Vol. 3. No. 7.—Published by A. F. Ponton & Co. at 80-84 Adelaide St. E., Toronto, Ont.

RADIO

Incorporating "WIRELESS & AVIATION NEWS"

OCTOBER - 1922 Price 15c

The most original and effective publicity 'stunt' yet attempted. This Radio Equipped Aeroplane, has appeared over practically every buying community in Ontario. "J. V. E." Brand Radio Equipment is kept constantly before the public in this novel manner.

Wise dealers are cashing in on the "J. V. E." line of Radio Equipment backed by consistent advertising in the press and "in the air."

Refer to our 2-page Centre Spread Bargain List in this issue.

Jack V. Elliot and his Son with their Radio Equipped Aeroplane

THE JACK · V · ELLIOT CO.

HAMILTON - ONTARIO

RADIO

Incorporating WIRELESS & AVIATION NEWS

OCTOBER - 1922 Price 15c

The most original and effective publicity stunt yet attempted. This Radio Equipped Aeroplane has appeared over practically every buying community in Ontario [illegible] Brandes Radio Equipment is keeping constant reminder before the public in this novel manner.

Jack V. Elliot and his Son with their Radio Equipped Aeroplane

THE JACK · V · ELLIOT CO.

HAMILTON - ONTARIO

SPECIAL LOW PRICES ON RADIO SUPPLIES

An Opportunity to get Complete Sets or Parts at Less than Actual Cost

In an effort to reduce a large stock to make room for the arrival of further shipments, we are sacrificing profits for turnover.

We outline a few of the savings that can be made.

Head Phones

Best British Make—Type A

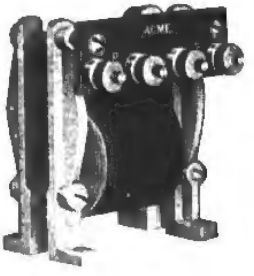
4000 ohms— Regular Price $19.00
SPECIAL PRICE—**$15.00**

3000 ohms Regular Price $17.75
SPECIAL PRICE—**$15.50**

Holtzer Cavot Head Phone
2000 ohms—SPECIAL PRICE—**$8.75**

Dreyfus Concert Type— SPECIAL PRICE—**$9.50**

Amplifying Transformers



Very latest type, highest grade—
SPECIAL PRICE—**$5.00**

Bradley Stats— SPECIAL PRICE—**$2.25**

Signal Condensers

.0001 Verbal Condenser Dial Knob, complete, Guaranteed - SPECIAL PRICE- **$3.00**

Bakelite Dials - SPECIAL PRICE— **.65**

Many other bargains that we have not room to illustrate.

Send for Special Price List today and get that set you have been wanting at a saving of 50%.

787 Queen St. W. J. M. PAQUIN Toronto, Ont.

THE ELECTRICAL SHOP

Standard Radio Equipment

(De Forest Patents)

PLACE YOUR ORDER NOW

A reputation for manufacturing radio receiving sets that give greater efficiency than any other make is creating a demand for our sets that even with our increasing production will tax all of our resources to keep up with it.

To own a radio set manufactured by us is to ensure the maximum enjoyment to be obtained from radio.

Our "UNIVERSAL RECEIVING SET consists of the necessary tuning elements, a detector unit and two stages of Audio amplification, all assembled in a highly finished quarter-cut oak cabinet. The "B" batteries are also placed in the cabinet. This set will respond to wave lengths 180 and 20,000 meters. HONEYCOMB COILS are used for inductances, associated with high grade condensers having Vernier attachments.

Owners of these sets are breaking long distance receiving records.

Our "SC-10" RADIO RECEIVING SET is a short wave length regenerative set designed for those who would rather purchase a single unit and add one of our type "S" two step Audio amplifiers later on. This set is very easy to operate and is far in advance of any similar set now being sold both as to appearance and results obtained.

We will be pleased to send you, on request, a copy of our R30 BULLETIN, which gives full information on our radio equipment.

"SC-10" Radio Receiving Set

CANADIAN INDEPENDENT TELEPHONE CO., LIMITED

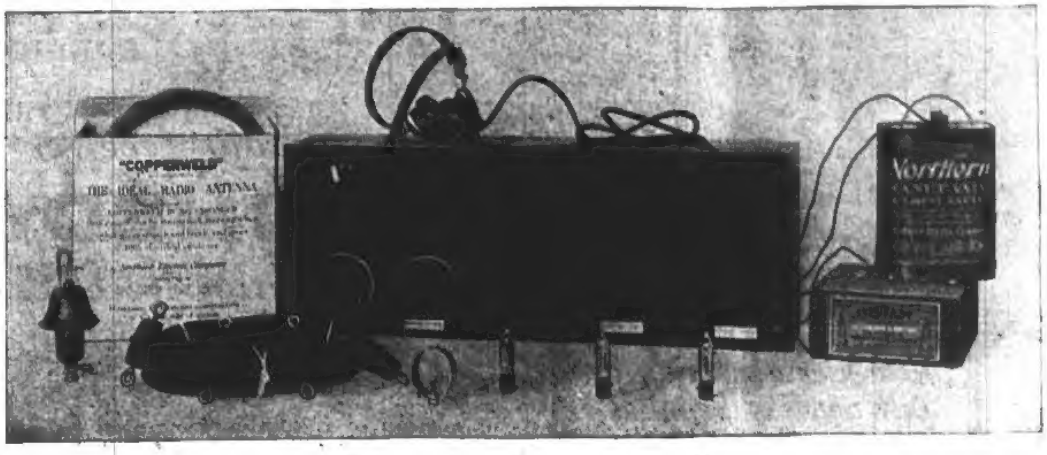
Offices : 212 KING STREET W. **Factory : WALLACE AVE., TORONTO**

WESTERN DISTRIBUTORS:

Radio Corporation of Winnipeg, Winnipeg, Man.
Radio Corporation of Vancouver, Vancouver, B.C.
Radio Corporation of Regina, Regina, Sask.
Radio Corporation of Calgary, Calgary, Alta.

ORDER THIS NEW SET EARLY

R1000 Radio Telephone Receiving Set



This set, which can be purchased complete or Unit by Unit, has the famous R 215-A "Peanut" Vacuum Tube, Copperweld Antenna Wire and many other new and desirable features.

Its wave length, from 200 to 600 metres, covers the full range of local or distant Canadian and American Broadcasting, Shipping, Stock and Weather Reports, Official Time, etc.

Full description and prices are in our Bulletin No. 1000. Ask your dealer for a copy. If he hasn't one, phone or write our nearest House.

The R1000 Radio Telephone Receiving Set consists of—

1 No. R1 Short Wave Tuner and Detector Unit.

2 No. R5 Amplifier Units.

1 No. R6 Double Head Set, 2500 ohms.

1 No. R650 Aerial System.

3 No. R215-A "Peanut" Valves.

1 No. R180 Northern Peanut Valve Filament Battery.

1 No. R90 45 Volt Plate Battery.

RADIO

A. F. PENTON & Co., Publishers. (Member Canadian Business Publications Association)

60-62 ADELAIDE ST. EAST, TORONTO, CANADA.

C. LINCOLN-MITCHELL, Publication Manager.

Volume 5. | TORONTO, OCTOBER, 1922. | No. 7

Long Distance Commercial Radio Telegraph Communication

By J. H. Thompson, Chief Engineer, Marconi Wireless Telegraph Company of Canada.

Long distance radio telegraph communication as understood to-day may rightly be said to date from December, 1901, when Marconi received at Signal Hill, St. John's, Newfoundland, the letter "S" as transmitted from Poldhu, Cornwall, a distance of 2,200 miles. In these experiments a fixed gap spark transmitter was used, the input power to this transmitter being not more than 10 to 12 kilowatts. The transmitting aerial consisted of 50-7/20 stranded copper wires, suspended from a horizontal stay between the tops of two masts 200 ft. apart, each mast being 160 ft. high. These wires were arranged in fan shape, and were connected direct at the bottom to a common wire which led from the transmitter. The receiving aerial at St. John's consisted of a copper wire 200 ft. long, its upper end being held aloft by a kite. The detector consisted of a coherer in series with telephones. A periodic reception was of necessity used owing to the movement of the kite, rendering tuning impossible. These experiments were continued and the demonstration confirmed, thus establishing without doubt the fact that transatlantic communication was feasible.

In February, 1902, arrangements were made for the erection of permanent stations at Poldhu, Cornwall; Glace Bay, N.S., and Cape Cod, Mass. On these stations the aerial was carried upon four wooden masts, each 210 feet high, erected on the corners of a 200 foot square.

At the same time experiments in reception were carried out on board the S.S. "Philadelphia," while this vessel crossed the Atlantic, westward bound, with the result that readable messages were received from Poldhu up to a distance of 1,551 miles from that station by night, and 750 miles by day. Later in 1902 the vessel "Carlo Alberta" was placed at Marconi's disposal by the Italian Government, and was especially fitted by him for experimental work. This vessel sailed from Plymouth for Sydney, N.S., in October, 1902, messages being received from Poldhu during the voyage, and also while in Sydney Harbor.

Looking back with our present-day knowledge of radio science and art, and its still existing difficulties, these early achievements seem truly remarkable and compel admiration for the pioneers who were responsible for them.

Towards the end of 1902 work had so far progressed at Glace Bay and Cape Cod, that preliminary tests could be made, and on December 21st, 1902, one year after receiving the letter "S" at St. John's, Newfoundland, communication was established between Glace Bay and Poldhu with complete success, messages being sent, including one from the Governor-General of Canada to King Edward VII. Following this, in January, 1903, communication was also established between Cape Cod and Poldhu, and among the messages transmitted was one from the late Theodore Roosevelt to King Edward VII. Thus began Transoceanic radio communication.

The practicability of transatlantic working now having been established, it was decided by Marconi and his associated directors to defer entering upon regular commercial service until the completion of new stations at Glace Bay, N.S., and Clifden, Ireland. Towards the end of 1907 these stations were nearing completion, and on October 17th, 1907, intercommunication on a limited press service was inaugurated, this service being extended in the following February to ordinary traffic between London and Montreal. It was now hoped that permanent service had been established, but unfortunately in August, 1909, Glace Bay was partially destroyed by fire, and in consequence transatlantic communication was not re-established until April, 1910, from which date the service can be regarded as being permanent. Reliable communication was then being obtained, and the "duplex system" established.

The development of other long distance circuits then took place, high power stations being erected in various European countries, the United States, and later in Japan. Since 1914 many long distance stations have been erected in different parts of the world, some of them having exceptionally large transmitters, and efforts have been directed towards the further increase of distance over which reliable commercial communication can be carried out. To create conditions suitable for first class commercial working, special attention has of necessity been given to automatic high speed working and its attendant difficulties, and in consequence the modern long distance station comprises a variety of complicated apparatus.

TRANSMITTERS

From the ten k.w. used at Poldhu for the transmission of the first signals received across the Atlantic the power of the transmitter has been increased, until to-day we have transmitters of 1,000 k.w. capacity, and arrangements whereby as much as 1,500 k.w. may be delivered to an antennae. This growth has been marked by many radical changes in the type of transmitter. Until a few years ago these transmitters were of spark type, of a size from 100 to 300 k.w. Such transmitters were installed at Glace Bay, N.S.; Clifden, Ireland; New Brunswick, N.J.; Carnarvon, Wales; Bolinas, California; Kahuku, Hawaii and Arlington, Va. These transmitters were all operated with a rotary discharge gap. Good service was obtained with these transmitters, but attention was being directed towards the development of transmitters of higher efficiency. Towards this end high frequency alternators of various designs were built and put in service. The arc generator was also developed, and these two types—i.e., the arc and high frequency alternator, being continuous wave transmitters, began to displace the spark transmitter, this displacement being assisted to a great extent by improvements in the reception of continuous wave, in particular

Published by special permission of Mr. J. H. Thompson, the Marconi Wireless Telegraph Company of Canada, Ltd., Montreal.

by Fessenden's classic heterodyne method, and the development of the vacuum tube. The spark transmitter is to-day practically obsolete for long distance work. At the present day the largest transmitters are of the arc type, which runs as high as 1,000 k.w., these arcs being of the Poulsen type. High frequency alternators have been developed in the United States (Alexanderson), Germany (Goldsmidt), and France (Latour), with capacities as high as 300 k.w. These alternators are giving reliable service, and have been developed at considerable expense and with great ingenuity, since the problem of speed control is an exceedingly delicate one. No sooner have these latter two types of transmitters been well developed than the possibility of their displacement by valve transmitters arises. Valve transmitters are now in use on transatlantic work at Carnarvon, Glace Bay and Clifden, and are giving excellent service. Considerable progress is now being made in the development of high-power valves, and it is quite possible that they will displace the high-frequency alternator and the arc at many existing stations.

Regarding the antennae, since the beginning of long distance working the tendency has been towards higher and larger antennae, with the result that there is to-day at Croix d'Hins, near Bordeaux, France, an antennae weighing 4½ tons, and having for supports eight 820-foot self-supporting towers. Great attention has been paid to the question of improving the antennae as an efficient radiator, with the result that some of the long distance antennae are of the Alexanderson multiple tuned type, while on other long distance aerials, notably those of the Marconi Company, special attention has been given to the development of the earth screen.

RECEPTION

The first signal across the Atlantic was received with the coherer type of detector. This was followed by the magnetic detector, which in turn gave way to the Fleming valve and the crystal, the latter being now displaced by the three element valve.

The receiving aerials and receiving circuits have also undergone considerable development since the inauguration of long distance working. Duplex working was first established on the Glace Bay-Clifden circuit. This was accomplished by erecting a separate receiving station at Louisburg, N.S., distant 30 miles from Glace Bay, and a separate receiving station at Letterfrack, Ireland, distant 12 miles from Clifden. Transmitters in each case are controlled from the receiving station and simultaneous sending and receiving made possible by the introduction of a balancing out aerial at each receiving station, so that interference from the nearby transmitter could be eliminated. The need of reliable high speed working was productive of considerable development work with a view to improving signals, reducing static, and cutting down interference, with the result that we have to-day aerial systems and circuits which will receive over a somewhat limited arc in one general direction. Such circuits, together with selective note-tuning devices, have rendered high speed working possible under average conditions, so that we have to-day transmission taking place at one hundred to two hundred words per minute, the signals being automatically recorded, under conditions which formerly would have made reception of hand speed signals by telephone exceedingly difficult. Automatic recording has been given almost continuous study since the earliest days of wireless communication, and this phase of long distance working is by no means the least interesting. The idea underlying the first type of recorder was that used on land lines at that time. This recorder consisted briefly of a coherer which actuated a sensitive electro-magnetic relay, which in turn operated a pen recording the dots and dashes upon a moving tape, this tape being kept in motion by a clock-work motor. With the introduction of transmitters with musical notes and the use of crystal detectors it was found that more reliable results could be obtained by aural reception, since distinction could then be made between different stations on practically the same wave length, signals could be read through limited static, and this method, therefore, became the rule, since traffic was not then heavy enough to warrant any change. During this period, however, and up till 1914, a great deal of attention was directed towards photographic means of recording. In general the apparatus used consisted of a very delicate mirror galvanometer, the incoming signal producing a very small movement of the mirror, this movement in turn reflecting a small spot of light across a sensitized ribbon. This ribbon was kept in continuous motion, and passed from the galvanometer in turn through a developing bath, fixing bath, and through an arrangement for drying. An appreciable time elapsed between the receipt of the signal and its appearance for examination on the tape, and in general considerable improvement appeared desirable. With the advent of the three electrode valve, with its amplifying qualities and a corresponding increase in energy available for operating recording devices, little further development on the photographic method took place, although this method was recently revived with considerable improvement in detail by the General Electric Company in what is known as the Hoxie recorder, on which apparatus high speed transmission has been recorded up to 200 words per minute.

With three electrode amplifiers available, attention was directed towards acoustic methods of recording, apparatus being devised so that the amplified signal produced vibrations on a telephone diaphram of sufficient amplitude to permit of a hard jewel suitably attached to the diaphram to impress a phonographic record upon a rotating wax cylinder. This is known as the dictaphone method. Signals recorded at high speed were subsequently read out at low speed upon a phonograph. This method has certain objections, one being that in the slowing down to read by ear the tone of the note may drop one or two octaves and render reading difficult; also there are certain delays occasioned on changing cylinders, etc. Nevertheless, it is still rendering good service on some stations, although not now in use on the Glace Bay-Clifden circuit, having been superseded by later methods.

