminals. There will be three 600-foot steel towers and the station will be equipped with a 100-kilowatt radio set. It is calculated that the new station should be able to communicate easily with similar high-power stations to be erected by the navy in the Hawaiian Islands, Samoa, Guam and in the Philippines.

Wireless Pioneer Dead

Prof. Adolf Slaby, electrical expert, is dead in Berlin. Professor Slaby was at one time a co-worker with Marconi in experiments in wireless telegraphy. A German system of wireless is based on Professor Slaby's discoveries.

Calls Marconic the Best System

THE report of the technical committee appointed by the Postmaster General to consider various systems of long-distance wireless telegraphy, particularly in relation to the proposed imperial chain of wireless stations, was issued on May 1.

According to a wireless despatch from London to the New York *Times,* the report says.

"The Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the imperial chain."

The committee considers wireless telegraphy to be in a condition of rapid development and thinks it undesirable that the Post Office should be pledged to the continued use of any existing apparatus, or subject to any penalty by way of continued royalties. With a trained staff and with an engineer of special knowledge and standing at the head for testing, and, if necessary, further developing any new invention or improvement, the committee sees "no reason why the Post Office wireless stations should not be ultimately equipped with apparatus far more efficient than that now used in any so-called system, more especially as the Post Office will be able to combine, in spite of existing patent rights, apparatus or devices which, because of the existence of such rights, cannot now be combined by any one else."

The committee also investigated the following wireless systems: Telefunken, Poulsen, Goldschmidt, and Gallette.

One of the Post Office requirements is for continuous communication by day and night over land and water for distances ranging from 2,000 to 2,500 miles. The companies controlling the various systems were invited to give practical demonstrations. The report says:

"Except in the case of the Marconi system we did not obtain any demonstration on a commercial scale, or any demonstration over a distance of even 1,000 miles."

In order to test the Marconi plant, a continuous watch was kept for a week by skilled operators on the actual commercial working between Clifden and Glace Bay. The report says:

"The Marconi Company, we are satisfied, is working on a commercial scale between Clifden and Glace Bay. We were present when messages were transmitted automatically at the rate of fifty words (of five letters) a minute. We see no reason why the rate should not considerably increase if it becomes necessary."

With regard to the Telefunken system, the committee reports that its practicability on a commercial scale for a distance of 2,000 miles has not yet been proved.

It is satisfied that the Poulsen system is practicable for short distances, but, though it has been tried between San Francisco and Honolulu, there is no evidence regarding its practicability.

The committee reports that the Goldschmidt system is, no doubt, successful over short distances.

No evidence regarding the practicability of the Gallette system, even over short distances, was forthcoming.

WIRELESS ENGINEERING COURSE

By H. Shoemaker

Research Engineer of the Marconi Wireless Telegraph Company of America

CHAPTER V.

In the preceding articles I have treated the resistance of conductors carrying alternating currents as if it had the same value of resistance that it would have for steady currents.

For small conductors and low frequencies these values are the same, but for the higher frequencies and large conductors the resistance will have a greater value.

The resistance of a given conductor increases with the frequency, and for a given frequency the ratio of the resistance (R) for steady current to the resistance (R′) for alternating current, increases with the diameter or cross section of the conductor. This is due to the fact that with steady current the current density or distribution of the current is uniform throughout the cross section of the conductor, while with alternating currents the current is not uniformly distributed, as it takes a certain time for the current to penetrate into the interior of the conductor. This phenomena is very pronounced with high frequency currents, and with frequencies of the order of a million the currents do not penetrate the surface more than a few hundreths of a centimeter, therefore, the interior of the conductor is useless as a conductor and will have the same resistance as a very thin shell or tube of the same diameter.

The ratio of R to R′ also depends on the magnetic property of the conductor or its permeability (μ) and its specific resistance (ρ), which depends on the material of which the conductor is made.

For frequencies of lower order, such as are used for lighting and power purposes, the resistance R′ does not differ very much from R.

The following formula and table of constants will enable the reader to calculate the ratio of R to R′ for frequencies of the lower order. This table and formula is taken from the hand-book for the Electrical Laboratory and Testing Room by J. A. Fleming, Vol. 1, page 318.

$R' = k\,R$

Where k is a constant depending on

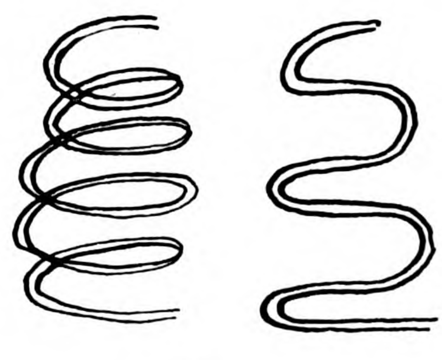


Fig 16

the frequency n, the diameter d of the conductor and its specific resistance p. The following table gives the values of k for different values of nd^2. This table is calculated for copper and the product nd^2 must be divided by the ratio of ρ for any other material to ρ for copper.

Thus, if the conductor has three times the specific resistance of copper, $\frac{nd^2}{3}$ should be used instead of nd^2.

nd^2	k
0	1.0000
20	1.0000
80	1.0001
180	1.0258
320	1.0805
500	1.1747
72C	1.3180
980	1.4920
1280	1.6778
1620	1.8628
2000	2.0430
2420	2.2190
2880	2.3937
5120	3.0956
8000	3.7940
18000	5.5732
22000	7.3250

The value k for intermediate values of nd^2 can be found by interpolation or by constructing a curve from the above table, with nd^2 values as abcissas and k values as ordinates. By keeping the frequency n constant and varying d, curves can be plotted, showing the variation of k with d for a given frequency, or d may be kept constant and n varied, in which case the curve will show the variation of k with a variation of frequency.

While the above is not of great practical importance when frequencies of the lower order are used, it becomes of considerable importance when frequencies of higher order are used.

By using stranded conductors made up of small wires this change of resistance with frequency is prevented to a great extent.

In the above table the permeability μ is considered unity, and the formula only holds for non-magnetic materials. If iron is used as a conductor, k is greatly increased. If materials having greater value for ρ are used, then the value for k is decreased.

Conductors made of materials having a high specific resistance do not vary in resistance with the frequency to as great an extent as copper.

The resistance of a conductor expressed in terms of C.G.S. absolute electro magnetic units is:

$$R = \frac{\rho l}{S} \qquad (16)$$

Where l is the length in Cm. and S the cross section in sq. Cm. $S = d^2 \times .7854$ or $\frac{\pi d^2}{4}$ d = diameter of the conductor.

Substituting $\frac{\pi d^2}{4}$ for S in (16) we get

$$R = \frac{4 \rho l}{\pi d^2} \qquad (17)$$

This formula enables us to calculate the resistance of a conductor when we know its length, diameter or cross section and the specific resistance of the material of which it is made. The result obtained from the above formula will be in centimeters and must be divided by 10^9 to reduce it to ohms. For copper wire ρ is 1600 and the resistance in ohms would be:

$$R = \frac{6400 l}{\pi d^2} / 10^9$$

For high frequencies of the order of 10^6 the resistance (R^1) is expressed by,

$$R^1 = R \sqrt{\frac{p \mu S}{2 \rho}} \text{ or} \qquad (18)$$

$$R^1 = R \sqrt{\frac{p \mu \pi d^2}{8 \rho}} \qquad (19)$$

For non-magnetic wires or conductors μ will be unity and

$$R^1 = R \sqrt{\frac{\rho \pi d^2}{8 \rho}} \text{ or}$$

$$R^1 = R \frac{\pi d}{2} \sqrt{\frac{n}{\mu}} \qquad (20)$$

Therefore:

$$\frac{R^1}{R} = \frac{\pi d}{2}\sqrt{\frac{n}{P}} \quad (21)$$

If we substitute for P its value 1600 (For copper) in (20), then:

$$R^1 = R\frac{\pi d}{80}\sqrt{n} \quad (22)$$

The above formula holds for frequencies of the order of 10^6 and for straight conductors having diameters exceeding 1 Cm. For conductors wound in spirals or coils of small diameter the high frequency resistance will be further increased. These formulae therefore cannot be used with great accuracy for determining the high frequency resistance of coils of small diameter ad closely wound.