High speed recording has been carried out in France by means of a galvanometer, known as the magneto-oscillograph, the moving part of a galvanometer carrying a light rigid pointer in light contact with a tape or smoked paper. Clear record is obtained; but as a recording device it would appear to have obvious disadvantages, unless the marked tape is automatically treated in order to preserve the record sufficiently well for transcribing purposes.

A form of recording apparatus much in use to-day is that known as the undulator type. It is briefly a syphon type of recorder, which is operated by a robust electro magnet, the latter being controlled by the incoming signal. This method has been made possible by the use of valve amplifiers, since signals can now be amplified until they represent considerable energy, and can thus be utilized to actuate the comparatively heavy parts necessary to robust apparatus.

From this we come to the ideal method of recording by printing, which is now being employed with success on land lines, and which is being adapted to high speed radio work. In general the more ideal the results aimed at, the more sensitive becomes the apparatus to parisitic disturbances, and it is, therefore, necessary to employ delicately-balanced circuits which will restrict as far as possible all impulses, excepting those of a particular note frequency. This condition requires that the frequency of the transmitter remains constant within exceedingly narrow limits, and that its strength remains constant. So far the only transmitter which appears to fulfil this condition is the valve transmitter, and it would, therefore, appear that the future of the high speed recording printer will depend upon the extent to which valve transmitters are employed.

GENERAL

All long distance circuits to-day are duplex, each end of the circuit consisting of separate transmitting and receiving stations, these stations being separated by distances varying between ten and several hundred miles, the transmitters being operated by remote control either from the receiving station or from a central office. The tendency to-day is to operate several independnt circuits from the same set of transmitting and receiving stations, and several of these multiple systems are now in successful operation. In such cases the several transmitters are usually grouped in one building, each transmitter operating upon a separate aerial, although in some cases successful operation has been obtained with more than one transmitter operating upon the same aerial. Reception in these cases is usually carried out in separate receiving aerials or loops conveniently grouped about the receiving station, although here again reception of several stations is sometimes carried out upon the same aerial, a notable case being the aerial at Riverhead, the receiving station for Radio Central at Long Island.

Considerable development of high power stations is under way and in prospect on this continent and in Europe, and some long reliable commercial ranges are being anticipated; for instance, there is a proposal to erect a plant to communicate between Berlin and Buenos Aires, a distance of about 6,400 miles. Also proposed two large arc stations at San Francisco and Shanghai, for establishing communication between these two points, a distance of about 5,300 miles. In this latter case it is understood that towers of the order of 1,000 feet high are contemplated, and that arc generators of about 1,000 k.w. are being considered, antennae current of the order of 600 amperes and upwards being expected upon wave-lengths of the order of 22,000 metres. Reliable commercial communication, i.e., communication with very little interruption upon these long ranges, is by no means a certainty, success depending mainly upon freedom from static.

This will be governed partly by development of further means of elimination of static and partly by the location of the receiving station relative to areas in which static is less prevalent. Signals have, of course, for some years been received over greater distances than those above mentioned, but for commercial work relatively clear signals should be available under all conditions, and this is a somewhat difficult problem to meet. It is stated that uninterrupted communication has been carried out during the summer months between Cavette, P.I., and Goat Island, Cal., a disance of about 6,000 miles. Static conditions on the Pacific Coast are more favorable for long distance working than upon the Atlantic Coast.

SOME OBSERVATIONS ON THE EFFICIENCY AND IMPEDANCE OF TELEPHONE RECEIVERS

The sound output of a telephone depends upon the product of the electrical current flowing through it and the number of turns of wire on the iron cores. It is, therefore, obvious that the first requisite of a good telephone is low direct current resistance compared with the number of turns in the winding.

This ratio of resistance to number of turns of wire, or resistance per turn, can be decreased by

(1) Increasing the size of wire, and thus decreasing its resistance;
(2) Using wire made of metal of a lower specific resistance; and
(3) Decreasing the length of the turns; or, in other words, making a smaller iron core.

However, there is seldom room enough in the telephone for other than the finest wire, and copper is the most economical low resistance conductor. The most effective way of decreasing the resistance per turn is, therefore, to reduce the cross section of the core and thus the length of wire per turn.

A common but misleading method of rating telephones by their direct current resistance is used by numerous manufacturers. While this method may discriminate between very high and very low impedance telephones, it is not reliable for selection phones of similar construction. For instance, some phones used to be wound with German silver wire, and, while their direct current resistance may have been 5,000 ohms, the resistance of a similar phone, wound with the same size of copper wire and the same number of turns, would be approximately 400 ohms.

The only real criterion of the telephone is its alternating current impedance, and the ratio of its reactance to its effective or alternating current resistance. This ratio is even more useful than the ratio of direct current resistance to the number of turns, in that it is dependent both upon the direct current resistance per turn and the quality of iron or steel in the cores. Thus, of two phones having an equal direct current resistance and number of turns, one having cores of soft iron, the other of silicon steel, the one having soft iron cores may have a ratio of reactance to resistance of 1.5, while the one having silicon steel cores may have a ratio of 3.0 or more.

The secret of good quality in a radio receiving circuit is the proper impedance relations between its component parts. It is a mathematical fact that the transfer of energy from one part of the circuit to another is maximum when the two coupled parts are equal in electrical impedance.

When two pieces of apparatus, not equal in impedance, are required to be connected together, a transformer may be used whose two windings have impedance equal respectively to the two parts to be connected. It is for this reason that a transformer is used between the tubes in the radio circuit—that is, the output or plate side of the tube has a lower impedance than the input or grid side of the tube.

Similarly, for best results, the impedance of the telephone must be similar to that of the plate circuit of the tube, or a transformer is necessary. It is, therefore, more economical to make the telephones of high impedance to equal the plate circuit impedance than to make them low and use a transformer.

The alternating current impedance of the telephone at any given frequency of current is the geometric sum of the alternating current resistance and the reactance, or

$$Z=\sqrt{R^2+X^2}$$ where Z is the impedance,
R is the resistance and
X is the reactance.

Since the impedance of the receiver is proportional to the square of the number of turns in its winding, any impedance required can be had by increasing the number of turns sufficiently.

Although increasing the number of turns means decreasing the size of wire, and thus increasing the resistance per turn, the ratio of reactance to alternating current resistance remains nearly the same for the same type of telephone.

CANDIDATES SUCCESSFUL IN EXAMINATIONS

The Department of Marine announce that 39 candidates were examined during the month of August, 1922. The following list was released for publication on September 22nd of those who were successful in obtaining Certificates of Proficiency in Radiotelegraphy:

FIRST CLASS COMMERCIAL

Boyd, J. R. ..... Carlsbad Springs, Ont.

AMATEUR.

Berry, E. M.	London, Ont.
Brooke, E. D.	London, Ont.
Black, R.	Victoria, B.C.
Burton, T. H.	Victoria, B.C.
Bonavia, G. W.	Victoria, B.C.
Brakes, W. H.	Victoria, B.C.
Collins, F. I.	Chatham, Ont.
Cookson, J. H.	Chatham, Ont.
Cornish, F. C.	Chatham, Ont.
Cooper, F. P.	Victoria, B.C.
Davey, E.	Chatham, Ont.
Edwards, A. A.	Chatham, Ont.
Graham, B. S.	London, Ont.
Gurd, R. H.	London, Ont.
Harris, E. H.	Victoria, B.C.
Hyde, G. S.	London, Ont.
Hutchinson, D. S.	London, Ont.
Hare, G. E.	Sarnia, Ont.
Houston, G. G.	Charlottetown, P.E.I.
Hyndman, F. W.	Charlottetown, P.E.I.
Jackson, H. L.	Chatham, Ont.
Lindsay, J. W. C.	London, Ont.
Langford, C. H.	London, Ont.
Moore, R. E.	Windsor, Ont.
Moir, S.	Chatham, Ont.
Mugford, B.	Victoria, B.C.
Partridge, C. B.	London, Ont.
Rose, C. A.	Brantford, Ont.
Rogers, K. S.	Charlottetown, P.E.I.
Stallard, W. J.	London, Ont.
Sinnott, M.	Charlottetown, P.E.I.
Smith, N. J.	Victoria, B.C.
Sole, A. E.	Sarnia, Ont.
Sproule, L. W.	Sarnia, Ont.
Smith, F. G.	Sarnia, Ont.
Wade, J. A.	London, Ont.

Miss Mary Pickford and Mr. Douglas Fairbanks broadcasting, for the first time in their lives, from the new, beautiful Radiophone Station, C K A C, La Presse, Montreal, at 8 p.m., October 2nd, 1922.

This broadcasting was rebroadcasted and heard all over the United States and Canada, and half-way across the Atlantic.

This is the most luxuriously equipped radiophone studio in existence. Attention is drawn to the microphone, clearly seen through the wicker lamp shade. The slightest sound made in the sound-proof room is instantly picked up by the microphone. Marconi equipment throughout. At the moment this flash-light was taken, Miss Pickford was listening to an address of welcome from the Marconi Station, C F C F, addressed to herself and husband, on behalf of the Montreal Theatrical Managers' Association.

For the benefit of listeners-in: 430 metres wave-length is used at Station C K A C, La Presse, Montreal.

The above photograph was taken of Mr. and Mrs. Douglas Fairbanks, who were recently brought to Montreal by the Marconi Wireless Telegraph Co., Ltd., and La Presse, in the interests of radio.

The picture shows Mary Pickford and Douglas Fairbanks receiving an address of welcome broadcasted from the Marconi Wireless Station, C F C F, on the Canada Cement Building, Montreal, and received at the La Presse Model C set, equipped with a Magnavox.

Mr. Morse, of the Marconi Co., made this address of welcome, after which the visitors replied first in English and then in French. These speeches were rebroadcasted, and were heard all over Canada and the United States and half-way across the Atlantic Ocean.

The La Presse have a very luxuriously equipped radiophone studio, and attention is brought to the microphone clearly seen through the wicker shade lamp. The slightest sound made in the sound-proof room is instantly picked up by the microphone. This station is equipped by Marconi throughout.

During their visit to Montreal, Mr. and Mrs. Fairbanks were very much impressed with the wonderful reception accorded them, and complimented the La Presse on their beautiful station. This is the first time that either Mary Pickford or Douglas Fairbanks have spoken over the radiophone, thus making their visit to Montreal and the opening of the La Presse station of particular interest to radio fans.

La Presse new radio car received direct from the polo grounds the world's series baseball play by play. At Amherst and St. Catherine Streets, Montreal, the crowd became so great and enthusiastic it took twenty policemen to hold them in check.

La Presse is now broadcasting regularly, and their programs will be printed in the Radio Broadcasting Program from week to week.

For the benefit of listeners-in, 430 metres wave-length is used at station C K A C, La Presse, Montreal.

Miss Mary P[illegible] and Mr. Douglas Fairbanks broadcast[illegible]
Radiophone Station [illegible] K[illegible] A[illegible] La Presse, Montreal[illegible]

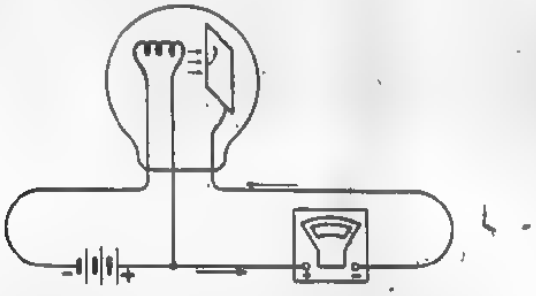
[illegible]

English and [illegible] These speeches were [illegible]

RADIO-TELEPHONY

By W. B. Cartmel, B.S., M.A., M.E.I.C., Fellow of the American Physical Society—An Address Given Before the Wireless Association of Ontario, September 8th, 1922

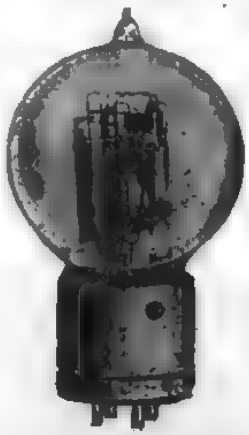
The lecture that I am going to give you this afternoon covers the transmission of speech and music by radio. What I have in mind is a discussion of the finer points of receiving and transmitting equipment, which are necessary in order to satisfactorily transmit speech or music. Such transmission has only been rendered possible by the development of the vacuum tube, so that my paper will include a very brief discussion of these tubes, and especially of the peanut tube, in which, I believe, you are all extremely interested. I do not intend to say much about vacuum tubes in general, because amateurs are quite familiar with such tubes; in fact, it was stated recently in one of the papers that there are over four thousand vacuum tube sets in use in Toronto. As you are all aware, the audion bulb has resulted from a discovery made by Edison in the year 1883. He placed a metal plate within an incandescent lamp bulb, in which the filament was lit up by a D.C. voltage of something like one hundred volts. On connecting this plate with the positive terminal of the filament, he was able to obtain a current of several milliamperes. The arrangement is shown in Figure 1.



This was never properly understood until the discovery of the electron in 1897 by Sir J. J. Thomson. It was found that in the exhausted glass bulb particles of electricity were shot off from the filament across the vacuous space in the lamp to the metal plate, and these particles then flowed around through the connecting wire of the milliammeter back to the positive terminal of the filament. It is not my present purpose to enter into a long discussion about electrons, but I do wish to say that in 1897 Sir J. J. Thomson did definitely prove that electricity consists of very minute particles.

After the discovery of the electron, Professor A. J. Fleming was led to use the Edison effect in constructing a two electode valve for the detection of currents in wireless telegraphy. Later, in 1906, DeForest added a grid to control the electron stream within the Fleming valve, and thus produced a detector vastly superior to the Fleming valve. It was afterwards found that the three electrode valve, the audion bulb of DeForest, was also a good amplifier. Soon after this it was realized by the engineers of the Bell System that a telephone repeater, which was at that time a crying need on telephone lines, could be produced from the DeForest audion used as an amplifier.

The adaptation of the electron tube for amplifying speech was begun ten or fifteen years ago by the engineers of the Western Electric Company and of the American Telephone and Telegraph Company in the United States. In their development of a telephone repeater they carefully investigated all the properties of the electron tube, so as to be able to design tubes which would transmit telephone conversations faithfully, and with this repeater they succeeded in giving good telephone transmission over wire lines between New York and San Francisco. So successfully was this done that speech was transmitted across the continent without distortion. Many of these repeaters are through line repeaters, and current is flowing through their filaments twenty-four hours a day, every day in the year. For this reason it was found important to have a minimum consumption of electric power in the filament. You will readily see the importance of economy in this case; while others were developing a tungsten filament for vacuum tubes, telephone engineers were working on a type of filament more difficult to produce, but having the advantage that it consumes less power. This filament was originally a European development, and is known as the Wehnelt cathode. The Western Electric engineers, starting with the idea of the Wehnelt filament, which is a filament coated with certain chemicals, making it give out electrons at a lower temperature than would be required by a tungsten filament, finally succeeded in developing a filament consisting of a platinum-iridium wire coated with barium and strontium oxides, which gives off electrons copiously. It only requires to be heated to a dull red heat, as compared with the white hot tungsten filament. In this way they succeeded in producing a vacuum tube, which gave splendid results, with only a very small consumption of electric power.

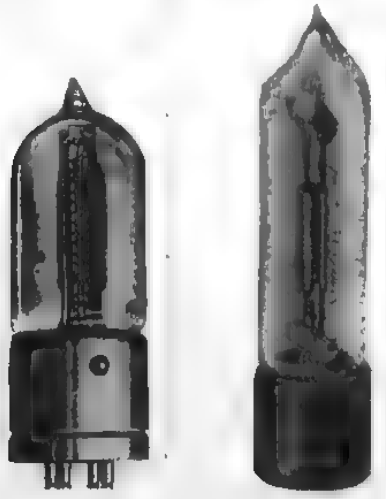


I have here a picture of this tube (Figure 2). It was used for amplifying currents in a telephone line.

In the course of their delevopments the engineers of the Western Electric Company and of the A. T. & T. Company have designed a variety of power and other cubes, and in 1915 established a world's record by tele-

Published by special permission of W. B. Cartmell, B.S., M.A., M.E.I.C., of the Northern Electric Co., Ltd., of Montreal, Que.