The following table, taken from Prof. Pierce's Principles of Wireless Telegraphy, page 338, will give the reader an idea of how $\frac{R^1}{R}$ varies with the size of wire and increase of specific resistance.

TABLE FOR RATIO OF $\frac{R^1}{R}$.

R^1 = Resistance for 1,000,000 oscillations per second.

R = Steady-current resistance.

Diameter in Cm.	Copper P=1,600.	German Silver P=20,900.
.01	1.008	1.000
.02	1.117	1.000
.03	1.32	1.000
.05	1.95	1.000
.1	3.88	1.005
.2	7.85	1.09
.3	11.8	....
.4	15.7	4.30
.5	19.7	5.38
.6	23.6	6.5
.7	27.5	7.5
.8	31.	8.6
.9	35.	9.7
1.0	39.	10.7
1.5	59.	16.
2.0	79.	21.5

From the above table it will be seen that for high frequencies, conductors having a diameter over .05 cm., the resistance varies nearly in the inverse ratio of the diameters while with steady current it varies inversely as the square of the diameter. In the first case the resistance decreases as the circumference of the conductor increases and in the second case it decreases as the cross section increases.

It will also be seen that the copper conductors having a diameter .01 cm. and under, the high frequency and lower frequency are the same. For conductors having high specific resistance as German silver; the high and low frequency are practically the same for conductors having diameter up to .1 cm.

Those who have come into contact with the wireless apparatus have no doubt noticed the fact that conductors in the high frequency circuits get hot while the amount of energy used is not over one or two thousand watts. These conductors are of large size and would take a steady current of the order of a hundred amperes to heat it, to the same temperature.

The resistance of these conductors to the high frequency current is 40 or 50 times that to a steady current. To prevent this waste of energy is now the general practice to make conductors carrying high frequencies, of a great number of small wires insulated from each other and so placed that the conductivity of each will be the same. This is accomplished by laying the wires around a cotton or hemp center, thus forming a conducting shell. Flat conductors having a thickness of .004 or .005 inches have practically the same resistance for high and low frequency.

As alternating currents of both high

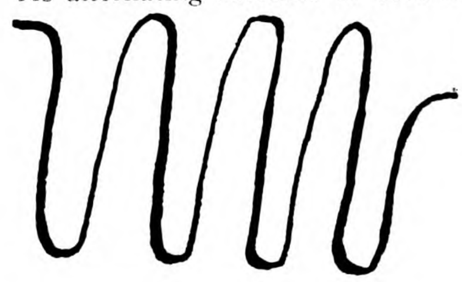


FIG 17

frequency and low frequency are generally measured by thermal instruments which indicate the amount of energy dissipated in a conductor, it is necessary to use a form of conductor whose resistance is constant and has sufficient carrying capacity for large currents. In some forms of instruments, such as wavemeters or standard circuits it is also necessary to keep the resistance constant for all frequencies. This is accomplished as above stated, by making the conductor of a great number of small wires. The exact form which these conductors have taken will be treated in a later chapter, and as apparatus in which they are used is described. The reader is referred to Chapter II of Principles of Electric Wave Telegraphy, By J. A. Fleming: for a more complete treatment of this subject.

Where resistance is used in alternating current circuits it must be non-inductive if it is used for measuring purposes. If it is wound in the form of a coil its effect on the circuit carrying alternating current will be equivalent to a resistance and inductance in series. This effect increases with the frequency.

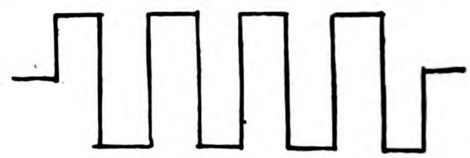
Resistance coils or units can be constructed so as to have practically no inductance. They are then said to be non-inductive. There are a number of forms which these units can take. Fig. 16 represents a form generally used in instruments for low frequency work. This form has considerable capacity where the wire is small and of great length.

In this form the wire is doubled back and wound on a form, so that the current flowing through the wire will be in opposite direction in each half of the wire at the same time. These halves are so close together that the magnetic fields set up in them neutralize each other with the result that there will be no magnetic flux around the wires.

Fig. 17 shows another form in which the wire is folded back on itself in such a manner that the magnetic effect is completely neutralized. In this form the capacity effect is very small as the two ends are at considerable distance apart.

If a one layer coil is wound on a paper cylinder and then flattened so that the enclosed area is reduced to the thickness of the paper then the inductance will be practically zero.

ORDINARY RESISTANCE



NON-INDUCTIVE RESISTANCE

Resistance is represented in circuit diagrams as shown above.

(To be continued.)

This course commenced in the December, 1912, issue.

Icebergs and Wireless on the Atlantic Ocean

Since the terrible *Titanic* disaster of April 15, last year, a great deal of interest has been centered on the danger to trans-atlantic steamship traffic by the presence of icebergs, and means of reducing the danger to a minimum.

The old sailing steamer *Scotia* has been sent out to patrol the iceberg region and to go north along the coast of Newfoundland and investigate the conditions in that district, so that iceberg forecasts for the steamship route may be made.

The United States Government steamers *Seneca* and *Birmingham,* it is understood, are also to assist in this work, and it seems that everything possible is being done to safeguard the Atlantic greyhounds from the icebergs.

The governments will now institute a system of weather and iceberg reports to be transmitted to all trans-atlantic steamers by wireless telegraphy.

For this service to be of any utility to inward bound steamers it would be necessary that the messages should be communicated to the steamers by the Cape Race station before the steamers enter into the iceberg region. This would require the Cape Race station to communicate a distance of 500 or 550 miles.

The Cape Race Wireless station is owned by the Canadian Government and operated for the Government by the Canadian Marconi Company. The Canadian Marconi Company is obtaining remarkable results from the equipment at Cape Race, which is not of the most modern type, but has so far been unable to increase the range of the station sufficiently.

It appears that considerable alterations will have to be made; the height of the masts increased and probably more modern apparatus installed before the desired results can be obtained.

It is to be hoped, however, that the importance of this station and the excellent service it could perform will not be overlooked by those interested in the safety of trans-atlantic steamers, and that Cape Race will very soon have a wireless equipment such as is called for by the importance of its position, commanding as it does the whole of the grand banks of Newfoundland, the most dangerous portion of the Atlantic Ocean.

An Objection

A Marconi operator whose experience qualifies him as one of the company's most expert telegraphists takes exception to the article by J. C. S. Tompkins which appeared in the April issue of THE MARCONIGRAPH under the title, "Some Simple Improvements," and suggests that for the benefit of the operators some corrections be made.

Fig. 1 is a sketch showing the actual connections of the type D tuner, giving the sliders and their connections to the receiving circuits. The article states that unless one is at a considerable distance from high power stations using long wavelengths it is impossible to tune with them. Tuning to a given

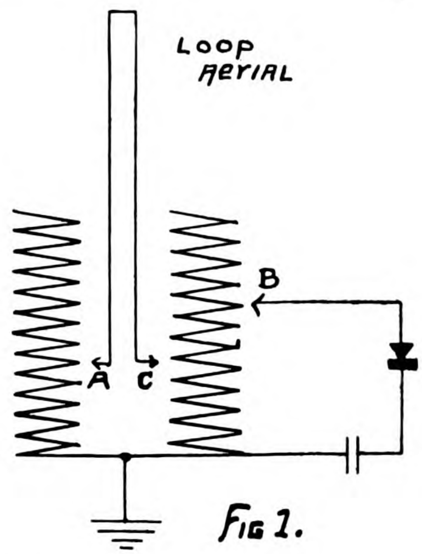


FIG 1.

transmitting station is not a matter of distance, and if one is able to tune to a high power station at a great distance he should also be able to tune them in at a lesser distance.