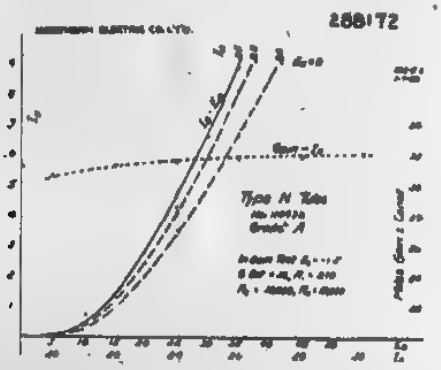
phoning from New York over a wire line to an antenna at Arlington, and thence through the other to Hawaii. However, that is something I do not wish to speak about much to-day, but wish next to speak of the development of a little tube used as a detector or



3 4

an amplifier designed for use by the United States Signal Corps, and shown as the VT-1 (see Fig. 3). These were produced by hundreds of thousands during the war. The filament of this tube was made of the Western Electric standard filament material, previously mentioned as having been developed for repeater bulbs, and in this tube good results were obtained, using only 1.1 ampere and 2.5 volts for heating the filament. This made a record for economy of power consumption, and led to further efforts in this direction, resulting in the development of the peanut tube (Fig. 4), which will give excellent results, with only one volt and .25 ampere in the filament. This you see will run very well from one dry cell.

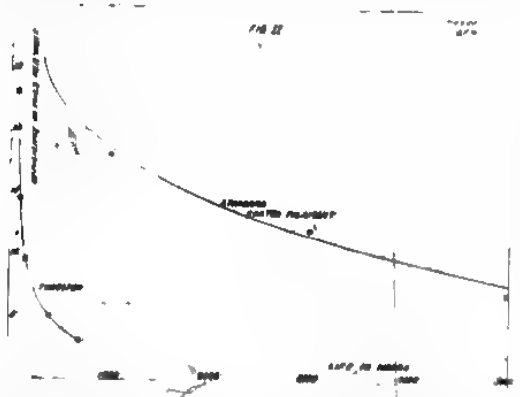
I now wish to show you some curves obtained with



the peanut tube (Fig. 5). These curves show the value of plate current that is obtained with different currents flowing through the filament. There is also a dotted line showing how the gain increases with the filament current. What is referred to here as gain is frequently called amplification. On this curve the gain obtained is in the neighborhood of 24 miles of standard cable, which is the telephone engineers' way of measuring amplification. The method of measuring gain in miles of standard cable arose in connection with telephone repeater bulbs. On telephone lines there is a limit to the distance over which one may talk satisfactorily. Talking through a telephone over the best open wire lines, this limit is about eight hundred miles, unless a repeater or some other means is used for increasing this distance. On talking over a telephone cable, however, the telephone current is cut down much more strongly, and satisfactory transmission from an ordinary telephone set can not be obtained over a greater length than thirty miles of standard No. 19 gauge, paper insulated, telephone cable.

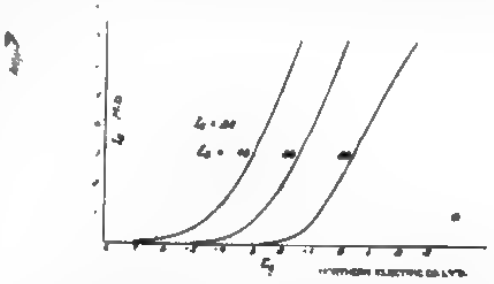
In our laboratories we make up an artificial cable box containing a suitable combination of resistance coils and condensers, which is used for various purposes, and, among other things, for measuring the gain from a vacuum tube. In measuring the gain by means of this artificial cable, we find how many miles of cable may be added in the circuit when a vacuum tube is inserted, and still get the same volume of sound in the receiver. This gives us the gain in miles of standard cable. You will note that as the current through the filament is increased from .25 of an ampere up to .3 of an ampere the gain increases by only about one-tenth of a mile out of a total of twenty-four miles, and there is, therefore, very little advantage in using higher current values. From the standpoint of life, variations in the current through the filament make an enormous difference. In order to obtain the best results with longest life with this filament, it is desirable to check the filament current with a suitable ammeter. This is different from the case of the tungsten filament, which is run at constant voltage in order to get the best results. The other conditions that we recommend are that the plate current should not exceed .6 of a milliampere. These are the points to be borne in mind if you wish to obtain a very long life from your tubes. Keep the plate current down to .6 of a milliampere and the filament current as low as

possible. Now, as regards the battery voltage, the plate battery should not be run at over 50 volts with the grid connected direct to the negative end of the filament, although 40 volts is more generally used. If we have a negative potential—a so-called bias potential—on the grid, we may add five or six volts in the plate battery for each volt added. Thus with a negative voltage of 1½ volts on the grid we may add nine volts more to the plate battery, making a voltage on the plate of forty-nine volts, or with the grid 4½ volts negative, we recommend a maximum voltage in the plate battery of 67½ volts. Now, while I have emphasized the conditions under which you may obtain the longest life out of your tube, I do not wish you to think that these tubes are liable to burn out in a short time, or that they are inferior as regards length of life to tubes having tungsten filaments. Tungsten filament will, to be sure, stand more than will the Northern Electric standard filament (previously referred to as Western Electric standard filament), but on the other hand, tungsten filaments have to withstand enormously more. The emission of electrons from tungsten filaments is so poor that they have to be heated white hot in order to give a satisfactory emis-



sion of electrons. I have here a curve (Fig. 6) showing the difference as regards power required to produce the same amount of electron emission from the tungsten filament as from standard oxide coated filament. It will be noted from this curve that using standard coated filament is possible to construct an efficient tube having an average life of 5,000 hours. The Northern Electric Company make a tube known as the VT-1, which has an average life of 5,000 hours. This length of life is not guaranteed for every tube, although since it is an average value, many of the tubes exceed this length of life.

Now I have given you a sketch of the battery requirements for peanut tubes as detectors and amplifiers, and I will now give you a sort of summary of the voltages that are required in a set. I am doing this partly because I have seen incorrect hook-ups in a number of magazines which purport to give reliable information to amateurs. In these hook-ups the voltages were not satisfactory for our tubes, nor would they be for any make of tube. With the peanut tube as a detector with no blocking condenser, connect the grid to the negative end of the filament, give it an additional bias of from one to 1½ volts negative on the grid, and use seventeen to twenty-two volts in the plate circuit. Fig. 7 shows the plate current (IB) in milliamperes corresponding to different values of grid potential (EC) in volts. This figure shows curves corresponding to three different values of plate battery (EB), viz.: 20 volts, 30 volts, and 40 volts. With 20 volts on the plate and a negative potential of 1½ volts on the grid, we can see from this figure that we would be operating on a sharp bend in the curve where excellent detection would be secured. When using a blocking condenser for detection, connect the grid to the positive end of the filament, using anywhere from twenty to fifty volts in the plate circuit. As an amplifier, connect the grid to the negative end of the filament and use a negative grid bias by means of a battery of from 1 to 2 volts. Negative potential is necessary on the grid when amplifying in order to prevent electrons from flowing from the filament to the grid,



thus causing distortion. Reference to Fig. 7 will show that negative potential is also needed on the grid when amplifying with 30 volts or 40 volts on the plate, in order that operation may take place on the straight portion of the curve. When detection is made with a blocking condenser, the plate battery can in some cases be the same both for the amplifying stage and for the detector stage, care, however, being taken to see that in the amplifier stage the opposite end of the filament is connected to the grid from what is used in the detector stage.

Now I wish to say something about the amplifiying and detecting properties of an audion. These tubes amplify both the voltage and the current. The voltage amplification factor depends on the design of the tube. The standard repeater bulb has an amplification value of 5.5 to 6.5, although there is a type of repeater bulb that amplifies the voltage twenty to thirty times, and special bulbs are sometimes used that amplify two hundred times. Our peanut tube amplifies the voltage anywhere from 5.5 to 6.5 times—let us say six times. What is meant by this is that if we put a voltage on the grid, the current in the plate circuit increases by six times as much as if we had added that much voltage in the plate circuit itself. Suppose, for instance, a battery of 1½ volts be applied to the grid, it will boost the plate current as much as six times 1½, or nine volts added to the plate circuit. The current in the plate circuit is also amplified, so that the power amplification of the peanut tube is 187, which means that the strength of a signal is amplified 187 times, as was previously stated.

I would like to explain very briefly how it is that this tube, which is essentially an amplifying tube, is such a good detector, because you will realize the great advantage of standardizing on one type of tube, provided it is capable of doing both jobs well. Many detector tubes as you know have a little hump in their characteristic curves. With such tubes sharp detection is obtained, but it is necessary to adjust the plate voltage so that the detection takes place on the hum

of the curve. Such a hump on the curve renders the tube useless as an amplifier. The peanut tube has no such hump in its characteristic curve, and does not need any, because a different principle is used to accomplish detection. In order to explain this, let us consider a tube in which there is no grid and no plate battery. This, you will remember, is similar to the so-called Edison effect, already mentioned at the beginning of this paper. Edison placed a plate within the bulb of his incandescent lamp and, connecting this plate with the positive end of the filament, he was able to obtain several milliamperes of current. This was afterwards found to be due to electrons or particles of negative electricity flowing through the vacuous space of the lamp from the filament to the plate, and it is the control of this stream of negative electricity by means of a grid which gives us the modern vacuum tube. Now you will notice that since the plate is connected direct to the positive end of the filament, that it is at the asme voltage as that end of the filament and, therefore, electrons do not flow from that end of the filament to the plate because, as we know, there must be a voltage between the filament and the plate—that is to say, a "B" battery, in order to get a flow of electricity. However, Edison probably used one hundred volts to light the filament of his lamp and, therefore, the voltage between the negative end of the filament and the plate was one hundred volts, which answered very well indeed to drive the current through the plate circuit. I think you will readily see that every point between the negative and the positive end of the filament is acted upon by a different electric pressure forcing electorns, beginning with one hundred volts at the negative end of the filament and diminishing to nothing at the positive end. You will see, therefore, that there will be a corresponding flow of electrons The electrons emitted from the negative end will be drawn along towards the plate very forcibly, while the other portions of the filament will have their electrons driven less and less forcibly as we approach the positive end of the filament, where the electrons are not driven over at all. Now, if we put an actual "B" battery in between the filament and the plate, the portions of the filament between the negative and the positive ends will be acted on more strongly; and as we increase this plate battery, portions nearer the positive end of the filament will contribute more electrons, until finally with sufficient voltage, a uniform flow will proceed from all parts of the filament. When this point has been reached, any further increase in plate voltage will only have a general effect in forcing electrons from the whole of the filament over towards the plate. It is at that place where there is a sudden change in the efficiency of the plate battery in driving over electrons that the tube is most efficient as a detector. Let us see if we can find out how much voltage must be used in the plate circuit in order to operate on the point in the detecting curve defined above. In detecting, we receive electrical oscillations on the grid at a negative potential, otherwise we do not obtain good results. Let us imagine, therefore, that the grid is attached to the negative end of the filament, and we will suppose that we have put in a grid battery of, we will say, 1½ volts, in order to maintain the grid sufficiently negative. In addition to this grid battery, there is another voltage on the grid to be considered, viz.: the contact difference of potential between the grid and the filament. I have not said

anything about this so far, but such a difference of potential exists, and this may be either positive or negative, and may be as great as two volts. In the peanut tube this voltage is negative, and by the process of manufacture is kept down to less than one volt. In order to make electrons flow all over the heated surface of the filament, including the positive end, it is necessary to put additional voltage on the plate to overcome both the negative grid battery voltage and the contact difference of potential. Now, as previously stated, in the peanut tube from five to six volts are necessary in the plate battery to overcome the effect of one volt in the grid battery, so that every volt or every fraction of a volt received at the grid produces as much effect in changing the plate current as six times as much voltage applied in the plate circuit. Therefore, if we take the grid battery voltage, say 1½ volts, and add to it the filament voltage, which is one volt in the case of the peanut tube, then add to that a voltage of from ½ to 1 volt contact difference of potential (we will assume ¼ of a volt in this case), that will give us 3¼ volts; multiplying this by six gives us nineteen and a half volts as the proper voltage to use with this type of tube in order to get the best detection. This voltage varies with different tubes, but will be in the neighborhood of 19½ volts.

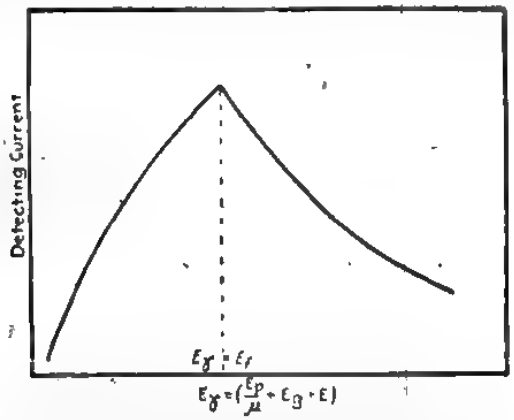
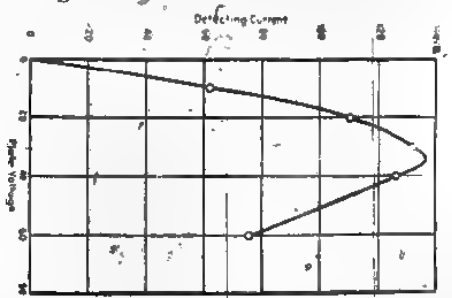
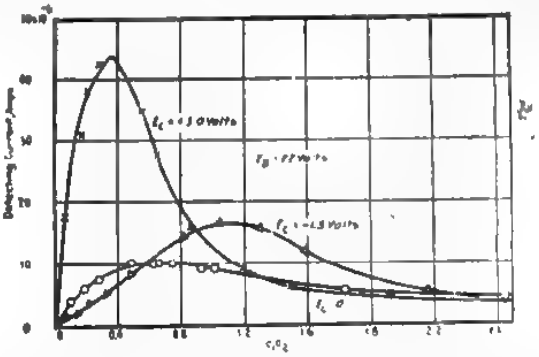


Figure 8 shows us a theoretical curve worked out mathematically, giving a sharp detection for the voltage as we have computed it, and Figure 9 gives the results of some experiments made on a tube of a type similar to the peanut tube. It will be noted that, while the detecting current is a maximum in this tube with



about 35 volts on the plate, there is almost as good detection over a range of from 23 to 43 volts. This is similar to the peanut tube which, although having a maximum voltage, gives good detection over a range of from 17 to 22 volts.

I have merely mentioned this method of detection, because some of you may find it necessary in the circuits that you use, to make use of grid voltage detection rather than a blocking condenser in the grid, and I wish to emphasize the fact that this little tube is an excellent detector used in this way, because of its low filament voltage, which makes it very sensitive. However, even with the peanut valve, the best results are obtained by using a blocking condenser and a grid leak. In this case the best results are obtained with a positive potential on the grid, or with the grid connected to the positive end of the filament. This gives much better results than with the grid connected to the negative end of the filament. I have no direct results showing the sensitiveness of this method, except for the reception of continuous current telegraph signals by heterodyne. The curve I have here (Figure



10) shows the detecting current in three cases—one with the grid three volts positive, another with no potential on the grid, and another with 1½ volts negative on the grid. You will notice that for weak signals very much better results are obtained with the grid three volts positive, in which case the detecting current rises to a sharp peak value as the signal strength increases, and then rapidly falls off. You will note that with 1½ volts negative on the grid there is also a peak to the detection curve, but that this occurs for a fairly strong incoming signal. With very weak signals no voltage on the grid gives better detection than 1½ volts negative, but that with three volts positive the detecting current is enormously greater for very weak currents than in either of the other two cases. What I wish to emphasize is merely that in using detection without a blocking condenser it is necessary to maintain the grid slightly negative in order to stop any flow of electrons to the grid, and that the tube must be operated within a certain range of plate volt-

age (seventeen to twenty-two volts), unless the grid is made more negative, in which case five or six volts must be added in the plate circuit for every extra negative volt on the grid. With blocking condenser detection, we recommend, on the other hand, that the grid be connected to the positive end of the filament, and that if any voltage is to be on the grid this should be a positive voltage. In this case the peanut tube is not limited to twenty-two volts on the plate, but higher values may be used. This may be seen from

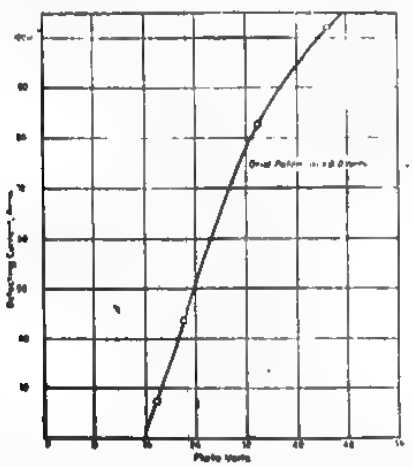
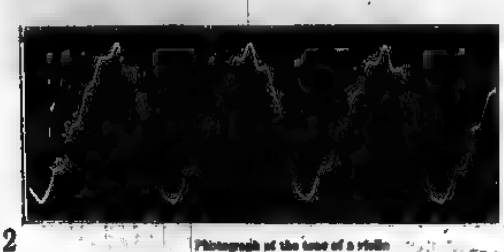


Figure 11, which shows the results of different voltages on the plate in connection with heterodyne reception, using a blocking condenser on the grid.