The aerial connection on the right hand side of the loop is not connected to the B slider, as the article stated, but is connected to the C slider; the B slider being the one which controls the local detector circuit.

The article in question would have us believe that when the A slider is pushed off the inductance, leaving one side of the loop open, the antenna has a long wavelength, principally due to the fact that the linear length of the antenna is twice its original amount. This is misleading. Having made tests of the wavelength, both with a looped antenna connected in the regular manner (Fig. 1), and then made another wavelength reading, with one side of the loop open just as the article suggests, I learned that in the first case the wavelength was 875 meters, and in the second case 930 meters; showing that disconnecting one side of the loop gave an increase in wavelength of but 55 meters. The reason such a slight increase is to be had lies in the fact that the antenna doubles back upon itself, and the end of the loop on the side which is disconnected from the receiving apparatus vibrates along with the other wire practically the same as

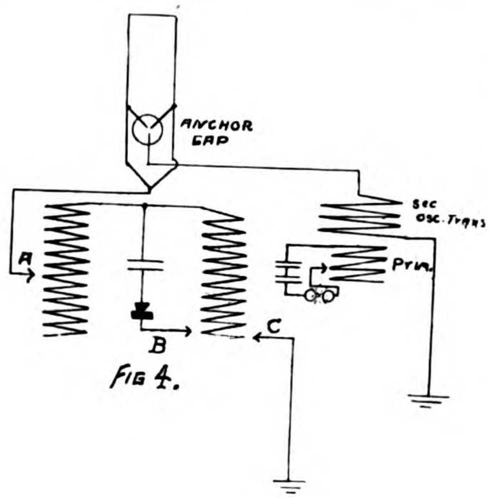


Fig 4.

if it were connected to it. The very fact that the wavelength increased but 55 meters in this particular case demonstrates this contention.

There is no doubt that better results were obtained on the long wave lengths when the A slide was pushed off the inductance coil leaving one side open, and exception is taken only to the statement that by doing so the wave length of the antenna is considerably increased. It should be known that while the theory or action of the loop is not thoroughly understood, it is certain that the "looped" antenna has none of the characteristics of the ordinary plain aerial.

The closing paragraph in the article refers to still a different manner of changing the wave length, by screwing the anchor gap points together as shown in Fig. 2, and disconnecting the earth lead.

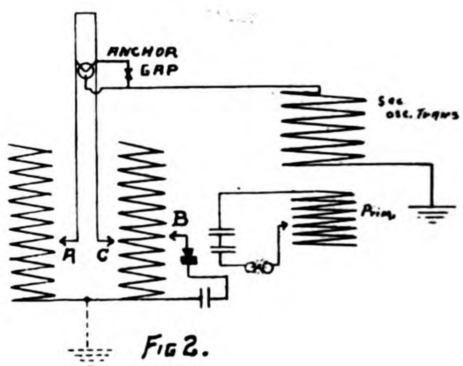


Fig 2.

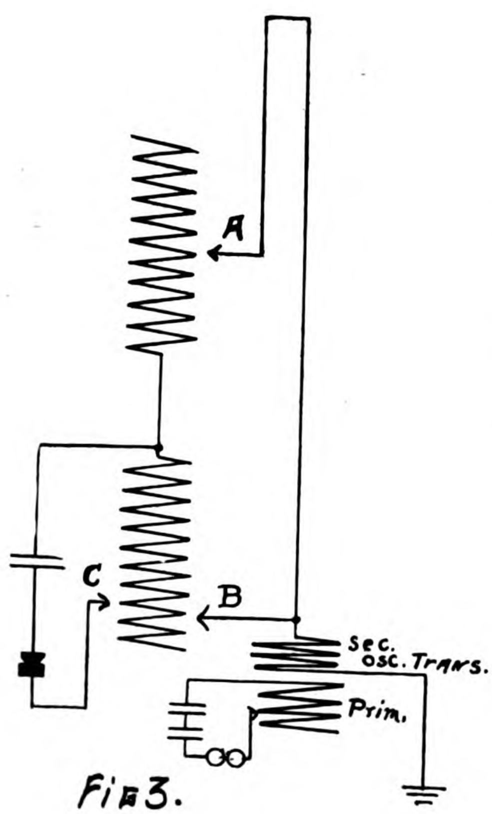


Fig 3.

Fig. 3 shows what this is in effect and under such conditions one has in reality three tuning inductances in series and one side of the antenna connected direct to the earth through the helix. To really get the best results on the longer wave lengths the type D tuner should be connected as shown in Fig. 4, in which it will be noted that there are no dead ends from the antenna near the wireless station, and that the coil of inductance under the A slider is used as a loading coil for the inductance which supplies energy to the detector circuits. Fig. 3 cannot possibly give any advantage over Fig. 4 and as recent experiments have determined, if it is connected as in Fig. 4 it is possible to tune in wave lengths as long as 5,500 meters with efficiency.

Note that the earth lead is connected to the C slider.

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.

J. E. F., Brooklyn, writes:

(1) Please show data for finding the pull of an electro-magnet.

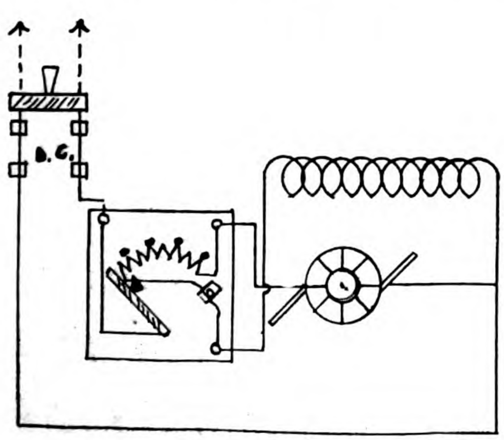
Ans.—The pull of an electro-magnet can be determined from a formula give by Silvanus Thomson in his book on Elementary Electricity and Magnetism. It is:

$$P = \frac{B^2 A}{8}$$

P = pull in dynes.
A = the area in square centimeters.
B = the lines of force per square centimeter.

Having secured the pull in dynes the pull can be converted into pounds per square inch. The pull of a pound represents 445,000 dynes, consequently the formula can be converted to pounds per square centimeter which in turn can be changed into pounds per square inch.

The number of lines of force per square inch given by the electro-magnets can be calculated from the ampere turns. Elements of design and somewhat elaborate formulæ must be taken into consideration, but these require too much space to be dealt with here. We refer you to pages 374 to 381 in the book mentioned which should answer your question more fully.



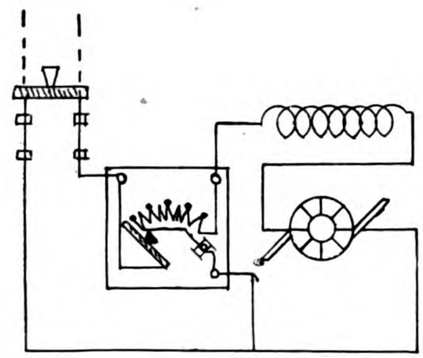
Shunt Wound Motor.

(2) Please show connections of a shunt wound motor with starting box.

Ans.—We give a sketch herewith.

(3) Please show connections of a series wound, also with a starting box.

Ans.—A sketch is also given.



Series Wound Motor

(4) Why is it almost impossible to send out a wave of 60,000 or 70,000 meters? Also, I have read of a new method discovered to do this—is this true?

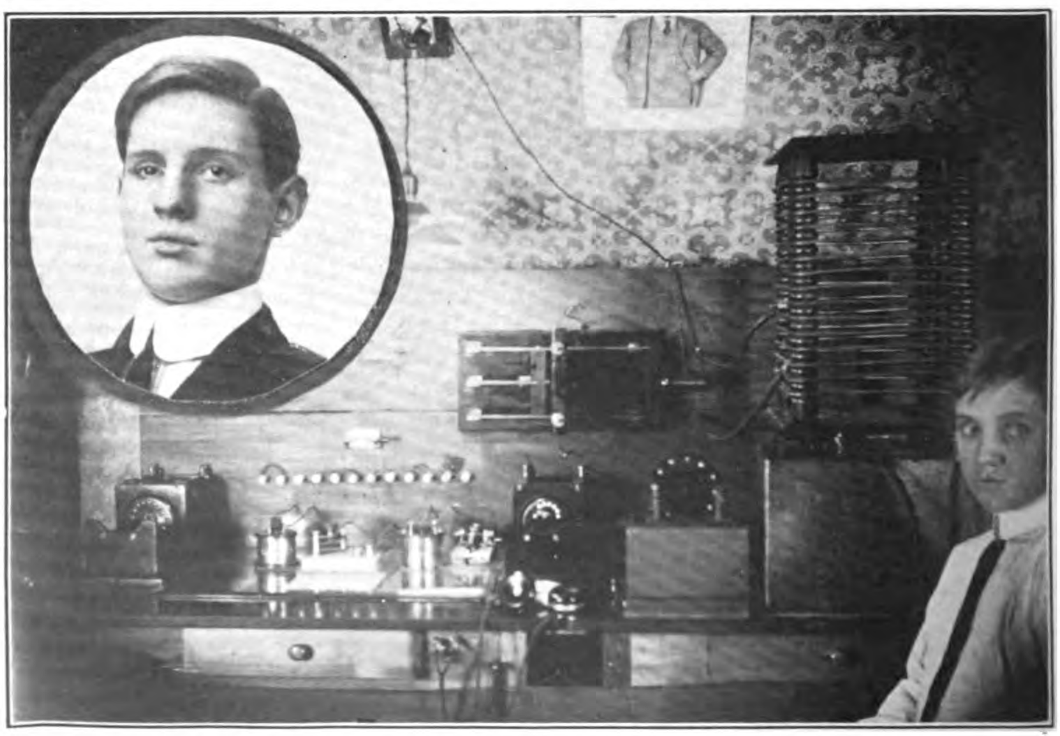
Ans.—It is quite possible to send on a wave-length of 60,000 meters provided the antennæ is long enough to place it in tune with such a transmitter. In ordinary practice a wave-length of 60,000 or 70,000 meters would require a very high power station and a very large condenser to give a wave-length as long as this, but the principal difficulty would be with the antennæ. An antennæ to be in tune with it would have to have a linear length of about 15,000 meters or 45,000 feet, approximately nine (9) miles in length. The new method referred to uses the antennæ grounded at the farther end through a condenser which in effect gives a closed oscillatory circuit, consequently a wave-length of 60,000 or 70,000 meters can be secured without such a large antennæ.

AMATEUR CLUB NEWS

In this department the affairs of the various wireless clubs and associations will receive attention. Believing that all amateurs are interested in the experiments and research work of others the publishers plan to give readers each month distinctive items on the progress made by club members, thus offering all an exchange of ideas in organization and experimental matters and bringing students in closer touch with each other. To this end we will also publish a Wireless Club Directory. The names of the officers and the street address of the secretary are requested from all clubs. Notification of any changes should be forwarded at once. Short descriptive articles of experiments or new stations with distinctive features, accompanied by drawings or photographs, will be published.

The large photograph on this page shows the 2 kw. wireless station owned by Frank Wheddon Heinrichs, of Pittsburgh, and largely of his own design and construction. The appearance of this set, however, is very different from the one he first experimented with.

"With an old rolling pin and a salt box, which I obtained from the kitchen," says young Heinrichs, "I made a double slide tuning coil. I wound No. 22 D. C. C. wire around the rolling pin, used the sides of the salt box for ends and, having purchased a few feet of 1/4 inch brass rod, I soon had a very fair wireless instrument. I built a condenser of tin-foil and wax paper in sections and by means of a five-point switch converted it into a



THE LARGEST AMATEUR STATION IN PITTSBURG, AND ITS OWNER variable condenser Other necessary instruments were made in the same ungainly fashion. But when all were finished I had a station that would work, and although the results were by no means wonderful, I was very much elated over my success and determined to build a real station.

"I went about its construction in an entirely different manner. I drew my plans first, and when the size of the table and position and number of instruments was arranged on paper I began to read everything I could obtain about wireless telegraphy. After a few weeks of careful study I had a pretty fair idea of what I wanted to do.

"My aerial was built first. I made it of eight strands of No. 14 bare copper wire, 100 feet long, and spaced the wires two feet apart. I used eight electrodes and 42 porcelain cleats, 10 cleats being used to insulate the stay wires which kept the aerial from rocking.

"The transformer came next, and in its construction data given by A. P. Morgan was followed to a large extent. This was a very hard undertaking, for I had no lathe on which to do my winding, and had to cut each piece of core iron by hand. There were 10 pounds of No. 30 enameled wire in secondary and 100 double turns of No. 12 D. C. C. on primary. The whole was immersed in oil to insure perfect insulation and high efficiency.

"The condenser was of the rack type. There were eleven glass plates 18 inches by 24 inches, having sheets of tin-foil 12 inches by 18 inches on each side. Mahogany stain and a few coats of varnish gave the condenser a very pleasing appearance.

"The helix consisted of 15 turns of ¼ inch copper wire wound around four 16 inch corrugated electrose insulators. The base and top were of finished mahogany, the whole being insulated from the table by four small blocks at the base.

"The rotary gap is a disc five inches in diameter, of hard fibre, having 12 points and being revolved at the rate of 10,000 R. P. M.

"The aerial switch, which is plainly shown in the picture, was made entirely of pure hard rubber 1 inch in thickness.

"The key purchased from the Murdock company and the hot wire meter from Brandes I have found to be valuable instruments in any station.

"The parts of the receiving set were all purchased except one of the loose couplers, which I made myself. I have not gone very much into detail, but I think the average wireless enthusiast will easily understand my explanations.

"With this station I have picked up Panama, Key West, Cuba, Washington, Brooklyn, New York and many other distant stations. Working with about half power, I can easily send 200 miles under fair conditions."

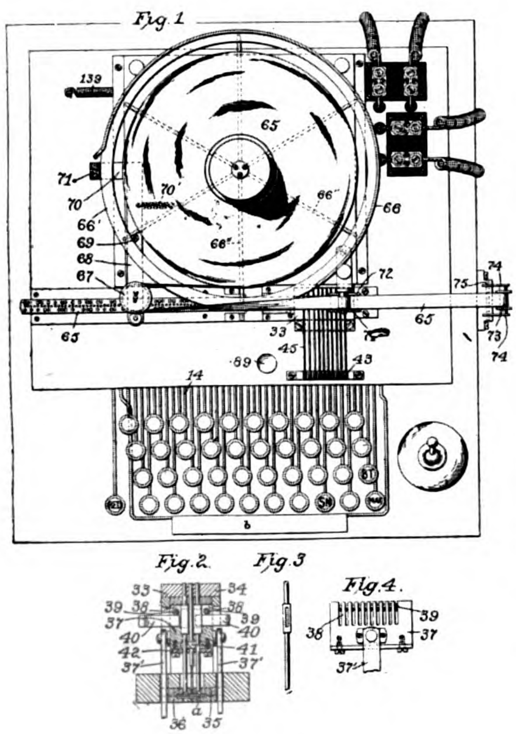
Wireless Club Directory

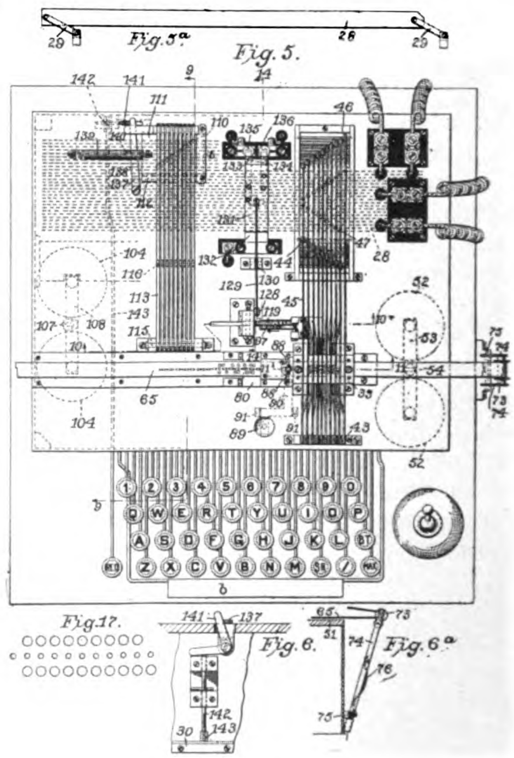
OMITTED THIS MONTH.