Before concluding about the little peanut tube, I wish to speak about its limitations as to volume. All tubes are limited as to the amount of power which they will deliver. This is true of the largest power tubes just as it is of the little peanut tube. This tube, however, gives a large output for a tube of its class, being capable of delivering a power output one hundred times as great as the amount delivered in a first class commercial telephone conversation. What is meant here by a first class commercial telephone conversation is the grade of transmission which the telephone companies consider satisfactory, which they try to met in all cases, and which they usually exceed for local calls and sometimes exceed on long distance calls.

I now wish to take up some of the finer points in connection with the transmission of speech, and more especially music. The question is, how must we design our radio equipment so as to transmit speech with the utmost intelligibility, so that we may even recognize the speaker's voice; or, in the case of music, how are we going to make sure of transmitting all of



12

the finer shades of expression so as to make music worth while, so that we can distinguish clearly between the peculiar quality of the sound from a violin string as compared with the sound from the human voice or from a brass band instrument? What is the peculiarity that distinguishes one of these sounds from another? An examination of the vibration of a violin string, for instance, will tell us something about this. I have here in Fig. 12 a photograph of the vibration of a violin string. A photograph of reflected light was taken on a moving photographic plate, with the result as shown. This photograph was actually taken by means of an apparatus called a phonodeik. You will notice that the vibration is not a simple vibration, but is made up of two or more vibrations, and it is this compounding of two or more vibrations which gives the pecularity to a note that enables us to distinguish between the notes of two different musical instruments.

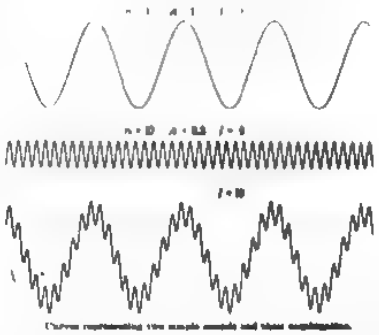
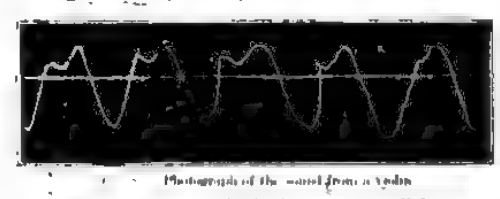


Figure 13 shows how two notes may be compounded together to give a note similar to the vibration of a violin string, that we have just seen. Usually the note from a musical instrument is much more complicated even than this, and in order to transmit faithfully the music from a violin or other instrument it is necessary to transmit carefully all of the various over-tones or harmonics as they are called.

The way in which a violin string will vibrate depends upon the way in which it is bowed, and sometimes we get a very complicated vibration, as shown



in Figure 14. Now, while it is not possible to see the co-existence of these vibrations, as in the simple case we have just considered, we can, however, in various ways find out the tones that make up the compound tone just shown. One of these is by means of a machine called a Harmonic Analyzer, with which one may trace over the curve and obtain from the machine the various harmonic components. Figure 15 shows the same violin tone we have previously shown, together with some of these harmonic components, as obtained by this machine.

Figure 16 shows a photograph of a sound wave from an organ pipe, and Figure 17 shows this curve, together with its harmonic components.

Now we can prove that these harmonic components exist in the curve, so that in reproducing a certain note from any musical instrument or from the voice, we have to reproduce not only the note itself, but all of its harmonic components. A proof of the existence of

these components can be given by means of a machine called a Harmonic Synthesizer. One makes various parts of this machine execute all of the various vibrations shown in Figure 17, and the machine then combines the vibrations, thus reproducing the original curve. Figure 18 shows the curve, as reproduced by

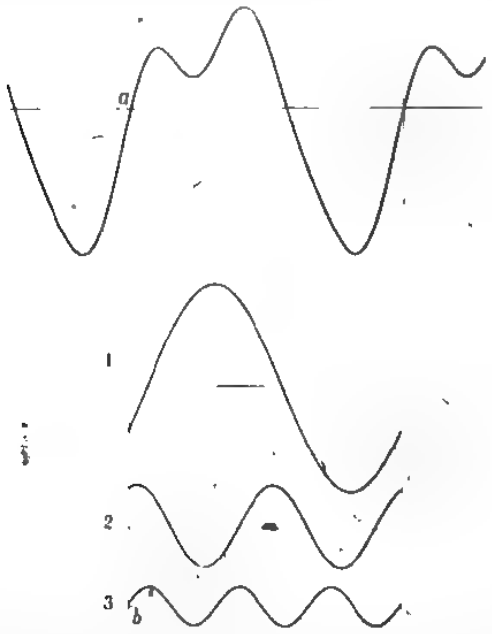


Fig. 15

the Synthesizer, traced over the original curve that was analyzed by the Analyzer. Now, our engineers have made a thorough study of sounds and their reproduction, in connection with the transmission of speech over a telephone line, and they have found it suitable to so design their telephone equipment as to transmit vibrations having frequencies varying from two hundred to two thousand vibrations per second. While this has been generally suitable for wire telephone work, they have sometimes found it desirable to design telephone lines and apparatus which would transmit vibrations as high as three thousand or more cycles per second, although satisfactory telephone conversations are ordinarily given with apparatus which transmits vibration up to two thousand vibrations per

16 Photograph of the sound wave from an organ pipe

second. Furtehrmore, transmitter and receiver diaphragms usually have a resonance point in their transmitting characteristics in the neighborhood of nine hundred vibrations per second, and this has been found for certain reasons to be very satisfactory. When, however, we come to transmit music, if we wish to obtain a good result, it is necessary to transmit sounds with much more faithfulness. The microphone used in the Northern Electric Company's broadcasting equipment and the loud speaking receiver have their diaphragms so arranged that the resonance point is so high as to produce no detrimental effect. The

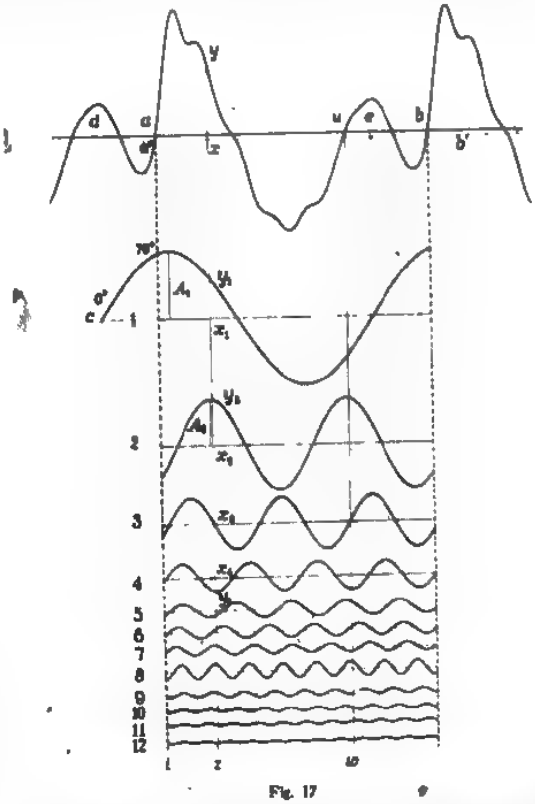
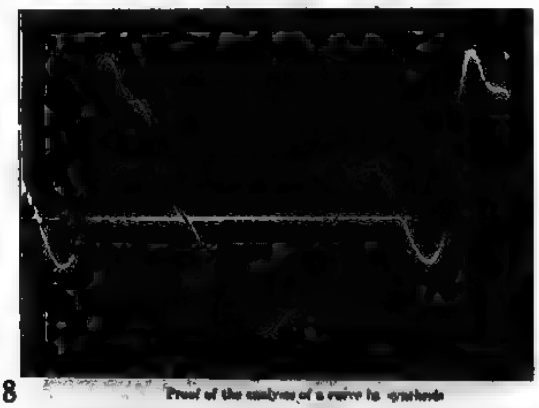


Fig. 17

resonance point of the microphone is in the neighborhood of seven thousand vibrations per second, and for that reason, among others, will transmit music per-

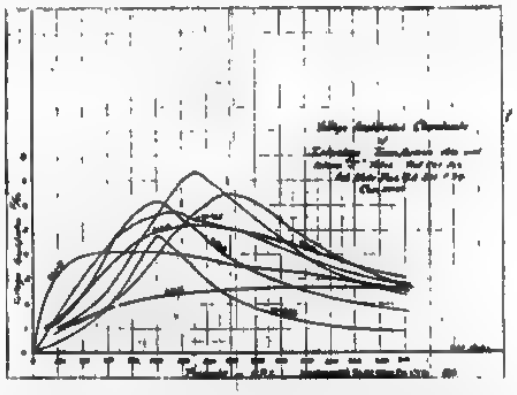


18 Proof of the analysis of a curve by synthesis

fectly. This microphone, as we have seen, will transmit all of the notes of the piano, whose highest note is C_7, having 4,138 vibrations per second down to the lowest note of the piano, which is A_0, or twenty-seven vibrations per second. It will, therefore, easily transmit the deepest note of a bass voice, which is $D_1^\sharp$, or thirty-eight vibrations per second.

A point that is of importance to amateurs is the effect that interstage transformers produce on these

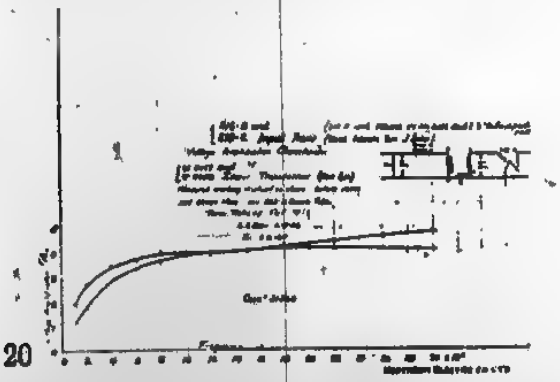
vibrations. I have here a curve (Fig. 19) showing the results of some tests of a number of different interstage transformers. These tests were made to deter-



19

mine how the voltage amplification—that is to say, the step-up of the voltage—varies with the frequency. You will notice that the one marked 231-A gives a good voltage amplification out as far as three thousand cycles and beyond, and would, therefore, be a very good transformer. The two curves which are unmarked represent tests on a well known competitive make of interstage transformers. These give a big voltage step-up, one in the neighborhood of thirteen hundred vibrations per second, and the other in the neighborhood of sixteen hundred vibrations per second. While these two transformers will give a loud effect, they will not reproduce music faithfully, because the harmonics of a note will not be reproduced in their proper proportion. The two curves marked W-858 and 201-A are the results of tests made on two transformers of Northern Electric manufacture. These two transformers are intended for telegraph purposes and give good clear, loud notes at one thousand cycles per second, and, while admirably adapted for the purpose for which they are intended, would be useless for the reproduction of music. The best results for the transmission of music would, no doubt, be obtained by combining the 231-A with the 201-E, with one in one stage and the other in the other stage, which would give a very uniform result.

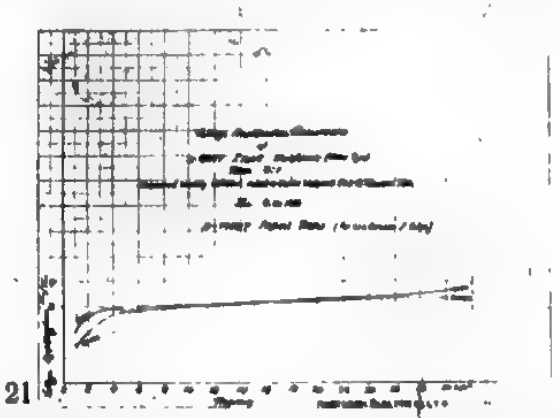
Figure 20 shows the results for the 218-B and 218-C



20

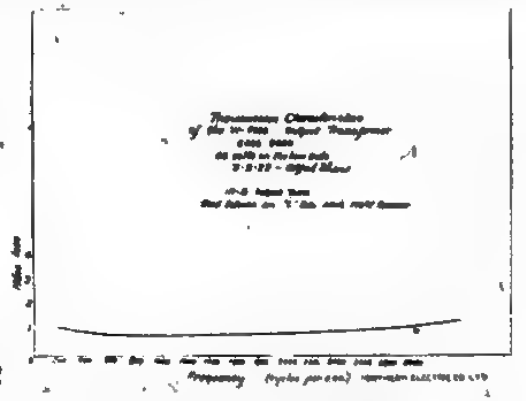
input transformers, which are used in amplifiers for connection from the receiving set to the loud speakers. Figure 21 shows the results for an input transformer, which also has a very flat, smooth characteristic, and will transmit the highest frequencies with remarkable faithfulness. Figure 22 shows a curve measured in miles less for an output transformer for connecting the amplifier to our 196-W loud speaking receiver, and the last of these figures, Figure 23, shows the results for a coil used in the first stage of our amplifier.

Now I wish finally to say a word in regard to transmitting circuits and apparatus, as many of you are

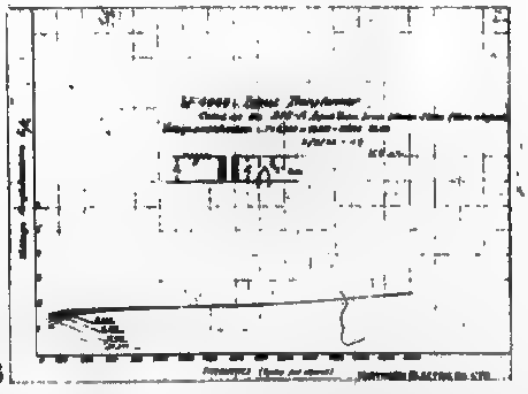


21

interested in transmitting. You know how transmitting is done on a telephone line. A steady current passes through an ordinary telephone transmitter or a microphone, and when we speak into this microphone variations in the current passing through the trans-



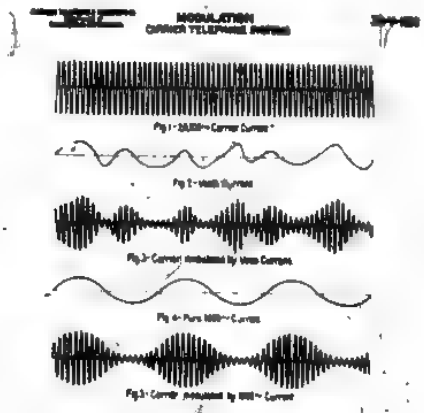
22



23

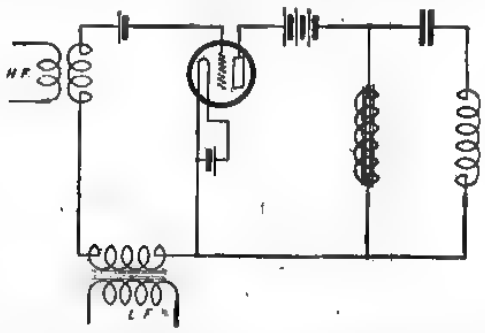
mitter are effected through the sound waves from the voice acting on the transmitter diaphragm, and by varying the resistance of the transmitter button they vary the current through the transmitter, and thus modulate the voice waves. A similar thing takes place in a radio transmitting set, where a steady constant

high frequency current is produced by an oscillating electron tube, and this is modulated in accordance with the voice waves. The first picture of the next slide (Figure 24) shows the steady oscillations produced in



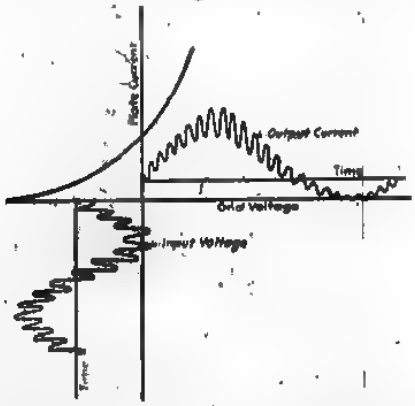
24

the oscillator. Figure 2 on the same slide shows the vibrations of the voice. Figure 3 shows the carrier current, or high frequency current, as modulated by the voice current. Figure 4 shows a pure note of one thousand vibrations per second; and Figure 5 shows the carrier modulated by the one thousand cycle cur-



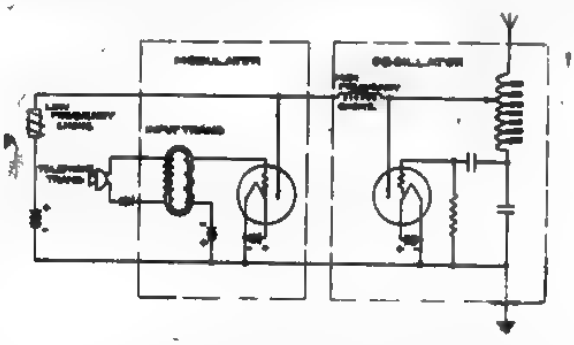
25

rent. The two circuits that we have used chiefly in connection with radiophone transmitting are the Van der Bijl circuit and the Heising circuit. The Van der Bijl circuit is shown in Figure 25. For low frequency



26

input a transmitter is used in connection with a transformer to send voice current into the modulation tube. The high frequency carrier wave from the oscillator and the voice current from the transmitter are fed through their respective transformers on to the grid of the modulator. The action of these two frequencies on the grid will give us an input voltage, as shown in the lower curve of Figure 26, which is a simple combination of the two frequencies, such as was shown in Figure 13. Due to the curvature of the grid voltage plate current curve, the output current of the modulator is as shown marked output current on Figure 26. This gives us a modulated wave similar to 5 of Figure 24. This method was used by the Western Electric Company in their 1915 experiments when they transmitted by radiophone to Honolulu. The circuit which is now chiefly used, however, is the Heising circuit, shown in Figure 27. This circuit may be operated



Schematic of Heising Modulation System

with only two tubes, one used as a modulator and one as an oscillator. The oscillator tube is connected to the antenna in such a way that the antenna forms a part of the oscillation circuit.

In modulating there is an important point to be kept in mind in order to obtain satisfactory results. In order to explain this satisfactorily it will be necessary to explain something about the reaction of the different frequencies in the modulated wave. In the modulated wave, shown in 5 of Figure 24, where we have a simple one thousand cycle current modulating the high frequency wave, there can be shown to be present a number of different frequencies in addition to those which were put in, namely, the one thousand cycle and the high frequency. If the high frequency is 20,000 cycles per second, there will be in this modulated current frequencies of 20,000, 21,000 and 19,000. Now in the case of the carrier modulated by voice current, as in 3 of Figure 24, the modulation is produced by a band of frequencies of from two hundred to two thousand cycles per second, so that in the modulated wave there will be the original carrier, together with two side bands. That is, there will be the 20,000 cycle carrier, together with an upper side band of from 20,200 to 22,000 cycles per second, and a lower side band of from 19,800 to 18,000 cycles per second. When we come to detect, the detecting tube acts similarly to a modulator, and the carrier frequency, which is present in the modulated wave, acting on these side bands will give us the original wave. This is the process of detection; such being the case, each one of the high frequency components of the side bands will react on one another, giving us other frequencies in the wave as detected, and these frequencies not being present in the original sound will change the sound as received; in other words, will produce distortion. To overcome this, we supply a very large amount of carrier wave as compared with the voice frequency. This will give us side bands which are weak, as compared with the

carrier. Now the strength of the detected signal depends upon the product of the strength of the side band and the carrier, so that even if the side band is weak, the carrier being strong, we get a strong signal, whereas the various components of the side band being equally weak, the product is weaker still, and their effect becomes insignificant. Modulating in this way, we are able to reproduce by radio with a minimum amount of distortion.

In conclusion, I wish to acknowledge my indebtedness for the pictures showing violin, organ and other vibrations. These are reproduced by permission from "The Science of Musical Sounds" by Professor Dayton C. Miller, who was kind enough to furnish his original photographs from which to make up the cuts.

RADIO STATION IN FAR NORTH

Fort Good Hope, situated on the Mackenzie River, north of the Arctic Circle, has now a radio receiving set. This set was made by the Universal Radio and Electric Co. of Windsor, Ont., and sent to Fort Good Hope. This set has a guaranteed range of 4,000 miles on the broadcasting wave lengths, and is made with three steps of radio amplification detectors and two steps of audio amplification.

This set was very carefully designed, and every attention given to details to make it absolutely perfect in operation.

This station is probably the most northerly one in operation to-day.

OFFICIAL LIST OF STATIONS

The Deparment of Marine and Fisheries, under the direction of Commander C. P. Edwards, head of the Radiotelegraph Service, have lately published an "Official List of Radio Stations of Canada." This book is very complete in all its details, and is in loose leaf form, the cover being in stiff board in royal blue, with gold lettering.

Mr. Edwards and his associates have long been thinking of putting a book of this description on the market, but have only this summer been able to complete and publish such a list, and we feel sure it will fulfil a long-felt want among the radio industry in Canada.

This book is selling for the very moderate sum of $1.00 per annum, and, being bound in loose leaf form, it is possible to bind all volumes under one cover.

We feel sure that this book will have a large circulation and in every way warrant its publication by the Government.

NEW ONTARIO RADIO ASSOCIATION

The New Ontario Radio Association held its first annual meeting in the Y.M.C.A. Building, Fort William, Ontario, on Wednesday, October 4th, and was attended by twenty radio enthusiasts. The following officers were elected to hold office for a period of one year, or until the next annual meeting:

President—D. J. McCaskill.

1st Vice-President—A. A. Mahon.

2nd Vice-President—C. S. Taylor.

Secretary—W. M. Sutton.

Treasurer—H. H. Richards.

Recorder—R. M. Eriksen.

Executive Committee—Technical, W. M. Angus; Program, T. Daley.

It was through the personal efforts of Mr. D. R. P. Coats, of the Perkins Electric Co., Winnipeg, Man., that the local association was formed.

Most of the high-powered broadcasting stations in Canada and the States have been heard on sets owned by seevral local club members.

LIGHTNING HAZARDS NOT INCREASED BY AERIALS

Actualy Less Danger With Aerial Than Without, Investigation Shows

"Watch out for lightning—beware of fire injury—or death as a result of using your Radio set with a roof aerial. Thunderstorms with attendent lightning may kill you while you sleep. Protect yourself, your family, your friends. Safeguard your life with a Hoosis Lightning Protector!"

Wow-w—but that does get one scared! But, is it a warning from the fire department, or does the municipal or federal government issue such warnings? Good heavens, not at all—this is merely an advertisement in the newspapers, attempting to sell lightning arresters by the "scare-'em stiff" method.

We do not wish to discourage the use of lightning arresters because occasionally they do protect delicate Radio receiving instruments and because, in some localities, they are required by law. But we do wish to discourage hysterical fears, unfounded in most cases, and greatly exaggerated in others.

Lightning is the result of a discharge of electricity between a cloud and the earth. This discharge often amounts to millions of volts, which sounds very dangerous, but isn't, if it strikes somewhere else. Be assured, that the lightning is not going to follow you around and seek you out for a little light diversion. It seeks the fastest way out and the shortest way down. Now if your aerial is properly erected and grounded, it will tend to equalize the electrical strain between the charged clouds over your roof and the earth beneath you, in very much the same way as a lightning protector, or lightning rod.

In other words, a properly erected aerial is, in a manner of speaking, a lightning protector, and is therefore, a safeguard, if anything, against lightning. The possibilities of a single wire aerial as an equalizer between the charged cloud and the charged earth, may not be very great, but it certainly can by no stretch of the imagination be termed an attraction to lightning.

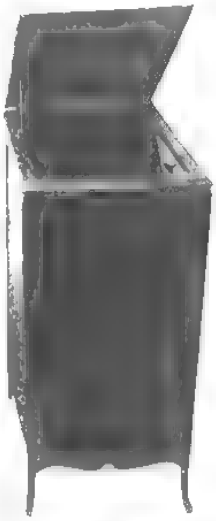
Assume that the electrical energy in a cloud decides to come to earth. A single No. 14 wire, strung as an aerial over your roof is not going to affect the going or coming of the lightning flash in the least. The entire mass of wire in your aerial won't move a million-volt lightning flash one iota of an inch. It is like trying to use a one-inch horse-shoe magnet to draw a locomotive ooff its iron track when it is speeding at sixty miles an hour.

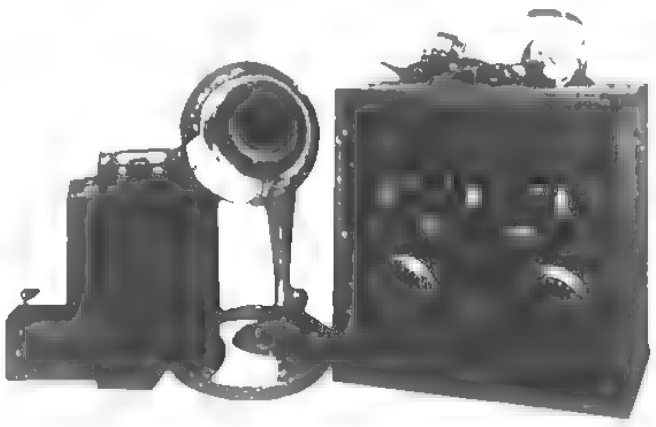
Lightning arresters are of value mainly to protect instruments from the extra heavy current charges caused by excessive static and from high potential current induced by lightning discharges taking place at a distance But they offer no protection from a direct bolt of lightning, at least, no more protection than the mistaken idea that an aerial offers attraction.

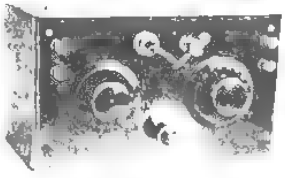
The similarity between an aerial, properly grounded, and a lightning rod, is sufficient to cause the statement that a good aerial, well erected and well grounded offers the same protection against lightning that a lightning rod does. And this is effected, by the fact that the aerial and the lightning rod both tends to equalize the electrical potentials between the earth and the clouds above, thus preventing to some degree, the lightning flash caused by the difference in potential between the earth and the clouds immediately above.

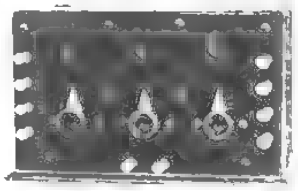
BARG

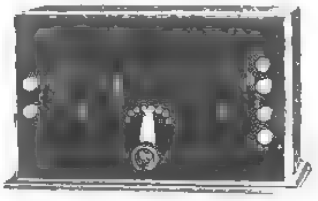
Less than Half-Price

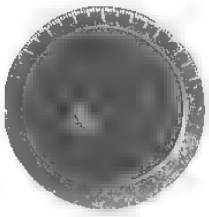


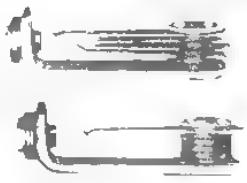












THE JACK V. ELLIOT COMPA

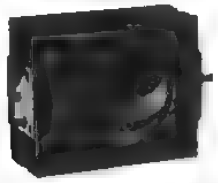
AINS

Get In On This Sale

Orders only accepted whilst surplus stock lasts.

Cash Must Accompany Order.

Oct. 16, 1922



J. V. E. Variometer is a well-made instrument comprising mahogany finished wood and nickeled brass parts. The winding and air space are correct for fine tuning. It may be panel mounted or put in plain view, as its appearance will be a credit to any set. Its performance is all that can be expected from any Variometer.

Price $3.40
Knocked down 2.00

J. V. E. Variocoupler is the one you will eventually buy, because its 180 degree coupling will give you finer adjustment than the old style 90 degree. Its perfection in giving many users the wonderful results you hear of. All metal parts are brass, nickel plated. Taps on primary. Panel or base mounting.

Price $2.90
Knocked down 1.75

J. V. E. Rheostat—Exceptionally even and smooth adjustment with this sturdy instrument. Price ..... $ .40

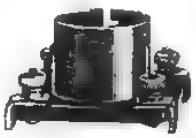
J. V. E. Nickel Binding Post, as shown above ..... $ .06
Rubber Knob Type ..... .07

J. V. E. Contact Points—Nickeled with lock nut ¼ Face ..... $ .01
J. V. E. Switch Stop ..... .01

J. V. E. Variable Condensers—All metal, sturdy and well built. The solid construction will insure you against the capacity changing through temperature changes, vibration or rough and careless handling. They are guaranteed to be mechanically perfect. The three plate size is an ideal Vernier Condenser.

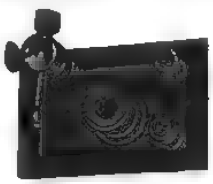
3-Plate $1.00
11-Plate 1.50
23-Plate 2.25
43-Plate 3.00

J. V. E. Switch Arm—Well finished and easily worth many times price asked. Lock bushing bearing. Contact tension spring. Highly nickeled with large hard Rubber Knob. Price ..... $ .25



J. V. E. Socket may be either panel or base mounted. The receptacle part is highly nickeled and firmly set in black base. Will take either small Power tubes or standard Detector or Amplifier tubes ..... $ .45

J. V. E. Head Band—Aluminum and highly nickel plated; parts light, comfortable and handsome. Price ..... $ .75



J. V. E. Crystal Detector—The neatest Detector on the market. Beautifully finished, perfect adjustment. Adjusting screw locks final adjustment, mounted on bakelite. Price ..... $ .75

Galena Crystals—Only highest grade crystals used and packed in cotton to protect mineral from dust and oil particles. Price $ .25

Look at These Prices!

Paper Tubes, 4" x 12"	$ .05
Paper Tubes, 3" x 12"	.35
G. E. Crystal Sets	7 50
Dials, Celluloid	.20
Grid Condensers, .0003	.15
Phone Condensers, .001 M.F.	.10
Improved Grid Condensers, .0004	.15
Grid Condensers, .00005 M.F.	.10
Pair Phone Cords	.90
Teagle V. T. Sockets	.75
Sliders	.15
4" x 8" Tuning Coils	1.50
Gramaphone Cabinets	20 00
Cabinet Loud Speaker, Special	35 00
Detector Tubes, no name	4.00
Detector Tubes, U V 200, Radiotron	5.00
Amplifier Tubes, U V. 201, Radiotron	7.00
Thordarson Audio Frequency Amplifying Transformer	6.25
Sterling Radio Frequency Amplifying Transformer	6.00
Sterling Audio Frequency Amplifying Transformer	3 75
Hydrometer	.65
Filament Current Ammeter, 0-3A.	3.75
Plate Voltage Voltmeter, 0-100V.	6.75
Pocket Type Voltmeter, 0-30V	2.00
Small Rubber Tubing, per foot	.03
Large Rubber Knobs	.05
A. Battery Charger	14.00
B. & A. Battery Charger	20.00
Storage Batteries—	
A. 6 volt, 50 amps.	12.00
A. 6 volt, 81 amps.	15.00
B. 2 volt cells	.35
B. 32 volt in carton	2.50
B. Batteries, 22½ volt	1.35
100 volt B. Batteries	7.00
J.V.E. Loud Speaker	30.00
J.V.E. Loud Speaker, without Power Amplifier	30.00
Magnavoxes	90.00
Brown Loud Speaker, large size	60.00
Brown Loud Speaker, small size	25.00
Brown Microphone Amplifier	40 00
Antenna Wire—7 strand, No. 22, copper, over 100 ft.—3 lbs. coils	1.00
Antenna Wire—7 strand, No. 22, copper, 4 lb. coils, over 300 ft.	2.00
Magnet Wire—No. 20, D.C.C. copper, per lb.	.65
Magnet Wire—No. 24, D.C.C. copper, per lb.	.75
Cabinets, same as used in B. sets, mission oak	2.00
Bakelite Panel, as used in B. sets, 6 x 10 x ⅛	1.00

Y - - Hamilton, Ontario

THE RADIO HOMCHARGER DE LUXE

Beauty has been combined with utility in the new Radio Homcharger De Luxe, a battery charging rectifier developed by the Automatic Electrical Devices Company, 120 West Third Street, Cincinnati, Ohio, especially for the homcharging of Radio A and B batteries.