Notable Patents

John Gell, of London, has been granted a patent on an improvement upon his apparatus for perforating tape for automatic telegraph instruments. The specification discloses the following features:

In the accompanying drawings Fig. 1 is a plan view of the apparatus with the roll of tape in place; Figs. 2, 3 and 4 are detail views relating to the punches and the slider for operating them; Fig. 5 is a plan view of the machine with the roll of tape removed; Fig. 5ª is a detail view of one of the parallel selecting bars; Fig. 6 is a detail view of the means for adjusting the selecting pins for reducing the tape feed; Fig. 6ª is a detail view of tape take-up or tension means; Fig. 7 is a view of the housing for the punches and the connections for interlocking the punches with the slider for operating them; Fig. 8 is a view similar to Fig. 7, showing a plurality of sets of punching mechanisms to be operated simultaneously for perforating a plurality of tapes; Fig. 9 is a view substantially on the line 9—9 of Fig. 5 of the differential check or stop mechanism of the tape-feed-means; Fig. 10 is a sectional view at right angles to that of Fig 9 and substantially on the line 10—10 of Fig 5 with parts in elevation; Fig. 11 is a sectional view substantially on the line 11 of Fig. 5, but with some of the parts in elevation; Figs. 11ª, 11ᵇ, 11ᶜ and 11ᵈ are detail views relating to the tape feed wheel and presser foot mechanism; Fig. 12 is a bottom plan view of portion of the main plate of the fulcrum bar for the key levers, with some of said levers in place; Fig. 13 is a top view of the bottom plate of the fulcrum bar for the key levers; Fig. 14 is a view substantially along the line 14—14 of Fig. 5 of the contact key, with said key and other parts in elevation; Figs. 15 and 16 are, respectively, a plan and sectional view of the means for securing either a reduced or an increased feed of the tape; Fig. 17 is an enlarged view of diagrammatic form showing the group of the marking hole, spacing hole, punches and intermediate feed hole punches.





The arrangement of the finger keys is substantially the same as that disclosed in the patents above mentioned, excepting in the particulars hereinafter specially mentioned.

The key levers 14 are fulcrumed in a differential fulcrum bar consisting of the main portion 15 and the bottom plate 16 held thereto by the screws 17. The main plate or bar is formed as shown in Figs. 9 and 12 by grooving it longitudinally as at 18, and transversely as at 19, the transverse grooves being deeper, as shown in Fig. 9, than the longitudinal grooves. The key levers lie in the transverse grooves, while the fulcrum pins 20 fixed in the key levers lie in the longitudinal grooves, being confined by the walls thereof and bearing upon the bottoms of these grooves. The bottom plate, as shown in Fig. 13, is formed so as to leave projecting longitudinal ribs 21, and as transverse grooves are also formed at 22 in this plate, there are provided a series of projections 23 which, when the bottom plate is in place and secured by the screws passing through the registering holes at 17' will enter the spaces of the main bar and bear on the fulcrum pins 20 of the key levers, thus affording fulcrum points upon which the said pins may turn, the extra depth of the transverse grooves in the main and bottom bars permitting the key levers to have the necessary amount of vertical swinging movement therein. As indicated in Fig. 12 the fulcrum pins of the key levers are arranged in echelon, being thus positioned according to the varying lengths of the key levers so that they will all have the same terminal lift.

The key levers operate vertical rods 24 guided in a frame bar 25, Fig. 9, and in a frame plate 26. At their upper ends they carry each a selecting comb 27 having teeth to engage and lift certain predetermined groups or combinations of parallel bars 28, which are supported by links 29 pivotally mounted in the frame. The movement of these parallel selecting-bars controls the operation of the various groups of mechanism embodied in the apparatus, as will hereinafter appear. At the back of the frame a stop bar 30 is provided, and the key levers are weighted at 31 to hold them normally against this stop bar in order to even up the keyboard, and this evening action is independent of the weight of the parallel bars, so that should a key be operated calling for the raising of a certain number of parallel bars, including those bars common to another letter containing a less number of elements, the tendency of destroying the balance of the keyboard and the evenness thereof will be removed by the employment of the overweighted key levers and the back stop. Each key lever is provided with an anvil 32 which works against the lower end of the comb bar or stem 24.

Punching mechanism.—The grouping of the punches for perforating the tape is shown in Fig. 17, the upper row being the marking hole punches, the lower row the spacing hole punches, while the intermediate punches are for the feed holes, there being nine marking hole punches, ten spacing hole punches and eleven feed hole punches. Fig. 17 is the chart of the group of punches for the international Morse double current system. The American Morse code requires fewer punches than illustrated in Fig. 17, and the international cable code requires still fewer punches. It will be understood that my invention can be carried out with either grouping of punches, the operating mechanism being the same in each case, and my invention, therefore, is not limited to any particular code of grouping of punches, but, moreover, the construction permits, where required, of a standard type of instrument with interchangeable letter combs to meet the special differences between the several systems. These punches are mounted to slide vertically in a housing 33 being guided in a top plate 34 thereof, and in the guide-die-plate 35 arranged above the cutting-die plate, 36, the tape to be perforated passing through the channel or space between these die plates shown in Figs. 2 and 11. A slider 37 is movable vertically within the punch housing by pitman 37', operated as will be hereinafter described, and this slider has slots on each side shown at 38 in Figs. 2 and 4, and cross pins 39 extending across the upper ends of the slots, these slots receiving interlocking bars or pins 40 which, when projected inwardly in any predetermined groups, as selected by the combs, will select and connect the proper punches, to represent the letter, with the slider, so that when the slider is moved down, it will carry with it the punches selected to perforate the tape with the desired number and grouping of holes to represent the character corresponding to the key operated. For this purpose each marking-hole and spacing-hole punch is provided with an eye or opening to receive the interlocking pin or bar, as shown in Fig. 3. Only those marking and spacing-hole punches are carried down by the slider which are selected by the interlocking bars, but at each downward movement of the slider all of the feed hole punches are carried down to perforate the tape with the full number of feed holes. For this purpose the central feed hole punches are provided each with a boss or shoulder 41 being held in a recess in the slider by the bottom plate 42 screwed in place, and as the upper wall of this recess bears on the shoulders of the feed-hole punches, the whole series of said feed-hole punches will be carried down at each operation, whether the character printed be made up of few or many of the marking and spacing punches, and if of the former and the feed of the tape is short, some of the feed-hole punches will simply pass idly through the feed-holes which were punched at the previous operation. By the use of these feed-hole punches which operate at each depression of the slider, I am enabled to employ a maximum feed key marked "Max" on the keyboard, so that when a maximum feed of tape is required, or when a length of tape is required having only central feed-holes punched therein, instead of depressing the space key five times (when it is arranged for double spacing), or eleven times (when it is arranged for single spacing), the "max" key is operated, causing at one operation eleven holes to be cut, and the tape fed forward that distance, as will be hereinafter described.