Finished in a dull mahogany and beautiful old gold, it harmonizes with the finest room furnishings, and permits the Radio enthusiast to re-charge his battery after an evening's entertainment without even disconnecting it from his set.

The Radio Homcharger De Luxe is constructed upon the same perfect operating principle used in the Type A Homcharger, which has heretofore been the most popular battery charging rectifier in the Radio field. Its working parts are entirely enclosed, eliminating all danger of shock and fire. It is constructed of the highest grade materials throughout—moulded Bakelite Base—Jewel Ammeter—Oversized Silicon Steel Transformer. There are no frail castings to break, as all parts are made from highest quality stampings.

The Homcharger De Luxe can be operated by anyone. It is self-polarizing, so that the batteries may be connected either way, and they will always charge. It gives a tapering charge, as recommended by battery manufacturers, and is guaranteed not to harm or injure the battery in any way.

It will fully charge any A or B storage battery overnight at a cost of only a few cents. Conforms to the latest underwriters' requirements, and requires no watching.

It is being sold by all the leading radio, electrical and accessory dealers at the uniform price of $18.50. The above company has issued a very handsome booklet, illustrating the Radio Homcharger De Luxe in actual colors, which is free for the asking.

WESTINGHOUSE ENGINEER A PIONEER IN RADIO BROADCASTING

Almost any Radio amateur who owned a set capable of good range reception prior to 1921 is familiar with the history of station 8-XK of Wilkinsburg, Pa., operated by Frank Conrad. These amateurs know of the phonograph concerts broadcasted by Mr. Conrad during a period of a year and which were heard as far west as the Catalina Islands. They may recall hearing his request for records one night and may have sent him one, for there were 500 records received in answer to his plea. This was early in 1920 before the Radio broadcasting craze had swept the country and was, possibly, the first indication that Radio broadcasting had some wonderful possibilities as a medium of entertainment.

8-XK has not been very active the past two years for KDKA, of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., has taken its place as the broadcaster of Pittsburgh and environs. But even so, little 8-XK was the forerunner of powerful KDKA and actually was the indirect means of bringing the attention of Mr. H. P. Davis, Vice-President of the Westinghouse Company, to the radiophone as a means of popular entertainment and instruction.

Many Radio amateurs who know Frank Conrad as a broadcaster of ability may not know that he is assistant chief engineer of the Westinghouse Company, and, besides being inventor of a great deal of Radio apparatus, including a combined receiving and transmitting set for the U. S. Signal Corps which was used in France during the World War and a short wave meter, is one of the most prolific electrical inventors of the present day.

The Radio amateurs know Frank Conrad as a Radio amateur of ability, but few of them know that he stands near the top of his profession as an electrical designing engineer. Yet it is a fact, that during the time he has been engaged in electrical designing, approximately 120 patents have been accorded him.

The field covered by the Conrad inventions is broad, including as it does alternating-current and direct-current electrical measuring instruments of the indicating integrating (including prepayment) and recording types, relays and relay systems, voltage and current regulators, switches, electrically heated boilers, arc lamps, dynamo-electric machines, transformers, motor-control systems, systems of electrical distribution, mercury-vapor rectifiers, automatic synchronizers, phase relation indicators, ground detectors, bakelite micarta gears, starting, lighting and gear shifting and ignition systems for automobiles, carburetors, hand grenades and Radio telegraphy and telephony.

Despite his 30 years of service with the Westinghouse Company Mr. Conrad is a comparatively young man as executives go. He was still in his teens when he secured a job with the Westinghouse Company, then located in Garrison Alley, in a very small building, and as his friends have stated, has been growing with the Company and the electrical industry ever since.

Mr. Conrad is a flawless reasoner and attacks any subject with the same avidity with which he goes into engineering problems. He is able to concentrate so thoroughly upon what he reads that it is said he never forgets what he once has grasped. As those who know him state, he can remember the gist of the contents of every book he has ever read. For this one reason, perhaps more than others, he is remarkably well-informed upon practically every scientific subject of modern times.

He is responsible in no small measure for the success of KDKA for his experience gleaned in amateur broadcasting was available in perfecting this station. In fact, Mr. Conrad was the first person called in, when Mr. H. P. Davis, who first saw the Radio broadcasting vision, determined to establish the first Radio broadcasting station in the world to broadcast nightly concerts.

CRYSTAL DETECTOR NOT RECENT "INVENTION"

Many authorities now state that old patents, magazines, and other scientific literature, shows that the crystal devices claimed to have been "patented," were described in these magazines and patents many years before the present holders' "patents" were applied for. There is a great volume of this literature, it is said, in French, German and Dutch languages, as well as in English, clearly explaining the crystal detector, no one ever having bothered to file patent applications on them until comparatively recent times.

The subject matter of a patent which is described in a printer publication or in a patent two years before the application date of patent, makes it invalid under the statutes. It is also generally stated that no patent is valuable until it has been adjudicated.

RADIO CORPORATION—WESTINGHOUSE ROAD PROGRAM

Station WJZ, Newark, N.J., Eastern Standard Time

A week after the New York district changed from Daylight Saving to Eastern Standard Time, a new schedule for broadcasters in the Second Radio District went into effect. The proposed schedule has been arranged to eliminate as far as possible, the interference in the air for the invisible audience.

The management of WJZ had the privilege of broadcasting on 360 meters, sharing the time with the less powerful stations, or going in with the Class B, the most powerful stations in the Second District, and operating on 400 meters.

The Class A stations agreed to stand by on special occasions should WJZ, the Radio Corporation-Westinghouse Station at Newark, N.J., want to broadcast concerts, such as the Stadium Concerts given by the Philharmonic Orchestra; play by play results of the World's Series, and the Saturday afternoon football games from September 23 until the end of the season, also to permit WJZ to broadcast every evening.

Class A Stations are: WWZ, John Wanamaker, New York; WBS, D. W. May, Newark, N.J.; WHN, Ridgewood Times, Ridgewood, L.I.; WRW, Koenig Bros., Tarrytown, N.Y.; WBAN, Wireless Telephone Company, Paterson, N.J.; WAAT, Jersey Review, Jersey City, N.J.; WAAM, I. R. Nelson Company, Newark; and WFAF, Shotton Electric Co., Poughkeepsie, N.Y.

WJZ will continue to operate on the 360 meter wave length. As usual, the bedtime stories will be broadcasted every evening from 7.00 to 7.30 p.m. by WJZ. This station will then stand by for an hour on Monday, Thursday and Friday and Saturday evenings, and for an hour and a half on Tuesday and Wednesday evenings for the other members of Class A Stations in the Second District. Probably next week WJZ's program will be published in detail.

Class B Stations of the Second District, New York, are supposed to keep up a continuous day-time and evening program on 400 meters.

At present the programs for Class B stations are not complete. Class B members are: WOR, Bamberger & Company, Newark, N.J.; WGY, General Electric Company, Schenectady, N.Y.; WHAZ, Rennaslear Polytechnic School; WBAY, American Telephone and Telegraph Company, New York.

If all broadcasting stations keep their sending apparatus in first class condition, and the invisible audience also pay attention to details and adjustments of their receiving sets, it is thought that very little interference will result from the operation of Class A and Class B stations, in the New York district, broadcasting at the same time.

The proposed arrangement will provide continuous entertainment on two separate and distinct wave lengths from 8.00 a.m. until 11.00 p.m., and 400 meters sometimes until midnight.

RECORD OF CANADIAN PATENTS

223,697. **Radio Control System—Manrico Compare**—dated September 19th, 1922.

223,845. **Radio Telegraphy Signalling System**—The Federal Telegraph Company—assignee of Leonard F. Fuller and Roland G. Marx—dated September 19th, 1922.

224,050. **Electro-Dynamic Receiver**—The Magnavox Company—assignee of Edwin S. Pridham and P. L. Jensen—dated September 26th, 1922.

224,051. **Electric Relay**—The Marconi Wireless Telegraph Co. of Canada, Limited—assignee of Norman W. McLachlan—dated September 26th, 1922.

224,114. **Machine for Making Wire Fabric for Grids**—The International Western Electric Co., Inc., assignee of Otto Muller and Geo. W. Burchett—dated September 26th, 1922.

224,425. **Wireless Transmission Signals**—Earl Charles Hanson, Washington, D.C., 3rd October, 1922. An audio frequency wireless receiving station, antenna and ground, a vacuum bulb repeater, having a primary and secondary winding, and an iron core transformer so arranged as to eliminate radio frequency waves.

224,426. **Loud Speaking Wireless Phonograph**—Earl Charles Hanson, Washington, D.C., 3rd October, 1922. A receiving apparatus for audio frequency electric currents, comprising a telephone receiver, an iron core transformer, a vacuum bulb repeater, means by which said vacuum repeater is utilized to amplify the curernt in the secondary of said transformer, and a grip connected to one terminal of the primary of said transformer, the other terminal being connected to the ground, said grip being of suitable size and shape to be grasped by auditor.

224,427. **Audio Frequency Controlled Torpedo**—E. Charles Hanson, Washington, D.C., 3rd October, 1922. An apparatus for directing and controlling the movement of a self-propelled torpedo.

224,428. **Lifeboat Radio Signalling System**—E. Charles Hanson, Washington, D.C., 3rd October, 1922. A radio signally system for lifeboats.

224,429. **Wireless Transmission of Speech**—E. Charles Hanson, Washington, D.C., 3rd October, 1922. A wireless transmitting station, means for transmitting energy, having a frequency not in excess of speech frequency through natural media, including a voice controlled input circuit, a vacuum tube relay connected with said circuit for amplifying the energy thereof, a transformer having its primary connected with the output circuit of said relay, and its secondary connected to an antenna circuit.

WITH THE CANADIAN MANUFACTURERS

New All-Canadian Made Loud Speaker on the Market

The above is an illustration of the new All-Canadian made loud speaker manufactured by the Jack V. Elliot Company, Hamilton.

Exhaustive tests have been made, and the results obtained have been entirely satisfactory.

It is claimed by the manufacturer to be the equal of any loud speaker made in the world, and is the most reasonably priced high grade loud speaker on the market to-day.

It is beautifully finished and a credit to any manufacturer.

SHIELDED CONDENSITE CELERON

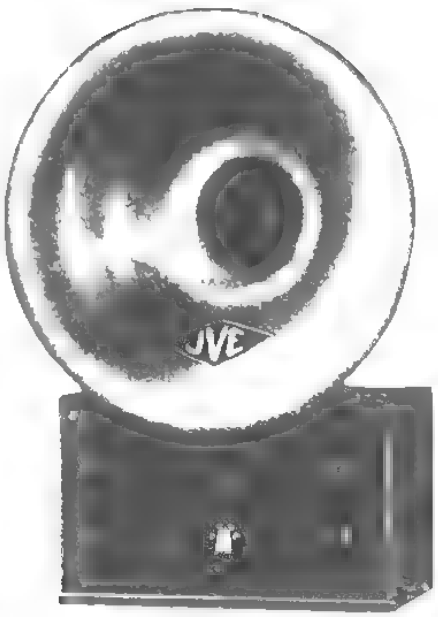
A condition with which all radio operators are familiar is the capacity effects of the operator's body in tuning. This phenomenon is a most annoying and troublesome impediment to expert operation.

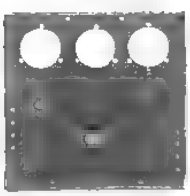
To overcome this, Diamond State Fibre Co. of Canada, Ltd., have developed a shielded panel material which they designate Shielded Condensite Celoron. This exclusive and important development consists of a special metal plate, embedded just under the back surface of the panel. The outstanding feature of this

construction is that it lowers body capacity and minimizes detuning effects.

In use, panels made of this material must, of course, be grounded, and care must be taken in attaching the grounding connection to see that it is in electrical

RADIO





Guide to Canadian Broadcasting Stations

Name	*Wavelength*	*Call Signal*
Montreal		
Marconi Company	440 metres	CFCF
Dupuis Frères Limitee	420 "	CJBC
Northern Electric Co.	410 "	CHYC
La Presse	430 "	CKAC
Can. Westinghouse Co., Ltd...	400 metres	CFZC
B. L. Silver	420 metres	CHCX
Bell Telephone Co. of Can.		CKCS
Toronto		
Bell Telephone Co. of Can.		CFTC
Can. Westinghouse Co., Ltd...	420 metres	CKCZ
T. Eaton Co.	410 "	CJCD
Evening Telegram	430 "	CJSC
Globe	420 "	CHCZ
Independent Tel. Co.	450 metres	CKCE
John Miller & Son	410 metres	CHFC
Marconi Company	440 "	CHCB
Metropolitan Motors	410 "	CHVC
Radio Equipment & Supply Co.	410 metres	CKKC
Star	400 "	CFCA
Simons Agnew Company	410 "	CJCN
United Farmers of Ontario	410 metres	CJCH
London		
Free Press	430 "	CJGC
London Advertiser	430 metres	CFCX
Radio Shoppe	410 metres	CHCS
Radio Supply Co.	410 "	CKQC
Hamilton		
Can. Westinghouse Co., Ltd...	400 metres	CHIC
Wentworth Radio Supply Co...	410 metres	CKOC
Ottawa		
J. R. Booth, Jr.	400 metres	CHYC
Fort Frances, Ont.		
International Radio Dev. Co...	400 metres	CFPC
Walkerville		
Motor Products Corporation....	440 metres	CFCI
Kitchener		
News Record, Ltd.	420 metres	CJCF
Calgary		
Radio Corporation of Calgary	430 metres	CFAC
W. W. Grant Radio, Ltd.	440 metres	CFCN
Edmund Taylor	420 metres	CJCY
Can. Westinghouse Co., Ltd...	400 metres	CHCC
Albertan Publishing Co.	410 "	CHBC
Western Radio Co.	400 "	CHCQ
Edmonton		
The Journal	450 metres	CJCA
Nelson, B.C.		
J. G. Bennett	400 metres	CJCB
St. John, N.B.		
McLean, Holt & Co.	400 metres	CICI
Jones Electric Radio Co.	400 metres	CKCR
Winnipeg		
Can. Westinghouse Co., Ltd...	440 metres	CFCD
T. Eaton Co., Ltd.	450 metres	CKCB
Lynn V. Salton	420 "	CKZC
Manitoba Free Press	410 "	CJCG
Radio Corp. of Winnipeg	430 metres	CHCF
Salton Radio Engineering	420 metres	CKZC
Tribune	400 "	CJNC
Regina		
Leader Pub. Co. of Regina	420 metres	CKCK
Vancouver		
Marconi Company	440 metres	CFCB
Geo. Melrose Bell	430 metres	CHCF
Vancouver Daily Sun	420 "	CJCE
Vancouver Daily Province	410 "	CKCD
Victor Wentworth Odlum	400 metres	CFYC
Radio Corporation of Vancouver, Ltd.	430 metres	CHCA
Can. Westinghouse Co., Ltd...	400 metres	CHOC
Halifax		
Marconi Company	440 metres	CFCE
Eastern Telephone & Tel Co...	410 "	CJCS
Iroquois Falls		
Abitibi Power & Paper Co.	400 metres	CFCH

contact with the metal plate. This can be best secured by cutting away the cover of Condensite Celoron and exposing the plate, permitting the soldering of the binding post or other form of connection to the metal plate.

In like manner, when openings are made through the plate to carry instruments, its back should be counterbored for a generous distance around the opening and deep enough to remove the metal plate, to prevent dielectrical contact between it and the instrument. Care should also be taken to insulate grid and plate leads from metal shafts that protrude through the surface of the panel.

This material, as well as plain Condensite Celoron, is being carried in stock in thicknesses of ⅛, 3/16, and ¼", by the above firm in Toronto.

NEW WORKRITE RHEOSTAT

The WorkRite Super Rheostat is the newest addition to the listed WorkRite radio parts. This rheostat meets the great need for an instrument capable of exact minute adjustments. Pushing the knob in and out changes the resistance from 6½ ohms to zero and turning the knob gives 50,000 possible adjuustments. This makes it easy to secure the proper adjustment every time, which is so necessary on the detector tube for distant concerts. The metal fittings are made of brass, nickeled and highly polished. Special resistance wire that will not corrode or rust is used. Screws for mounting on panel are furnished. The rheostat is all complete ready to connect into the set. The WorkRite Super Rheostat sells for $1.50. For additional information write to The WorkRite Mfg. Co., Cleveland, Ohio.