The space key or bar is shown at *b*, and when this is depressed all of the feed-hole punches will be carried down to perforate the paper, but instead of the maximum feed of tape taking place, a shorter feed of tape, as just referred to of one or two holes, takes place for spacing between words.

The interlocking bars 40 operate in two sets, one at the front and the other at the rear of the punch housing, those of the front set being pivoted to pivoted levers 43 and those of the rear set being pivoted to bell crank levers 44. The levers 43 are connected by links 45 to bell crank levers 46, and these bell crank levers are operated by springs 44′ and by selecting pins 47 passing through a plate 48, and engaged by the parallel selecting bars 28, and, as before described, these parallel bars are selected and operated in certain groups by the teeth or projections on the comb bars 27, according to which key is operated.

There are twenty-nine parallel selecting bars, as shown in Figs. 7 and 9, twenty of these controlling the formation of the letters and nine controlling the tape feed action.

The selecting pin guide plate 48 is secured by screws to the top plate of the machine, so that by removing these screws the said plate may be taken out, together with the whole set of pins 47 for cleaning the said pins and the guide holes through which they pass. The pins rest in the plate by their shoulders 50 bearing on the upper side of the plate. The object of these shoulders is to prevent the pins falling through when the upper main plate 51 is lifted clear of the parallel bars 28. In getting access to the removable pin-carrying plate, the upper frame plate 51 is first removed, and

Fig. 9.

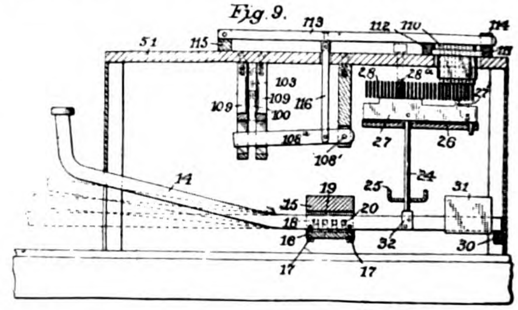


Fig. 7.

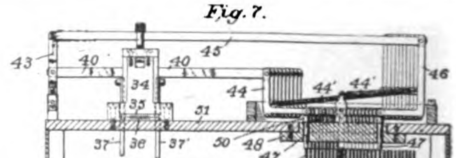
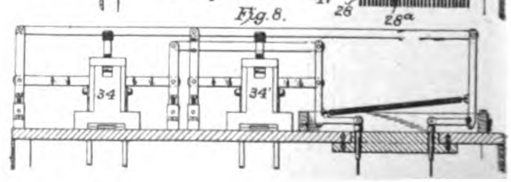
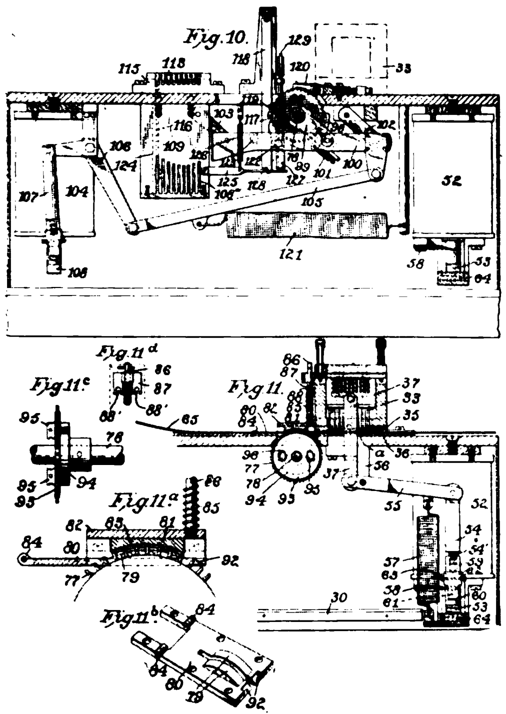


Fig. 8.





then the pin plate 48 is removed from the underside. This renders unnecessary disturbing the interlocking bar action and levers arranged above the frame plate.

The slider of the punch mechanism for forcing the punches down through the paper tape is operated by electro-magnetic means, and while I employ in my present machine solenoids, it will be understood that the substantial equivalent, *i. e.*, electro-magnets, may be employed instead. A pair of these solenoids are used, one of which is shown in Fig. 11 at 52 attached to the under side of the top plate 51 of the frame. The cores of these solenoids are attached to the cross bar 53, which has connected thereto the rod 54 which operates a lever 55 pivoted to a bracket 56, and forked to connect with the pitman 37′ of the slider, as before referred to. When the solenoids, or the electro-magnets, as the case may be, are operated, the connections will be operated to draw the slider down to force the group of selected marking and spacing punches and all the feed-hole punches through the tape, and in the form shown the connections are operated by the cores of the solenoids pulling up the cross bar 53 and operating the rod 54 and lever 55. The connections are returned to raise the punches by a spring 57, and in order to assist this spring in starting the withdrawal movement of the punches, I employ a reinforcing spring 58 of leaf form which is borne upon by the cross bar 53 when this nearly completes its upward movement, thus adding its force to that of the spring 57 to start the upward movement of the punches at the time when they might have a tendency to hang in the tape.

I provide means for adjusting the connections to alter the position of the punches in relation to the tape in a vertical direction, especially to provide means of readjustment when the punches have been shortened by re-sharpening. This means consists of the screw threaded shank 54′ of the bar 54 entering a screw threaded socket in the coupling member 59, which is connected with the lug 60 of the cross bar 53 by a pin 61. This pin is held in place by a sleeve 62 held on the coupling by a split pin 63, the sleeve having side portions reaching over the pin 61. By removing the pin 63 the sleeve 62 can be slid back to uncover the pin 61, which may then be removed, and then the bar 54, with the coupling, can be swung out from between the two solenoids, so that access may be had to the coupling to turn the same on the screw stem 54′ and thus adjust the connections to properly operate the punches, the parts being attached again by bringing the forked end of the coupling 59 to embrace the lug 60, inserting the pin 61, sliding the sleeve 62 over this pin and securing it in place by the split pin 63. The cross bar, when down, rests upon the stop 64, which may be of rubber.

The connection described provides for adjustment without requiring much space, and thus the solenoids can be placed close together to secure the best results.

Tape and tape feed.—The tape 65 coiled into a roll, as shown in Fig. 1, is mounted upon a holder 66 consisting of a rim 66′ and spokes 66″, which is mounted to rotate freely when the tape is drawn, whence it passes around a pulley or guide roller 67 carried upon a lever 68 pivoted to the frame at 69, and having an arm 70 with a brake shoe 71 fixed thereto, so that the pull on the tape, due to the feeding mechanism acting thereon, as will be described, will release the brake to allow the holder to rotate and the tape to be drawn freely from the coil or roll, but when the pull ceases the brake is applied by a spring 70′. The tape passes between guide rolls 71′, 72, and over and thence under a tension roller 73 mounted in arms 74 pivoted to the frame at 75, and pressed by a spring 76, Fig. 6ª, to take up any slack in the tape, after it leaves the supply roll. From the tension roller the tape passes to the punches between the die platens, as shown at *a,* Figs. 2 and 11.

Immediately after passing the punches, the tape is engaged by the teeth of the star feed wheel 77 mounted on the shaft 78, the teeth of said wheel engaging the feed holes in the tape to feed it along the required distances in accordance with the length of the letter or in accordance with the distances required when either the "max" key, the space key *b* or the "red" feed key is pressed. In order to guide the tape to this feed wheel, it enters a channel formed between the curved surfaces 79 on the plate 80, and the curved presser foot 81, said presser foot consisting of a block fixed to a housing 82, which is screwed to the plate 80, the said presser foot having a groove 83 to receive the teeth of the star-feed wheel. The curve of the under face of the presser foot and the surfaces 79 is concentric with the star feed wheel, so that the tape is directed concentric with the path of the teeth, and a number of the teeth will be engaging the feed holes in the tape at the same time and with accuracy to jointly feed the same along. The curved passage is of a size or height equal to double the thickness of the tape so that as a single thickness of tape is fed through, it may pass freely through the passage, but is held by the presser foot in position to insure proper engagement therewith by the teeth of the feed wheel.

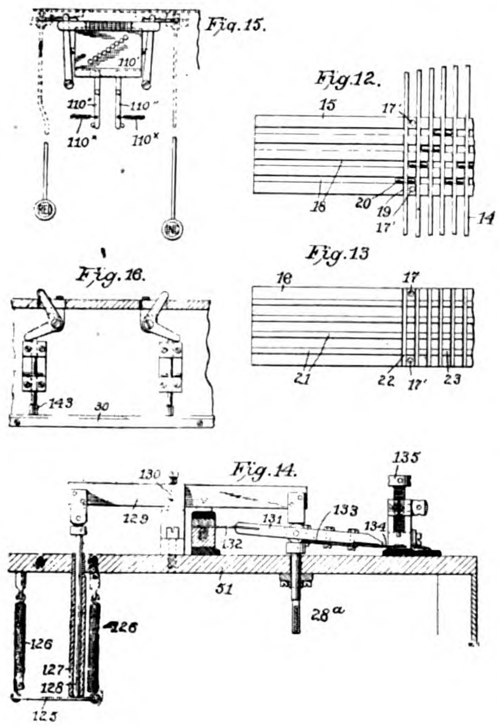
The plate 80 is slotted, as shown in Fig. 11ᵇ, to receive the star-feed wheel, the curved surfaces 79 being on each side of the slot. The plate is hinged at 84, and it, together with the presser foot, is pressed down in proper relation to the star-feed wheel by a spring 85 surrounding a stem 86 and bearing at its upper end on the underside of a bracket 87 secured by screws 88 passing through slots 88′ in the bracket or block. This block has an enlarged hole receiving the upper end of the stem of the presser foot, so that the plate, 80, together with the presser foot, may be moved upwardly, turning on the pivots at 84 for this purpose, the post moving in the enlarged hole in the bracket. For thus raising the presser foot and the plate 80 for the insertion of the tape, a key 89 is pressed which rocks a lever 90 pivoted at 91 to the under side of the top plate of the casing, the end of this lever bearing upon the under side of the plate 80 and lifting it against the pressure of the spring 85, so that the curved channel will be raised in respect to the teeth of the star-feed wheel for threading the end of the tape through said channel. The front edge of the plate 80 is beveled at 92 to direct the tape up into the guide channel. The presser foot does not exert any pressure on the tape, but simply positions the curved guide channel properly in relation to the teeth of the star-feed wheel to insure proper engagement of the teeth with the feed holes in the tape, which is then capable of passing freely along the channel.

By loosening the screws 88, the plate 80, together with the presser foot, its stem and the bracket or guide block 87, can be thrown back on the pivots 84 to expose the star feed wheel and exit mouth of the tape passage of the punch housing for cleaning and for adjusting the star-feed wheel in relation to the punches to regulate the feed.

Star feed wheel.—This wheel is of special and simple construction, consisting of a disc or plate 93 having the teeth and secured to a disc 94 fixed on the shaft 78 by screws 95 passing through slots 96 in the wheel disc into the fixed disc. By this construction the star feed wheel can be adjusted in relation to the shaft 78, which is moved differentially, as will now be described, according to the length of the letter, and thus the teeth of the feed wheel can be set to secure accuracy of feed.

Differential tape feed.—The shaft 78, as shown in Fig. 10, is rotated by a ratchet wheel 97 fixed thereto and a pawl 98 carried by an arm 99, the forked or slotted end of which swings on the shaft 78. This arm 99 is pivotally mounted on the feed girder 100 a spring 101 keeping the pawl in engagement with the ratchet wheel. This feed-girder is hung on parallel links 102—103 pivotally mounted in the frame. The feed girder is moved leftward, Fig. 10, to move the pawl 98 in position for a new feed action by power means consisting in its best form of a pair of solenoids, one of which is shown at 104, though, as before stated, other equivalent electro-magnetic means may be employed, namely: electro-magnets. The operating connections include a pitman 105, a lever 106, pivotally mounted in a frame bracket and connected by a bar 107 with a cross bar 108, to which the cores of the solenoids are connected. The leftward setting movement of the feed girder, due to the action of the feed-setting solenoids, is limited differentially in accordance with the key struck and the length of the letter corresponding thereto. The limiting stops in the present case consist of swinging arms or stop feed bars 108ª, Figs 9 and 10, pivotally mounted at 108′ in a frame bracket and guided at their free ends through fixed cheek blocks 109 between which the feed girder swings. There are nine of these stop-feed bars, and they are selected according to which key is depressed, by teeth 27′ on the combs 28, operating through the parallel bars 28 and selecting pins 110, Figs. 5 and 9, which pass through a carrier block 111 guided in ways 112 fixed on the frame, said pins, in turn, selecting and operating levers 113 guided at their free ends in a comb bar 114 and pivotally mounted on the frame at 115. These levers are connected by links 116 with the stop-feed bars 108ª. By this arrangement of levers 113 and connections, a long leverage is secured, and as the pins 110 contact with the levers at or near their outer ends, the rubbing and wear of these pins on the levers will be reduced to a minimum, and ease of touch at the keys will be secured. Furthermore, the use of swinging stop feed bars 108ª instead of sliding pins renders the touch earier and the action with less movement.

Operation of the differential tape feed mechanism.—Supposing a key is depressed representing a letter with two feed holes, the first action will be to lift that one of the combs 27 corresponding to that key, and this will select the proper parallel bar of the set at 28 and through the described connections shown in Fig. 9, the first stop feed bar 108ª counting from the right of Fig. 10 will be moved up between the cheek blocks into the path of the end of the feed-girder, and as soon as this has taken place, the feed-setting solenoids are energized, as will be hereinafter described, and the feed-girder will be moved leftward, Fig. 10, until it sets itself against the first stop feed bar, thus setting the pawl 98 back on the ratchet the amount required for feeding the tape forward two feed holes when said pawl turns the wheel upon the movement of the feed girder to the right, as will be later referred to. The leftward setting movement of the feed girder has the effect also of removing the tooth 117 of the reverse check lever 118 from the check ratchet wheel 119 fixed on the shaft 78, and having its teeth set reversely from that of the feed ratchet wheel 97. This latter ratchet is also controlled by a detent 120. While the parts of the tape feed mechanism are in this set position with the feed girder drawn to the left, Fig. 10, ready to perform the tape feeding action, the punches are operated by the energizing of the solenoids 52, as before described, and the tape is therefore perforated, and as soon as this has been accomplished and the punches have risen free from the tape, the feed-setting solenoids 104 are deënergized and a spring 121



draws the feed-girder 100 to the right, Fig. 10, thus causing the feed pawl 98 to turn the ratchet 97 and the shaft 78, and also the star-feed wheel 93 an amount corresponding to the number of feed holes the feed mechanism has been set for, in this instance, two feed holes, the movement being arrested by the reverse check-tooth 117 on the lever 118 engaging the check ratchet. This lever 118 is controlled from the feed-girder 100 by pins or rollers 122, 123 on the feed girder bearing on the lever. This check tooth arrests the feed accurately to the number of feed holes required. If a key is pressed requiring three feed holes, then the second setting stop or check bar 108a counting from the right of the series will be set to arrest the leftward movement of the feed girder, and when the feed-girder returns to the right, it will cause a feed of the tape equal to three feed holes, and so on throughout the series according to the length of the letters to be cut.