THE HISTORY OF RADIO

PUT THIS IN YOUR SCRAP BOOK

1883—Thomas A. Edison discovered what is now called the "Edison Effect," a phenomenon occurring in a burning incandescent electric bulb, in that an electric current can be made to pass through space from the burning filament to an adjacent cold metallic plate. While not applied to radio at this early date, the discovery was later used in developing the vacuum tube, now a veritable modern Aladdin's lamp and the very heart of radio communication.

1885—Electric signalling through the air without connecting wires is started when an English experimenter stretches two lengths of wire one-quarter mile apart and by charging one with a local electric current is able to induce a response in the distant wire.

1887—Professor Heinrich Hertz, a German scientist, proves experimentally that electric waves are sent through space with the speed of light by the electric discharge that takes place when a spark is made by an induction coil or a static machine. These waves have since been called "Hertzian waves."

1890—Prof. E. Branly, of Paris, develops the coherer, which considerably improves reception.

1894—British experimenters bridge a distance of 1¼ miles by means of improvements on the original induction system of 1885.

1895—Guglielmo Marconi proves that electric waves can be transmitted through the earth, air or water by means of sparks producing high frequency electrical oscillations.

1896—Marconi further proves that telegraph signals can be sent and received by means of the now famous Hertzian waves up to a distance of three miles.

1900—A. F. Collins bridges distances up to eight miles by means of his so-called electro static system of wireless signalling.

1901—Marconi, spurred by his early success, finally succeeds in bridging the Atlantic Ocean from Poldhu, Cornwall, England, to St. John's, Newfoundland, by sending the historical series of the letter "S," the distance being 1,800 miles.

1902—Prof. E. Ruhmer's photophone system of wireless covers a distance of 20 miles at Kiel, Germany.

1902—Wireless telegraphy is adopted on large trans-Atlantic passenger vessels, the test being on the American S. S. Philadelphia.

1902—Prof. J. A. Fleming, of London, England, invents the two element thermionic valve detector for radio reception.

1906—Prof. R. A. Fessenden, an American experimenter, develops a high frequency alternator system, having a range of 20 miles.

1906—The Telefunken Arc system of wireless telegraphy is developed and covers a distance of 25 miles.

1906—Dr. Lee De Forest, an American radio expert, improves the Fleming original vacuum tube by inserting the third or control element, known as the grid.

1908—Prof. Poulsen perfects another arc transmitting system which covers more than 150 miles on first test.

1908—Marconi trans-Atlantic radio stations are opened to the general public for the transmission and reception of radiograms between Great Britain and Canada.

1908—Prof. Marjorana perfects an arc oscillating generator and liquid microphone system and bridges Rome with Sicily, a distance of 300 miles.

1911—The radio telephone covers a range of 350 miles between Nauen, Germany, and Vienna, Austria.

1912—The International Radio Telegraphic Conference approves regulations to secure uniformity of practice in radio services.

1912—E. H. Armstrong, an American, invents the now famous regenerative vacuum tube circuit while experimenting at Columbia University.

1913—The powerful radio station at Nauen, Germany, successfully bridges a practical telegraphing distance of 1,550 miles.

1914—Laws are formulated by foremost maritime nations requiring that vessels of certain sizes and grades carry wireless equipment and operators.

1914—The Marconi Wireless Telegraph Company of America inaugurates a new American trans-ocean wireless service by opening its California-Honolulu circuit.

1915—The American Telephone and Telegraph Company, working in conjunction with the Western Electric Company, succeeds in telephoning by radio from Washington to Paris, a distance of 3,700 miles, and from Washington to Hawaii, a distance of 5,000 miles.

1916—President Wilson and Mikado of Japan exchange radiograms at opening of newly established trans-Pacific radio service between the United States and Japan.

1917—Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company, develops a 200 kilowatt high frequency alternator, now used almost exclusively in trans-oceanic radio communication.

1918—Both radio telegraph and radio telephone conclusively prove their tremendous importance in warfare in the World War.

1919—Canada and England are linked by radio telephone for the first time, vacuum tube transmitters being used.

1919—The Radio Corporation of America is formed, taking over the interests of the Marconi Wireless Telegraph Company of America and the radio activities of the General Electric Company in plans for a world-wide wireless system.

1920—The American Government returns high power radio stations, employed throughout the war, to the Radio Corporation of America.

1920—American radio amateurs reorganize their forces, now reinforced many thousands of times by war trained radio men, and begin to turn their attention to amateur radio telephone development

1920—An American built and controlled station to be known as Radio Central is conceived with facilities for simultaneous wireless telegraph communication to the entire world. To this end a tract of land covering ten square miles is acquired on the north-eastern end of Long Island, near Port Jefferson, and construction work begins.

1921—Popular radio broadcasting begins.

1921—Twenty-seven amateur radio men make history by transmitting across the Atlantic from the United States to Ardressan, Scotland. The power used in the various stations averaged from 50 to 1,000 watts.

1921—President Harding formally opens Radio Central by sending a radiogram addressed to the nations of the civilized globe.

1922—E. H. Armstrong announces his super-regenerative vacuum tube circuit.

1922—Dr. Irving Langmuir, of the General Electric Company, announces a 20 kilowatt vacuum tube, the most powerful ever made.

1922—Marconi demonstrates to an American audience his radio searchlight, a means of directing radio waves.

MARKET NEW INVENTION IN CANADA

That the almost world-wide interest in radio is going to bring a great many industries to Canada is shown by the forming of Jewett Radio-Phonographs, Limited, a million-dollar corporation, which has just leased a factory in Walkerville, Ontario. At the head of this is Mr. E. H. Jewett, one of the leaders of the Paige Detroit Motor Car Company, and president of Jewett, Bigelow & Brooks Coal Company, one of the largest coal mining corporations in the United States. Mr. Jewett is going to market in Canada a very unique invention called a radio-phonograph, which consists of an especially high grade of phonograph, with a wireless receiving station built into it, so that it will be possible to play the phonograph or turn a switch and hear a real band playing, an artist singing, or some well known lecturer discoursing on some important subject, and the radio tones come right into the room through the phonographic horn. In spite of the enormous number of radio receiving sets that have been made and sold, they have practically all necessitated the use of telephones strapped to the ears, and the invention which the Jewetts have acquired is considered the greatest advance so far in the radio industry.

Of so much importance is this invention that the United States army has selected it to make a very important test. Members of the air force will remember that all aeroplanes were equipped with wireless sending apparatus, but they were built on what is called the spark system, so that the messages could only be sent in code. Now army officials believe that it would be an immense advantage if aeroplanes could be equipped with sending stations, so that the observer on the aeroplane could send instructions to gunners or anyone else he wished to talk to, using his own voice, and being able to despatch the information very much more quickly and to much better advantage than would be possible when using a telegraphic code. Another big advantage would be, that if this message can be amplified into a room, so that it will not be necessary for an operator to sit at a listening station and depend on head phones, a great many of the difficulties would be obviated.

This device is already being manufactured in the United States, and will shortly be manufactured in the Walkerville plant, Ont. While no immediate Government orders are expected as yet, there is an enormous demand in the homes, in dance halls, movie theatres and large pleasure resort hotels, for an instrument that will give a radio concert, lecture, etc., without the audience having to sit with telephones on their ears, and the Jewett Company has already booked a large number of orders in Canada for such a device.

The company will also manufacture a radio outfit having two stages of amplification, using what is known as a vacuum tube or vales for the detecting and amplifying of the radio waves. This set will be at a popular price, and will require telephone receivers to operate. The company has also designed a very ingenious small-sized radio receiving outfit to sell at a low price, which will have a range of about forty miles, but which can be very easily built into a large tube set with a great range. In addition to this, the company will manufacture a great many radio accessories, including loud speakers and telephone head sets.

REDETERMINATION OF WAVE-LENGTHS IN SPECTRUM OF AN IRON ARC

As is now quite well known, the wave-lengths of certain sources of light are being quite extensively employed as fundamental standards for length measurements. The International Astronomical Union meeting in Rome last year adopted a new type of iron arc as a source of secondary standards of wave-length, thus making it necessary to redetermine the wave-lengths in this spectrum.

The required observations have, accordingly, been made by taking photographs of the interference fringes produced by cadmium, neon and iron lines. About 50 spectrograms covering a wave-length from 3,000 to 9,000A were obtained, and it is hoped that the observations will be reduced and compiled early in the fall.

Radio Telephone Between Denmark and Sweden

Reuter's Trade Service states that the radio telephone circuit between Copenhagen and Bornholm was recently opened to the public. The arc system is used for transmission and the rates charged are lower than for similar service by telegraph. This is the first public radio telephone circuit to be placed in service in Scandinavia.

Instructions for Building a Transformer to be used with a Tungar Rectifier

By a Toronto Experimenter

This bulb is about the size of an ordinary 100 watt Tungsten lamp, but with what is called a mogul base. This base will not fit the house lamp socket. Special size socket manufactured and sold by catalogue number G.E. 1194 is required. Inside this tube is a plate of graphite connected by a wire through the glass at the opposite end to the base.

Connect the positive terminal of the battery to one of the terminal screws on the socket. A source of alternating current is connected, between the negative terminal of the battery and the wire attached to the graphite plate. When the filament is lit, a current will flow through the battery in the right direction. This current is an intermittent direct current, and requires an alternating current ammeter to register its effective charging current.

A small lathe or some sort of strong winding machine will be required in winding the coils. The writer uses a No. 1005 Yankee bench drill, but mounted in a horizontal position on the table. The ball operating the friction feed was removed, and the feed screw put down as far as it will go. It has a turning ratio of 1 to 1 or 14 to 1, which makes it suitable for both large and small wire. A ¾ in. hole is in the base plate in which a centre point is placed. These alterations do not damage the drill for other use.

Winding Form

Piece of pine 6 in. long, 1⅝ in. by 1⅝ in.

On each end of this form fasten a strip of brass 1/16 in. thick by ¾ in. wide. At one end in the centre drill a ⅛ in. hole for centre point. At the other a 5/16 in. hole. A 2½ or 3 in. wood screw, that will just fit this hole, has its head cut off, placed in a vise, the brass strip slipped over as far down as the smooth part of the screw and securely soldered. Drill a hole in the centre of the form and insert the threaded portion, and screw the brass strip to the form so it cannot move. Short pieces of ¾ in. lumber are nailed to the four sides of the form, so as to make a flange to support the end cardboard pieces; this wooden flange should be at least 4 in. across. On a strip of cardboard 5 in. wide, 8⅛ in. long, draw two pencil lines lengthwise ⅞ in. from each side. Cut one end of the strip square and draw a line 1⅝ in. from this, and parallel to it, again at 3¼ in., 4⅞ in., 6 9/16 in. This makes six lines in all. Run the edge of a pencil knife along the edge of these lines, then cut the four cross lines from each side, in to the ⅞ in. lengthwise line and turn down the sides.

It is now bent around the form with a complete overlap on one side, the end pieces are turned up against the wooden flange (mentioned previously). Two other pieces of cardboard are cut 4¾ in. square, with a square hole in the centne, of a size that will fit tightly over the bent cardboard form. These two are slipped on and both end pieces are again turned up. Put one piece at each end, against the turned up pieces, so as to form a square spool with high sides. Four more strips of wood by screws are attached to the other end; these are removed after winding so that the coil may slip off. This will leave the coil with a square cardboard centre and end pieces which, after being taped and tied, protects the whole winding from being cut by the core strips.

Put on two or thre turns of good quality linen paper before starting the winding. Purchase 3½ lbs. No. 16 cotton, silk or enamel covered magnet wire, whichever is the cheapest. 4½ lbs. No. 14 enamel covered magnet wire. If cotton insulation is used here, get 4¾ lbs., as the insulation is heavier and the finished coil will be larger.

Note.—That if No. 14 D.C.C. wire is used the winding form will have to be increased ½ in. in length, as the required number of turns cannot be put on, for the first layer.

Coil

Take the number 14 and cut off four pieces each 8 feet long, remove the insulation at one end of each piece, for about ¼ in., place the four wires close together, between two pieces of wood, allowing the ends to project ¼ in., and place in a vise. Purchase 5 feet of No. 16 twin fixture cord, untwist; this will give 10 feet of wire. Cut off eight pieces each 6 in. long, remove the insulation from each end, being VERY careful not to cut any of the fine strands, after which solder one piece to each of the four wires in the vise. Allow the solder to flow freely from one wire to the other, so that when they are removed from the vise they will be firmly fastened together like a flat strip.

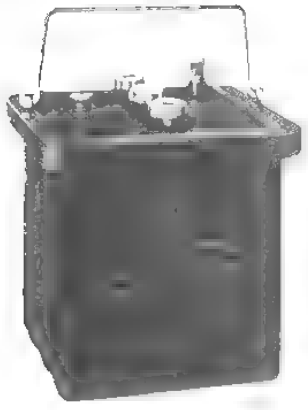
Cut a hole in the cardboard end piece at one of the corners, where the wood is cut away; put a small strip of tape over the soldered portion, the flexible wires through the hole as far as the joint. Wind all four of the No. 14 wires at once. Keep each one close to the other, and see that you get on 10 TURNS of the four wires. Wind the whole layer with tape so it cannot come loose.

Cut the four wires neatly and solder the other four lengths of flexible wire to the ends, placing them through a hole, in the same manner at this or the opposite end. Each pair of the four flexible wires are soldered together at the outer ends, and attached to the terminal screws of the porcelain socket. Next put on four layers of linen paper to separate this layer from the rest. On the same side that the first winding was started make another hole large enough for one piece of the flexible cord cut 6 in. long and soldered to the No. 16 wire. Tape the joint, put flexible wire through the hole. Tag the lead with the word "Line."

Wind on the No. 16 wire, filling each layer as evenly as possible; place a layer of thin paper between each layer of wire, it will wind 40 to 50 turns to the layer. Put on 13 layers, or just 590 turns. Cut the No. 16 wire and solder the No. 14 to it, also another piece of the flexible cord, and bring out through the sides. Tag this lead with the word "Graphite." Continue winding with the No. 14 for four layers, solder on another 6 in. piece of flexible lead, tag with words "Low, Batt. Neg." Continue for 10 turns, bring out another lead, tag with words "Medium, Batt. Neg." Then 10 more turns and put on final lead, marked

WITHERBEE

Radio "A" Batteries



"High, Batt. Negative" and "Line." The end of the fourth layer of No. 14 should be a total of 740 turns.

Cover the last or fifth layer with tape, remove coil from the form, tie in the projecting corners of the end pieces with string wound through the coil at the four corners. Tape the whole coil well. It is now ready for the core strips. The core can be assembled "Core" or "Shell type," whichever suits the builder. At any rate good quality No. 28 Gauge (0.014 in. thick) Silicon steel, annealed, and scaled or varnished, to minimize Eddy current losses should be used.

If gray sheet iron only is obtainable, make the wooden core form 2⅛ in. square. This is necessary on account that the gray iron will not take such a high magnetic saturation value. Also get about 1 lb. more of each size wire.

For "Core" type assembly cut the strips: One set 5 in. long, 1½ in. wide; 3¼ in. long, 1½ in. wide.

For gray iron: 5½ in. long, 2 in. wide; 3¾ in. long, 2 in. wide.

Alternate these positions until the core is complete, then clamp it together at the ends.

Shall type assembly: Cut half the number of sheets 10 in. long, the balance 13 in. long.

Overlap the pieces, or stagger the abutting ends. When finished, tape the outside part of the core as tightly as possible.

If it is desired to build this for a 12 volt battery, start the No. 14 wire at the beginning of the 13th layer instead of the 14th. This will give approximately 200 turns of No. 14 instead of 170.

In both cases a 6 ohm variable resistance (Nichrome wire is excellent, of a size that will require at least 10 to 15 amperes to cause it to glow, should be used, so that on the normal rate of 5 amperes it will be fairly cool). This resistance is necessary on account of the fact that the bulb requires a higher voltage to cause the charge to start than it does to keep the charge rate normal against the back pressure of the battery. Once this resistance is set, does not need to be moved. Always attach battery with the positive pole to the terminal screw on the socket, with the negative on the tap that is desired.