For the maximum feed, when the "max" key is depressed, no one of the stop feed bars is operated, the stop, in this instance, being the end wall of the check block indicated by a dotted line at 124 in Fig. 10, the feed girder, in this case, swinging its maximum distance to the left in being set.

It will be observed that the pawl carrying arm 99, instead of being pivoted on the shaft 78, engages the same loosely or by a forked or slotted connection, and that the feed girder is hung upon the two links 102 and 103, the arm 99 being simply for the purpose of carrying the feed pawl. This avoids strain on the parts and particularly the shaft.

In order to avoid rebound of the check-tooth lever 118 under high speed and a consequent overthrow of the feed mechanism, I provide a detent lever 125 pressed by spring 126 and arranged to engage the toothed lower end of the check-tooth-lever when this swings to the right to check the movement of the feed ratchet. This detent brings up against a tubular stop arm 127 depending from casing. The detent is depressed to free the check tooth lever for the setting action of the feed mechanism by a pin 128 passing down through the tubular stop and bearing on the detent. This release pin is operated by a lever 129, Fig. 14, pivoted to the top plate at 130, and in turn operated by the lifting of the contact key or plate 131 mounted on a spring leaf or blade 132 and carrying the spring contacts 133, 134, which close the electric circuits in which are included the feed setting solenoids and the punch operating solenoids, and these contact springs are so arranged relatively to their contact screws 135 and 136 that the feed setting mechanism will be operated first and then the punch solenoids. The release pin is depressed to release the detent from the check tooth lever as soon as the contact key or plate is lifted, and this lifting is due to the parallel bar 28a, which is common to all the combs 27. In the use of this contact plate or key held by the spring blade 132, I avoid the use of pivots, which are objectionable in that wear of these pivots would cause side play in the key.

Electric-circuit connectors.—As the electric circuit connections are substantially the same as those of the Patent 751164 above mentioned, and as the sequence of operations is the same as set forth in said patent, it is not thought necessary to describe or illustrate the same herein.

Reducing or increasing feed.—The selecting pins 110 which are selected by the feed controlling parallel bars and which, in turn, select the proper set of levers 113 for setting the check or stop feed bars 108^a, are carried by the plate 111 slidable in the guide ways 112. This plate is controlled by a lever 137, Fig. 5, which bears upon a pin 138 (dotted lines), on the carrier plate. The plate is drawn to the left by a spring 139, a pin 140 determining the position of the plate in this direction.

A bell crank lever 141, Figs. 5 and 6, when the reduce-feed key marked "Red" is depressed, is operated through a rod 142 from the reduce key lever 143, Fig. 6, and thus moves the carrier plate to the right so that, for instance, the selecting pin which would have selected that lever 113 for setting the second stop feed bar 108^a for a three-hole feed, when the carrier plate 110 was in normal position, will now select the first lever, so that the tape will be advanced only two feed holes instead of three, and thus by first depressing the reduce-feed key and then the letter key, one feed hole will be eliminated where otherwise there would have been two feed holes, and if another letter key is now depressed, the perforations representing this letter will be cut contiguous to the perforations first to form a composite character, which, for instance, will represent one of the punctuation or arbitrary signs as may be previously determined upon. On release of the reduce-feed key, the carrier plate, with its selecting pins, resumes its normal position under the action of spring 139.

Increase feed mechanism.—As shown in Figs. 15 and 16, I employ an increase feed key for the purpose of increasing the space between successive characters. This mechanism consists of a key marked "Inc," and when this is pressed, the carrier plate 110′ for the selecting pins would be given a movement to the left instead of to the right, so that the reverse effect from that just described in connection with the reduce-feed key would take place, namely: the feed of the tape would be increased above the normal. This increase-feed key is also combined with the reduce feed key "red," as shown in said figure, so that the carrier plate may be moved either way for either of the above effects.

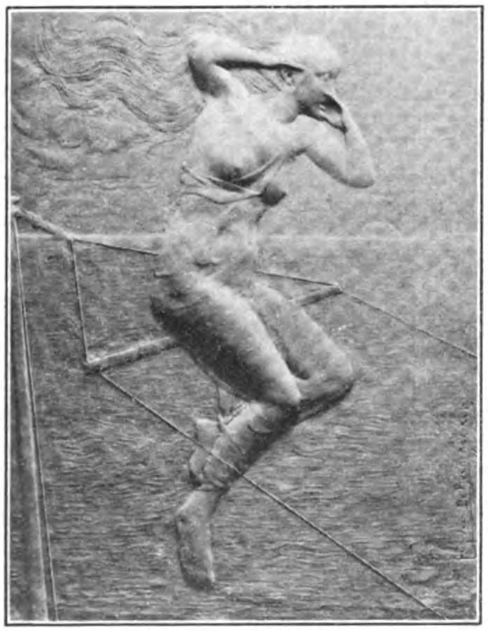
For holding the carrier plate in normal position, and for returning it to said normal position when moved either way therefrom, I provide the two levers 110″ one bearing on each side of a projection on the carrier plate, said levers being pressed by springs $110^\times$ to hold them normally against stop pins, and thus set the carrier plate in normal position. If the plate is moved either way, the lever 110″ on that side will yield to permit the movement, but as soon as the key lever is released, the carrier plate will resume its normal position under the action of the spring $110^\times$.

Producing a plurality of tapes.—When more than one tape is required to be perforated for use on different circuits, I employ the arrangement shown in Fig. 8, in which one or more additional sets of punches may be used in punch blocks or housings 34, 34′, the inter-locking bars of the different blocks being connected up to operate in unison from the same selecting mechanism above described.

In the art as heretofore practiced, when it was necessary to punch more than one tape, the passageway *a* between the dies 35 and 36 was increased, and the superimposed tapes were passed through the punch block as though they were one tape. But a limit is soon reached as to the number of tapes that may be so superimposed, and to meet this difficulty I provide the mechanism shown in Fig. 8, which is used in connection with the rest of the mechanism as previously described, the only alterations being in extending the feed shaft 78 and employing as many star-feed wheels and presser-feet as there are punch blocks.

Medallion by the Belgian Sculptor, E. De Bremaecker

As its name indicates, the Holland-Belgian Society of Friends of the Art Medallion, was founded some ten years ago in Belgium in order to renew the art of the medallion. With this object in view, models of medallions or plaques are ordered from artists of established reputation and copies of the work are distributed among the members.



E. De Bremaecker, the Belgian sculptor, received the order for the 1913 medallion and was given free choice of subject. The artist chose "Wireless Telegraphy." On the obverse a woman is seen posed on the aerial of a ship. She has just shouted and is listening for a reply. In the wavy hair of the symbolic figure appear in Morse code the famous calls, C. Q. D. and S. O. S. In the distance are seen the towers of the Marconi Poldhu station, silhouetted against the rays of the rising sun. On the reverse, to the left, are the names of the scientists to whom we owe the discovery of wireless telegraphy, that of Marconi rightly appearing in larger characters.

To the right are the names of the operators who heroically remained at their posts in time of danger. The names of those who perished—victims to their devotion—are marked with a cross. The martyr's palm and the laurel branch of glory are attached to a torch representing science. Above all stands out the inscription: "To the Glory of Wireless Telegraphy."

"THE MARCONIGRAPH seems to fill a noticeable gap in the literature of the progress of wireless telegraphy," says Charles M. Gardner. "You seem to get facts which haven't appeared in other magazines and periodicals. Before THE MARCONIGRAPH was published, I, for one, knew little if anything about the Marconi Company and Marconi instruments. I sincerely wish THE MARCONIGRAPH the greatest success."

In order to establish a relay between St. Louis and Richmond, Indiana (this being part of the relay to be established between St. Louis and New York), all amateurs living in St. Louis and Terre Haute and between points are requested to send their call letters, powers, approximate sending and receiving radius, and their full address, including name of county, to V. H. Pardieck, 320 South 8th street, Richmond, Indiana.