Suppose the builder desires to charge his battery while he is present (at a higher rate than 5 amps.). The current limit being the heating temperature of the wire on the transformer. Cut out the variable 6 ohm resistance, put the 3 point switch on "Medium" tap. A single pole knife switch rated at 30 amperes, 125-250 volts, connected at place marked X. Turn on the current: as soon as the bulb starts working, open this switch, which cuts off the high filament current. As long as the power remains on the heavy current will keep the filament incandescent for operation. If the power ceases for an instant it will stop at once and will not start again till the switch X is closed so that the filament can be lit. Aside from this one advantage, the opening of this switch when charging at 4 amperes or higher will considerably lengthen the life of the tube.

If larger wire is used, No. 14 in place of No. 16, with No. 12 in place of No. 14, it will be possible to charge at about 10 amperes, which is sufficient for the largest battery. This does not include the Edison type nickel iron cell.

SHORTHAND STUDENTS USE RADIO SETS TO GAIN SPEED IN TAKING DICTATION

A novel aid in the study of shorthand, the taking of dictation down from wireless speeches and programs, is the latest means of utilizing radio receiving sets in Pittsburgh.

Ruth Baker, who lives at 118 East Ohio Street, Pittsburgh, Pa., listens in and transcribes the text of speeches into shorthand notes while enjoying the radio program broadcasted from KDKA, the Westinghouse Electric and Manufacturing Company's radio broadcasting station at East Pittsburgh, Pa., and thus finds unlimited opportunity for practice.

"It's really fun," Ruth declares. "I like to hear the wireless program and I just take down shorthand notes while I am listening to the speakers. Then, instead of having to study my shorthand after the entertainment, all I have to do is to transcribe my notes for practice. It makes study a pleasure."

The method is recommended as an excellent one by Prof. O. B. Hughes, head of Park Institute, Pittsburgh, where Ruth attends. Many other schools are advising their pupils to employ the radio in similar fashion.

Difficulty often has been found by pupils in finding members of their household to dictate to them. Now, instead of coaxing a brother or sister into serving as unwilling dictators, or separating "Dad" from the sporting sheet, the shorthand student finds almost unlimited dictation in the eloquence of week-day speakers or the quiet Sunday morning sermon over the home radio set.

FASHION TALKS, ADVENTURE STORIES AND BEDTIME STORIES TOLD FROM WESTINGHOUSE-RADIO CORPORATION STATION WJZ

1—Marion Gillespie, who broadcasts "Women's Fashion News" daily from Westinghouse Broadcasting Station WJZ, Newark, N.J. Miss Gillespie prepares the articles which are broadcast, and just recently wrote "Just Girls" under the pen name of Marion Evans.

2—Florence Smith Vincent of the New York Evening Telegram telling an interesting animal story through WJZ.

3—Mrs. Oliver Harriman broadcasting Mrs. Warren Harding's message to the 150,000 Camp Fire Girls of America.

4—Howard R. Garis, author of the "Uncle Wiggily Bedtime Stories," whose stories are broadcast by three Westinghouse stations—KDKA, at East Pittsburgh; WJZ, at Newark, N.J., and WBZ, at Springfield, Mass.

5—Ralph Mayhew, who tells the stories from "The Bubble Books That Sing" every Sunday afternoon from Westinghouse Station WJZ.

6—David Cory, of the New York Evening Mail, telling one of his famous "Jack Rabbit Stories" broadcast every Thursday evening from Westinghouse-Radio Corporation Station WJZ, Newark, N.J. Mr. Cory has received thousands of letters from boys and girls all over the United States.

WESTERN NEWS

Taking a place among the ranks of the first newspapers in Canada to realize the tremendous possibilities offered by radio in service to dwellers in both country and city, the Manitoba Fress Press, Winnipeg, broadcasted its first radiophone programme to amateur operators of the West on the evening of Sunday, April 3.

The small transmitter which was picked up by operators in Manitoba was the nucleus of a plant which compares favorably with any newspaper radio station on the continent. A short period of operation with a Midget transmitter under station call 4 A H was followed by the installation of a half-kilowatt transmitter manufactured by the Canadian Independent Telephones Co. With this set C J C G attained a range which included three provinces and as many states on the other side of the international line.

While radio in the Middle West was making tremendous strides in popularity, due to a considerable extent to the success attained in operation of the 500-watt set, which was installed on the fourth floor of the Free Press building, work was being rushed to completion on a station on the roof of the building, which is not excelled by any newspaper plant in Canada. Election bulletins were broadcasted for the first time in Canada, when thousands of operators far from the campaign centre heard results of the Manitoba Provincial election of July 18, which were flashed from the Free Press station as quickly as they were received in Wininpeg. While residents in country points were informed of the trend of the election many hours before they ordinarily would receive the information, capacity audiences in four of the largest moving picture theatres in Winnipeg heard the election bulletins from C J C G by means of receiving sets with magnavox attachments, which were installed by the theatres, in co-operation with the Free Press radio department.

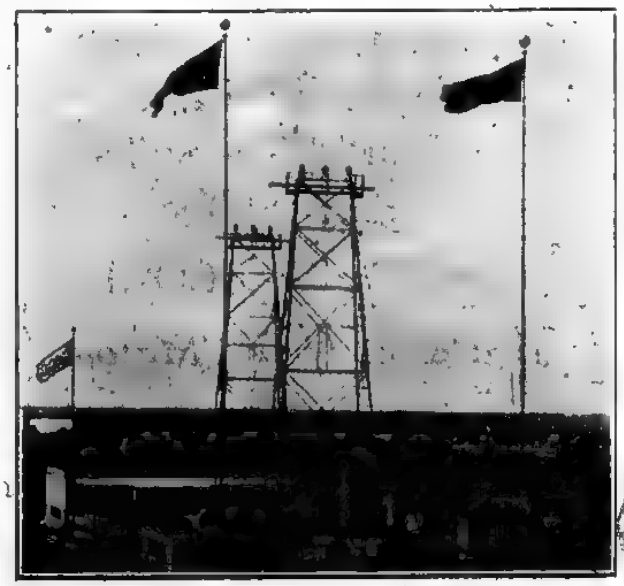
The completed major broadcasting plant of the Free Press was opened with a formal programme July 27, when a 2-kilowatt C. I. T. transmitter was put into operation for the first time. The success which has marked the operation of the new transmitter has been consistent since that time. C J C G is now heard in Western Ontario, Manitoba, Saskatchewan, Alberta, North and South Dakota, Minnesota, Wisconsin, Nebraska and Iowa. Reports from this wide territory, which have lost nothing in enthusiasm since the inception of the plant, indicate the popularity which has been gained by the Free Press station.

With tests showing an average antenna current of 9 amperes, the radio frequency input on the aerial is as great as that of any station on the continent. This power is obtained from the use of four 500-watt De Forest vacuum tube oscillators, with two 250-watt De Forest tubes as modulators. The power equipment, which is housed in a sound-proof vault, consists of a 5 horse-power Electric Specialty motor, which runs a 2,000-volt generator for supplying power to the plates of the oscillating tubes, and a 20-volt generator, which supplies current to the filaments of the tubes. Current for the modulator tubes comes from a system of storage batteries. The equipment was supplied by the Radio Corporation of Winnipeg.

At the foot of two steel towers, which rise 165 feet above ground level, is a single-storey brick building, erected on the roof of the Free Press building, to house the entire radio plant. A commodious studio, tastefuly decorated in blue and white, in which the radio artists perform for their ethereal audience, is separated from the instrument room by a sound-proof wall. The studio is so designed that its acoustic properties eliminate entirely outside noises and echoes from the performances of the artists themselves. Accommodation is supplied for visitors who are interested in the visible performance of a radio concert, the entire plant being thrown open for inspection following the evening programmes. The six-strand antenna is strung from the two 75-foot steel towers, which stand out brilliantly at night under the illumination of colored lights strung on the steel structures. Six flood-lights on the towers complete a light scheme which makes the station visible for miles at night. A blue and white flag floating from a stuff on the studio building brings to the eyes of passers-by the station call letetrs C J C G.

A course of instruction in the elementary principles of radio, given in a series of lectures in the Free Press building by members of the technical staff, aided many who were gripped by a wide-spreading interest of the newest development of science. This was supplemented and carried on by a department which advises amateurs who meet technical difficulties in the installation of receiving sets. Another means by which a great deal was done to introduce radio to country dwellers and arouse their interest was a tour of smaller towns by a radio car, operated co-operatively by the Radio Corporation of Winnipeg and the Free Press. The car, equipped with receiver and magnavox, gave street concerts picked up from C J C G, giving residents of the towns visited an actual demonstration of the possibilities of radio.

C J C G at the present time operates on a permanent schedule, which enables operators to know the time of all concerts. Musical programmes and the latest news reports are broadcasted during certain hours of the day and night.



WESTERN NEWS

Taking [illegible] papers [illegible] the [illegible] peg [illegible] amateur [illegible] April [illegible]

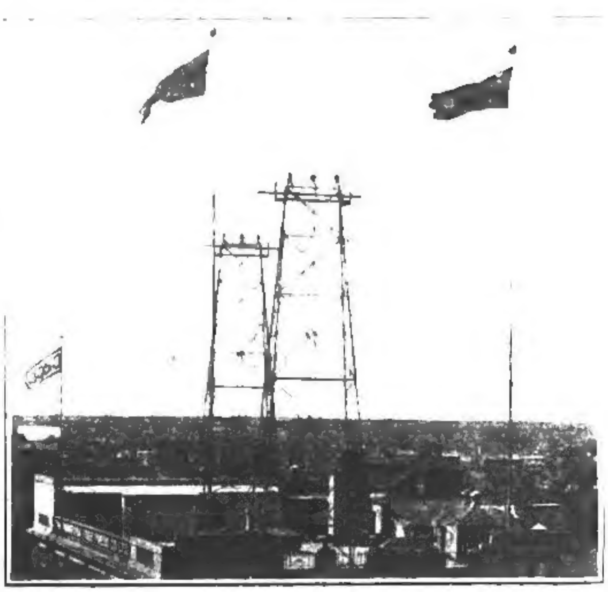
The [illegible] operators of Manitoba [illegible] which compares favorably with any newspaper station of the continent. [illegible] with a Midget transmitter [illegible] was followed by the installation [illegible] transmitter manufactured by the [illegible] dent Telephones Co. With this set [illegible] a range which included three [illegible] states on the other side of the [illegible]

While [illegible] the [illegible] tremendous strides in popularity [illegible] able extent to the success attained [illegible] 500-watt set which was installed [illegible] of the Free Press building [illegible] completion on a station [illegible] which is not excelled by any newspaper [illegible] Canada. Election bulletins were broadcasted [illegible] first time in Canada, when thousands of [illegible] from the campaign centres [illegible] results [illegible] [illegible] general election of July 18, which were flashed from the Free Press station as [illegible] received in Winnipeg. While residents [illegible] points were informed [illegible] hours before they [illegible] formation [illegible] moving picture theatres of Winnipeg [illegible] with magnavox attachments [illegible] the theatres, in co-operation with the Free Press radio department.

The completed major broadcasting [illegible] Free Press was opened with a formal programme [illegible] when a 2 kilowatt C. [illegible] T. transmitter was [illegible] operation for the first time. The success which has marked the operation of the new transmitter has been consistent since that time. [illegible] now heard in Western Ontario, Manitoba, Saskatchewan, [illegible] North and South Dakota, Minnesota, [illegible] Nebraska and Iowa. Reports from this wide territory, which have lost nothing in enthusiasm [illegible] ception of the plant, indicate the popularity which has been gained by the Free Press station.

With tests showing an average antenna current of 9 amperes, the radio frequency input of the aerial is as great as that of any station on the continent. This power is obtained from the use of four 500-watt De Forest vacuum tube oscillators with two 250-watt De Forest tubes as modulators. The power equipment, which is housed in a sound-proof vault, consists of a 5 horse-power Electric Specialty motor which runs a 2,000-volt generator for supplying power to the plates of the oscillating tubes, and a 20-volt generator which supplies current to the filaments of the tubes. Current for the modulator tubes comes from a system of storage batteries. The equipment was supplied by the Radio Corporation of Winnipeg.

At the foot of two steel towers, which rise 10? feet above ground level, is a single-storey brick building



T. EATON CO., LTD., WINNIPEG

The T. Eaton Co., Ltd., now have a fully equipped radio department in their Winnipeg store. This department is rapidly becoming popular for radio supplies in Western Canada, as it carries a very large stock of equipment, ranging from the smallest contact point to the finest receiving sets on the market. There is also a fully equipped test-room in connection with the department, where apparatus or sets may be fully demonstrated to the prospective customer. Many of the larger receiving installations in the West have been supplied by this store, while two long range receivers are supplying entertainment to the sick, one installation being at the Red Cross Home, Winnipeg Beach, and the other at the Minette Sanatorium. Anyone may write in for advice or supplies with absolute confidence, as the department is in charge of radio experts. Mr. L. V. Salton is manager of the department.

CANADIAN FIRM "RADIORITE" SETS

Canadian Armature Works, St. Catharines, are putting on the market a two-stage amplifier receiving set under the trade name of "Radiorite." They are guaranteeing this set to receive music and signals clearly for a distance of 500 miles in summer and 750 miles in winter. The circuit used is protected by patents in United States and Canada. They have received music from WAAP, at Wichita, Kan., a distance of 1,030 air line miles.

Western Canada

Western Canada

TUNING WITH A SHORT WAVE REGENERATIVE RECEIVER

By Vincent Thomas, of Winnipeg.

The short wave tuner seems to be one of the most popular pieces of radio apparatus on the market at the present time. The majority of beginners starting with a vacuum tube set either buy or construct a short wave regenerative, so a few words on the tuning of this widely used piece of apparatus will not be amiss.

The regenerative tuner is very sharp in its tuning, and is not like the honeycomb coil receiver, which is in a sense broad in its tuning—that is, it is very simple to get in tune with a transmitting station, as one set of honeycomb coils will cover a large number of wave-lengths. When using single, double or triple honeycombs, it is only necessary to select the coils corresponding to the approximate wave-length of the transmitting station; plug them into the coil mounting and tune with the primary and secondary condensers. A series-parallel switch, which places the primary condenser in series, or parallel with the primary coil, or shorts it entirely, thus giving the same set of coils a still greater range of wave-lengths. A honeycomb receiver should always be equipped with a series-parallel switch.

With the short-wave receiver it is entirely different, as there are no coils to change around, and you have no way of knowing if you are near the wave-length of the transmitting station or far from it. You have four or five tuning devices to look after, which, to the experienced operator, means great flexibility and control over the set; but to the novice it means something like a Chinese puzzle, and the words "which dial do I turn first?" is no uncommon or foolish question.

The varicoupler is the first thing to start tuning with, as it has charge of all wave-lengths. Turn the varicoupler dial around "slowly"—I say slowly, because you are not cranking up a Ford car, but trying to get signals on a sharp tuned instrument. If you turn the dial over fast, you will pass up the very thing that you are to get. If nothing is heard after you have rotated the dial around once or twice, move the switch arm up one contact point, but not three or four, as some fellows do; then once again go through the process of rotating the dial. Repeat this until signals are heard. When signals are heard, then is the time to use the plate and grid variometers. Should the signals still be weak, then bring the switch arm into paly once more. Do not condemn the set because you fail to get results the first time you try; watch your tuning, that's where the trouble lies.

The writer knows of a case where a set had been installed, and for six weeks the owner of it hardly got one of the local broadcasts. The reason tha the failed to get the results that a regenerative should and will give was in his tuning. This is how he went about it. He would whirl the dials around for a considerable time and eventually receive signals, but they were so weak that it was impossible to make head or tail out of what was being broadcasted. "Well, it's there," and again he would commence to whirl the dials around, move the switch arm up three or four points and, of course, the concert could not be found without spending fifteen or twenty minutes turning the dials around until the concert was received once more. There is no wonder why the party could not get results, is there? The writer was told that the money spent on this set might just as well have been thrown away. However, since learning how to handle the set, everything is different, and the owner would not be without the set now.

Always remember that if you tune slow and easy you will get what you are after; tune carelessly, and you might as well quit, as you will only get disgusted with the set. Start tuning with the variocoupler and switches; then when the signals are loudest, tune with the plate and grid variometer, and the best of results will be obtained.—Vincent Thomas, 535 Somerset Building, Winnipeg (Radio 4-C-E).